SELECT COMMITTEE ON DIGITAL SKILLS
Oral and written evidence

Contents
Age UK, Code Club, TalkTalk and UCanDoIT – Oral evidence (QQ 129-142) ................................. 8
Andrew WS Ainger – Written evidence (DSC0015)........................................................................... 26
Sanjeev Appicharla – Written evidence (DSC0042).......................................................................... 34
Sanjeev Appicharla (part 2) – Written evidence (DSC0081)................................................................ 43
Apps for Good – Written evidence (DSC0080)................................................................................ 46
Association for Learning Technology – Written evidence (DSC0057) ............................................ 50
The Association for UK Interactive Entertainment – Written evidence (DSC0086) ...................... 54
Association of Information Technology in Teacher Education – Written evidence (DSC0050) .................................................................................................................... 59
Barclays Bank – Written evidence (DSC0047)................................................................................ 63
Professor Patrick Barwise, BBC, Ofcom and Tinder Foundation – Oral evidence (QQ 103-112) ................................................................................................................................... 67
Bath Spa University – Written evidence (DSC0004) ..................................................................... 84
BBC, Professor Patrick Barwise, Ofcom and Tinder Foundation – Oral evidence (QQ 103-112) ................................................................................................................................... 86
BBC – Supplementary written evidence (DSC0112).......................................................................... 87
BCS, The Chartered Institute for IT – Written evidence (DSC0051)................................................. 95
BCS, The Chartered Institute for IT, Computing At Schools, National College for Teaching and Leadership and South Farnham School – Oral Evidence (QQ 143-157) .............................................................................. 103
BCS, The Chartered Institute for IT and Computing At Schools – Supplementary written evidence (DSC0110) ................................................................................................................ 123
Miles Berry, George Spencer Academy, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172) ................................................................................................................................... 124
Boston Consulting Group, BT and Virgin Media – Oral evidence (QQ 76-86) ................................. 144
Professor Nick Bostrom, The Hartree Centre and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)............................................................................. 160
Dr Jo Briggs – Written evidence (DSC0083).................................................................................. 179
Bristol City Council – Written evidence (DSC0126)........................................................................... 182
British And Irish Association Of Law Librarians – Written evidence (DSC0020) .......................... 192
British Sky Broadcasting – Written evidence (DSC0036) .............................................................. 209
Broadway Academy – Written evidence (DSC0059) ................................................................. 216
Professor Phillip Brown, Professor Alan Manning and Professor Judy Wajcman – Oral evidence (QQ 15-25) .................................................................................................................. 217
BT, Boston Consulting Group and Virgin Media – Oral evidence (QQ 76-86) ................. 231
BT – Written evidence (DSC0091) ......................................................................................... 232
BT – Supplementary written evidence (DSC0104) ............................................................ 243
David Chan – Written evidence (DSC0007) ..................................................................... 245
Channel 4 – Written evidence (DSC0099) ....................................................................... 249
Chartered Institute of Library and Information Professionals – Written evidence (DSC0045) ................................................................. 253
The Chartered Institute of Marketing – Written evidence (DSC0076) ......................... 262
Chartered Institute of Public Relations Social Media Panel – Written evidence (DSC0094). 267
David Chassels – Written evidence (DSC0061) ............................................................... 271
Citizens Online – Written evidence (DSC0005) ............................................................... 277
City & Guilds – Written evidence (DSC0044) .................................................................. 280
City & Guilds, Siemens and Skills Funding Agency – Oral evidence (QQ 232-249) ......... 286
City of London Corporation – Written evidence (DSC0090) .......................................... 311
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65) .................................................................................................................. 314
Code Club, Age UK, TalkTalk and UCanDoIT – Oral evidence (QQ 129-142) ............... 333
Communications Consumer Panel – Written evidence (DSC0068) ............................. 334
CompTIA – Written evidence (DSC0082) ....................................................................... 340
Computing At Schools, BCS, The Chartered Institute for IT, National College for Teaching and Leadership and South Farnham School – Oral Evidence (QQ 143-157) ................. 349
Computing At Schools and BCS, The Chartered Institute for IT – Supplementary written evidence (DSC0110) ............................................................................................................. 350
Confederation of British Industry – Written evidence (DSC0074) .................................. 351
Cornwall and Isles of Scilly Local Enterprise Partnership – Written evidence (DSC0054) .... 356
Creative Skillset (Sector Skills Council for the Creative Industries) – Written evidence (DSC0095) ................................................................................................................................. 367
Creative Skillset (Sector Skills Council for the Creative Industries) – Oral evidence (QQ 205-209) ................................................................................................................................. 373
Creative Skillset (Sector Skills Council for the Creative Industries) – Supplementary written evidence (DSC0116) ..................................................................................................... 381
Adam Crymble, Professor Tim Hitchcock and Dr Jane Winters – Written evidence (DSC0021) ................................................................................................................................. 386
Cyber Security Challenge, IBM Services and The Institution of Engineering and Technology – Oral evidence (QQ 173-191) ............................................................................. 388
Professor Leela Damodaran, Wendy Olphert and Jatinder Sandhu – Written evidence (DSC0093) .................................................................................................................................................. 406
Digital Youth Academy and Pera Training – Written evidence (DSC0029) .................................................................................................................. 415
Dynamo North East – Written evidence (DSC0107) .......................................................... 423
EE – Written evidence (DSC0026) .......................................................................................... 427
e-Learning Foundation – Written evidence (DSC0001) .................................................. 434
Elix-IRR – Written evidence (DSC0046) .............................................................................. 436
The European Azerbaijan Society – Written evidence (DSC0038) .................................. 455
European Commission and Organisation for Economic Co-operation and Development – Oral evidence (QQ 221-231) ........................................................................................................... 457
Federation of Small Businesses, Coalition for a Digital Economy and techUK – Oral evidence (QQ 53-65) .................................................................................................................................................. 471
Federation of Small Businesses – Written evidence (DSC0103) ....................................... 472
Bernadette Fishpool – Written evidence (DSC0025) .......................................................... 474
Frog Education – Written evidence (DSC0071) .................................................................. 477
George Spencer Academy, Miles Berry, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172) .................................................................................................................. 482
George Spencer Academy – Supplementary written evidence (DSC0127) .................... 483
Martin Goodyear – Written evidence (DSC0089) ............................................................... 484
Google, Microsoft and UK Forum for Computing Education – Oral evidence (QQ 40-52) .... 491
Go ON UK – Written evidence (DSC0079) ........................................................................ 508
Go ON UK, Tech Partnership and UK Digital Skills Taskforce and TeenTech CIC – Oral evidence (QQ 113-128) .................................................................................................................. 525
Professor Dame Wendy Hall and Baroness Shields – Oral evidence (QQ 210-220) ........ 542
Tony Harper – Written evidence (DSC0075) ....................................................................... 560
The Hartree Centre, Professor Nick Bostrom and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39) ..................................................................................... 566
Heart of Worcestershire College – Written evidence (DSC0018) .................................... 567
Here East – Written evidence (DSC0048) .......................................................................... 570
HM Government – Written evidence (DSC0084) .............................................................. 576
HM Government – Oral Evidence (QQ 250-264) .............................................................. 607
HM Government – Supplementary written evidence (DSC0121) .................................... 626
Professor Tim Hitchcock, Adam Crymble, and Dr Jane Winters – Written evidence (DSC0021) .................................................................................................................. 630
Humber Local Enterprise Partnership – Written evidence (DSC0060) ......................... 631
Humber Local Enterprise Partnership, Manchester City Council and Tech City UK – Oral evidence (QQ 192-204) ...................................................................................................................... 647

IBM Services, Cyber Security Challenge and The Institution of Engineering and Technology – Oral evidence (QQ 173-191) .............................................................................. 665

Imperial College London – Written evidence (DSC0122)............................................................................................... 666

Innovate UK (formerly known as the Technology Strategy Board), Professor Nick Bostrom and The Hartree Centre – Oral evidence (QQ 26-39) ......................................................... 669

Innovate UK (formerly known as the Technology Strategy Board) – Written evidence (DSC0070) .......................................... 670

The Institution of Engineering and Technology – Written evidence (DSC0049) ................................................................. 680

The Institution of Engineering and Technology, Cyber Security Challenge and IBM Services – Oral evidence (QQ 173-191)...................................................................................... 689

iRights – Written evidence (DSC0108) ........................................................................................................................... 690

Kingsmead Primary School, Miles Berry, George Spencer Academy and Naace – Oral evidence (QQ 158-172) ................................................................. 695

The Knowledge Transfer Network – Written evidence (DSC0056)................................................................................. 696

learndirect – Written evidence (DSC0066) ....................................................................................................................... 718

London Borough of Camden – Written evidence (DSC0058) ......................................................................................... 723

David Longman – Written evidence (DSC0053).................................................................................................................. 727

Makers Academy – Written Evidence (DSC0119) .................................................................................................................. 731

Management Consultancies Association – Written evidence (DSC0040) ................................................................. 735

Manchester City Council, Humber Local Enterprise Partnership, and Tech City UK – Oral evidence (QQ 192-204) ................................................................. 745

Professor Alan Manning, Professor Phillip Brown and Professor Judy Wajcman – Oral evidence (QQ 15-25) ................................................................. 746

McAfee – Written evidence (DSC0022) ........................................................................................................................... 747


Microsoft, Google and UK Forum for Computing Education – Oral evidence (QQ 40-52) ...................................................... 752

Microsoft – Supplementary written evidence (DSC0006) ................................................................................................. 753

Naace, Miles Berry, George Spencer Academy and Kingsmead Primary School – Oral evidence (QQ 158-172) ................................................................. 755

National College for Teaching and Leadership, BCS, The Chartered Institute for IT, Computing At Schools and South Farnham School – Oral Evidence (QQ 143-157) ......................................................................................... 756

National College for Teaching and Leadership – Supplementary written evidence (DSC0113) ................................................................................................. 757

National Institute of Adult Continuing Education and The Open University – Oral evidence (QQ 87-102) ................................................................. 761

National Institute of Adult Continuing Education – Written evidence (DSC0088) ................................................................. 779
National Library of Wales – Written evidence (DSC0117) ......................................................... 788
Nesta and Martin Wolf – Oral evidence (QQ 1-14) ........................................................................ 792
Nesta – Supplementary written evidence (DSC0003) ..................................................................... 807
NMI Systems & Software Leaders Network – Written evidence (DSC0062) ............................. 809
Northern Ireland Government – Written evidence (DSC0125) ................................................ 817
Ofcom, Professor Patrick Barwise, BBC and Tinder Foundation – Oral evidence (QQ 103-112) ........................................................................................................................................ 830
Wendy Olphert, Professor Leela Damodaran and Jatinder Sandhu – Written evidence (DSC0093) ................................................................................................................................. 831
The One Voice for Accessible ICT Coalition – Written evidence (DSC0033) .............................. 832
The Open University and National Institute of Adult Continuing Education – Oral evidence (QQ 87-102) .................................................................................................................. 835
The Open University – Written evidence (DSC0065) ..................................................................... 836
Organisation for Economic Co-operation and Development – Written evidence (DSC0016) ................................................................................................................................. 846
Organisation for Economic Co-operation and Development and European Commission – Oral evidence (QQ 221-231) ............................................................................................. 856
Organisation for Economic Co-operation and Development – Supplementary written evidence (DSC0120) .................................................................................................................. 857
Oxford Cambridge and RSA Examinations – Written evidence (DSC0014) ............................... 865
Pera Training and Digital Youth Academy – Written evidence (DSC0029) ................................. 868
Dr Lisa Payne – Written evidence (DSC0031) ................................................................................ 869
Promontory Financial Group – Written evidence (DSC0087) ..................................................... 879
Prospect – Written evidence (DSC0064) ........................................................................................ 886
QA Limited – Written evidence (DSC0069) .................................................................................. 894
Recruitment & Employment Confederation – Written evidence (DSC0035) ............................. 897
Research Councils UK – Written evidence (DSC0055) ................................................................. 900
The Royal Society of Edinburgh – Written evidence (DSC0030) ................................................ 908
Samsung Electronics UK – Written evidence (DSC0092) ........................................................... 912
Jatinder Sandhu, Professor Leela Damodaran and Wendy Olphert – Written evidence (DSC0093) ................................................................................................................................. 929
Science Council – Written evidence (DSC0096) ........................................................................... 930
Fiona Scott Lazareff – Written evidence (DSC0028) ................................................................. 938
Scottish Government – Written evidence (DSC0128) ................................................................. 940
Baroness Shields and Professor Dame Wendy Hall – Oral evidence (QQ 210-220) .................... 946
Siemens, City & Guilds and Skills Funding Agency – Oral evidence (QQ 232-249) .................... 947
Skills Funding Agency, City & Guilds and Siemens – Oral evidence (QQ 232-249) .................... 948

5
Social Security Advisory Committee – Written evidence (DSC0043) ................................. 949
Solace and Leeds City Council – Written evidence (DSC0124) ........................................... 953
South Farnham School, BCS, The Chartered Institute for IT, Computing At Schools (CAS) and National College for Teaching and Leadership – Oral Evidence (QQ 143-157) ........................................ 958
Sunderland Software City – Written evidence (DSC0063) .................................................... 959
Tables for Schools – Written evidence (DSC0118) ............................................................. 963
TalkTalk – Written evidence (DSC0105) .............................................................................. 971
TalkTalk, Age UK, Code Club and UCanDoIT – Oral evidence (QQ 129-142) .................... 975
Tata Consultancy Services – Written Evidence (DSC0106) .................................................. 976
Tech City UK, Humber Local Enterprise Partnership and Manchester City Council – Oral evidence (QQ 192-204) ................................................................................................. 978
Tech City UK – Supplementary written evidence (DSC0115) .............................................. 979
Tech Partnership, UK Digital Skills Taskforce and TeenTech CIC and Go ON UK – Oral evidence (QQ 113-128) ........................................................................................................ 980
techUK, Coalition for a Digital Economy and Federation of Small Businesses – Oral evidence (QQ 53-65) ......................................................................................................................... 981
Tinder Foundation, Professor Patrick Barwise, BBC and Ofcom – Oral evidence (QQ 103-112) ................................................................................................................................. 982
Tinder Foundation – Written evidence (DSC0077) ............................................................... 983
Trustworthy Software Initiative – Written evidence (DSC0024) ........................................... 985
Professor John Vivian Tucker and Dr Victoria Wang – Written evidence (DSC0023) .......... 990
UCanDoIT, Age UK, Code Club and TalkTalk – Oral evidence (QQ 129-142) .................... 995
UK Computing Research Committee – Written evidence (DSC0011) .............................. 996
UK Council for e-Business – Written evidence (DSC0102) ................................................ 999
UK Digital Skills Taskforce and TeenTech CIC – Written evidence (DSC0101) .............. 1003
UK Digital Skills Taskforce and TeenTech CIC, e-skills UK and Go ON UK – Oral evidence (QQ 113-128) .................................................................................................................. 1021
UK Digital Skills Taskforce and TeenTech CIC – Supplementary written evidence (DSC0111) ............................................................................................................................... 1022
UK Forum for Computing Education, Google and Microsoft – Oral evidence (QQ 40-52) .. 1024
UK Forum for Computing Education – Written evidence (DSC0078) .............................. 1025
UK Music – Written evidence (DSC0097) ........................................................................... 1040
Professor Tony Venables – Written evidence (DSC0114) .................................................. 1044
Virgin Media, Boston Consulting Group and BT – Oral evidence (QQ 76-86) .................... 1046
Virgin Media – Written evidence (DSC0100) ..................................................................... 1047
Philip Virgo – Written evidence (DSC0034) ....................................................................... 1057
Virtual College – Written evidence (DSC0039) ................................................................. 1071
Professor Judy Wajcman, Professor Phillip Brown and Professor Alan Manning – Oral evidence (QQ 15-25) ................................................................................................................................. 1073
Dr Victoria Wang and Professor John Vivian Tucker – Written evidence (DSC0023) .......... 1074
Welsh Government – Written evidence (DSC0123) ................................................................ 1075
Janet Anne West – Written evidence (DSC0109) .................................................................... 1086
Wikimedia UK – Written evidence (DSC0027) ..................................................................... 1094
Dr Jane Winters, Adam Crymble and Professor Tim Hitchcock – Written evidence (DSC0021) ........................................................................................................................................ 1101
Martin Wolf and Nesta – Oral evidence (QQ 1-14) ............................................................... 1102
TUESDAY 14 OCTOBER 2014

Members present

Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Lucas
Lord Macdonald of Tradeston
Baroness O’Cathain

Examination of Witnesses

Lucy Hastings, Programme Director for Strategy, Age UK, Clare Sutcliffe, Co-founder and CEO, Code Club, Iain Wood, Public Affairs Manager, TalkTalk, and Mary Payne, Chief Executive Officer, UCanDoIT

The Chairman: Good morning. Thank you very much for joining us for our second session this morning. I will go through a few of the housekeeping things first. You have a list of interests that have been declared by Committee Members. They were declared orally by Members at the previous sessions in July and they can be found in the transcripts. This is a formal evidence-taking session of the Committee and a full shorthand note will be taken. That will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of that transcript and you will be able to revise any minor errors. This session is on the record. It is being webcast live and will be subsequently accessible via the parliamentary website. You are very welcome also to submit any supplementary evidence
after the session that you would like to, and we may ask you to do so if there are particular issues we want to pick up.

Perhaps I may remind you to speak up in here so that everybody can hear you properly. I know, Ms Payne, that we need to make sure that we are addressing you very clearly, and we will be very careful to do that.

I am going to ask you, first of all, to introduce yourselves and say where you come from and what your interest is in the Committee, but also to make any opening remarks that you may wish to make. You do not have to. We can go straight to the questions if you so wish, so people may vary on that. I will start with Ms Payne.

Mary Payne: My name is Mary Payne. I am the Chief Executive of UCanDoIT. We take the internet into the homes of people with sensory, physical and complex needs. We deliver this training on a one-to-one basis. I started with UCanDoIT as a learner and progressed to being a tutor and I am now the chief executive.

Iain Wood: Iain Wood from TalkTalk. We are the UK’s leading value provider of broadband but also TV and mobile as well. We have been a strong and passionate advocate of digital skills. We are delighted that this Committee has been formed and are very grateful for the opportunity to give evidence.

Clare Sutcliffe: I am Clare Sutcliffe. I am the co-founder and CEO of Code Club. We run over 2,000 after-school coding clubs for children aged nine to 11 across the UK. When the computing curriculum came into effect in September we began to train teachers using our volunteers as well.

The Chairman: We have heard a lot about Code Club, so one of the things we will be very interested in is how we scale you.

Lucy Hastings: My name is Lucy Hastings, Programme Director for Strategy at Age UK. Age UK is the leading organisation supporting older people over 50. I represent the national organisation and also the 170 local independent Age UKs that cover the country.

Q129 The Chairman: Thank you very much indeed. Perhaps I can start with a general question for all of you. We have heard that increased digital skills will be necessary across all sections of society and for all jobs going forward. What do you think we should be doing to prepare the future workforce through the education system, making sure that we reach everybody rather than just concentrating on particular high-level skills? How do we make sure that we engage people across the whole of the education system going forward?

Mary Payne: I think that where school and education is concerned, it is embracing innovation and the new technology that is coming out. My charity is all for accessibility. It is looking at the young learner and whether they need specialist software.

The Chairman: To what extent are they getting that at the moment? You have obviously been formed to fill a gap, or you have come together to do that. Describe for us briefly, if you would, what that gap is and what you are doing where the system is not quite delivering itself at the moment.

Mary Payne: The gap that we feel is with people who were in education pre-1980. That is where we find a lot of our gap is concerned. With education today it is not actually learning about specialist software because you need it; it is being aware that you are going to go into
the workplace and other people you are going to be working with, colleagues, will be using it or you might have to use screen readers or specialist software. So, even if you do not have to use it for your own abilities, it is to be aware of it, that it is out there and what it is used for.

Iain Wood: I would agree with a lot of that. As a business, we are supportive of the changes to the computing curriculum, and there were concerns about the ability of teachers to deliver that. I think we have all seen the polling evidence that the majority of teachers do not necessarily feel confident, so I am delighted that Code Club is doing fantastic work in supporting that.

We also have to get away from the idea of basic online skills being a one-off bundle of skills that can be delivered as a package and a tick in the box as “job done”. What we saw this morning in the first session was true about continual professional development. In a way TalkTalk is a prime example of that. You would expect as a company that sells connectivity that we would be at the forefront of this. We have not found it easy either. Three or four years ago we delivered a lot of work as a business, be it marketing or telesales, in really traditional ways. Our chief executive came in and said that if we as a business selling technology access cannot get this right, what hope does the rest of the economy have? And it has not been easy. There was some resistance from people who prefer to operate in old ways.

One of the ways we got round it—and I think it is perhaps a model for others—is we created a kind of online team as an incubator. It was about identifying ways of doing things better online: reducing costs, delivering better services. We are at the tipping point now where that has delivered great results, but it is now expanding out and we are getting to the point where every job within the business will be an online job. So what we have gone through over the last three or four years is a bit of a model for what a lot of companies in Britain are going through in the transition to everybody having to get basic online skills. The work that the UK Digital Taskforce did in saying, “Everybody will need basic digital skills, 50% will need a little bit extra and then there will be 10% at the top that need to go a lot further” is a great model for the sort of skills that businesses and the economy will need.

Clare Sutcliffe: I always think it is quite interesting when people say “digital skills”. It does cover so many things. I try to categorise them for simplicity into the use of digital technology and the creation of it. We can talk about both of those but it is always useful to make the distinction. Code Club focuses on the creation of software rather than the use of it necessarily, but I do think that we need to be talking about both. In terms of how can we do that through the education system, we have to just train our teachers. But not just train them: they have to be inspired, because one of the best things that a child can have is an inspiring, excited role model who helps them through their education, not just somebody who regurgitates facts to them and tests them over and over again. I think that is important.

Q130 The Chairman: Pushing you a bit further on that, we have heard from other people about the work that Code Club is doing. You are clearly a drop in the ocean in terms of the size of the problem. To what extent do you think that your model could be expanded or are there other people like you? What would make it work? What would make it grow quickly?

Clare Sutcliffe: We have a plan to be in 50% of the country’s schools by the end of 2018, but we can only fit on average 15 children in each club, which is a drop in the ocean of each school. So no matter how much we try to do it, we are never going to reach 100% of the
country’s children. That makes me sad, but I think that the only way to do it is through teachers. We are kind of a sticking plaster on the problem, which is a lack of teacher skills and confidence.

**The Chairman:** That is very helpful because we have a future session on teachers, so we will be following up on some of your points.

**Lucy Hastings:** Digital skills are life skills and the workforce is ageing and we want to celebrate that. More and more people are choosing to stay at work or have to stay at work for financial reasons. However, we do know that the employment rate among the over-50s is significantly higher and more and more people are ageing. So we want to make sure that people are not discriminated against because they have out-of-date qualifications and because people are stereotyping old people to assume that they cannot learn new skills. Our agenda is all about developing those life skills, encouraging employers to ensure that employees of all ages are skilled to do the jobs that they do but also to prepare people to retire with the life skills to cope and lead a later life.

**Q131 Baroness O’Cathain:** What does a good digital skills delivery model look like? How can we make sure we are equipping people to be users of digital technologies and others to be producers of digital technologies, and also, I would like to say, those who are selling digital technologies to ordinary consumers?

**The Chairman:** We will start with you, Mr Wood.

**Baroness O’Cathain:** I had my eye on Mr Wood.

**The Chairman:** Yes, I thought you would like Mr Wood.

**Iain Wood:** We have recently launched a broadband manifesto and to inform that we did a lot of focus groups and we did a lot of polling. We specifically targeted middle to low-income women because, typically, they are the hardest to reach in a lot of this. Some really interesting findings came out of that.

First, they did not feel that the structured digital skills programmes that are available at the moment were relevant to them. They were not typically people who had had enjoyable school experiences and, therefore, were not in a hurry to put themselves back into a formal learning environment. So we have to think very carefully, and we heard this morning about shorter courses that teach specific skills rather than a three or four-year degree-type course that these people are never going to sign up for. I think you were right this morning to highlight that as one of the ways to do that.

The market also has to adapt. What we are starting to see now—and I think it is really healthy—is the market changing to start to deliver viable product solutions to people who might not otherwise take them. For instance, one of the things that we are doing is launching a specific pilot targeting elderly people. As part of that we recognise that there are certain barriers. Partly it is the upfront cost—people worry about that—but partly it is skills. What this package does is speaks to both of those. So they get some support. They get a very cheap tablet—it is £50—which they can give back to us after the first month if they do not want it and it is not for them, and we will give them their money back. They also get some training and support in learning how to use it, in taking away some of the fear that is a prohibitive factor. Then they also get a discount. They get free broadband for the first month and are discounted for several months after that. It is only after about nine months, once
they are confident and say, “You know what, this is for me”, that the price then moves up to the market rate. We have seen Argos do very similar things in terms of training, and we have partnered with Argos to give away free broadband to elderly people who take its tablets.

So the market is changing to deliver more innovative solutions that speak to the concerns of the demographics that have been hardest to reach, but I think there is a lot more we can do as part of that.

The Chairman: That is very helpful. Thank you.

Baroness O’Cathain: Perhaps I can ask something particularly on that. There is a block of flats not too far from here that has had Hyperoptic installed. I happen to be a resident. I have not been there for nearly three months and I came back on Sunday night and there were at least 20 sales bits from people like you and others about getting fast broadband and all they should do. It was unintelligible. I know something about broadband—I have it at home in my real home—but this was unintelligible because it was saying, “You can do better than BT by doing this” and then in small print, “but the line rental is not included”. It was disgraceful. I just threw it all in the bin and I am so cross that I did. I should have brought it here and given it to you. Perhaps it would have been a revelation to you. You are trying to get to women who are part of your middle-aged or older women, part of your target. You are not; you are shooting way off it.

Iain Wood: I completely and utterly agree with you that the market has a long way to go in providing transparent data. It was one of the key things that came out of the focus groups. People said to us they did not necessarily know where to go to get the right information. When they found the information they did not necessarily know how to compare it. They did not know how to compare packages, and certainly as a business what we have tried to do is simplify the number of packages we have. We have tried to strip out a lot of the jargon, and particularly when we are talking about what we are delivering in these bespoke packages to hard to reach people we try as far as possible to strip out the jargon, but I accept there is a long way to go.

We have invested in York. It is a landmark investment in the UK in terms of delivering city-wide one gigabit services. It is the first time anyone has done it and we have done it in a joint venture with Sky and CityFibre. But one of the challenges around that is explaining to people and creating the demand—why they would want those extra services. Doing that in a way that people understand is a challenge and I think it is something that we as an industry have to get better at.

Lucy Hastings: 5 million people over 65 have never ever gone online.

The Chairman: Five million?

Lucy Hastings: Yes, 5 million over-65s and 66% of over-75s have never gone online, never experienced the benefits. I have heard lots about courses and what I want is the technology to be really intuitive. You all have iPads here today; could we just switch them on? They are much more intuitive than they were a few years ago, and by engaging with this enormous group of people that have never been online and working with the private sector to design things that work for everybody, not to discriminate against older people and younger people, would be brilliant. We have worked with TalkTalk and others to do that, but it is about the motivation. How do you motivate someone to switch on an iPad and do something? It is not about necessarily going on a short course because, as Iain said, they
went into the classroom 50 years ago. It is about tuition, motivation and savings, and identifying how people can save money online. We all know about fuel poverty but if you want to buy a train ticket or pay a bill online, it is all discounted online. There is a massive discrimination issue out there.

**Baroness O’Cathain:** But nobody knows that.

**Lucy Hastings:** We try to tell people. Older people are telling us all the time that they want to learn but they want to learn in an environment that is trusted, where intermediaries are helping them and where it is integrated into their daily lives. So, if it is wanting to go shopping, they can do that online. Everything we do today we can do online. People do not want to or they are not interested or they are not motivated, and it is all about finding the hooks to motivate people.

**Baroness O’Cathain:** They are scared. That is one of the issues we have.

**The Chairman:** I think they are also scared. Particularly if they are handing money over, they are scared.

**Lucy Hastings:** It is addressing why they are scared and giving them support in a safe environment.

**Q132 Lord Giddens:** I am going to ask you to elaborate on this. We have heard an awful lot of evidence on younger people, and not very much on older people, and there are two aspects of it to me. One is how to get older people back in to work at a time when the economy absolutely needs them and where we cannot afford to pay people, frankly, to retire on pensions at the age they used to. That is a crucial thing. Is there any good practice in other countries to look to for that? What kind of policies would you anyway advocate for that? The second one is getting people back into society. I should declare an interest; I am a patron of KIT that brings IT to people with dementia in care homes, where it has proved, to some degree, transformative. So perhaps you would comment on both those things and how they could link. Then I think there is a gender issue probably with older men and older women. I do not know if there are major gender differences in these issues, but one suspects that there might be.

**Lucy Hastings:** I do have not the full stats on gender but you are right, there is a gender issue. More older people over 75 are women and they live alone and they are poorer, so inevitably they are the ones who are offline. There is a cohort of people that we absolutely need to address.

Interestingly, as society changes, the healthcare world will change, too, and we need to give people the confidence and the skills to adapt to technology to manage their healthcare. For example, if it means that you can manage your long-term condition by taking your own blood pressure, and monitoring all your own physical statistics and sending those through to your doctor—

**Lord Giddens:** It is going to be really transformative.

**Lucy Hastings:** It is transformative. You do not need to spend a day on public transport that comes once a day to take you to hospital, wait around and come back. It will fundamentally change the lives of people through managing their own healthcare, and we need to give people the confidence and the skills to embrace that so they can have a better quality of life later on.
Lord Giddens: Would you also recognise the point that was just made that you need to adapt the technology, you cannot just import it? That is what we have found in this organisation: technology itself needs changing and adapting to specific needs.

Lucy Hastings: I think consumer technology has changed hugely. The clunky healthcare technology of past years is different now. People can use their iPads and their iPhones and their watches to measure all sorts of things and keep track of their own health and make life choices around health prevention.

Q133 Lord Macdonald of Tradeston: Can I ask something on that? It is still, surely, for older people overly complicated, and also it is not resilient. It breaks down a lot, and we see in this Committee the number of times that we have to call in experts to tell us what to do next. A lot of the people over 60 we are talking about are fairly lonely. They do not have a son and a daughter-in-law who can pop in and sort them out. That is so fundamental to people. They give up when they realise that it is full of snags.

Lucy Hastings: I think that is right. It is not just technology; it is the support that goes with it. Age UK have developed a product called Breezie, which is a tablet that has telephone support, Monday to Friday, where you can pick up the phone and say, “How do I do this?” It is replacing the daughter-in-law or the brother-in-law who asks those particular gadget questions, or the grandchildren who give you a tablet at Christmas and then walk away and do not come back for six months. We do find lots of other people are coming to Age UK services with their tablet saying, “How do I do this? I got it for Christmas” It is about having the right support around.

Iain Wood: I was going to mention the Breezie product. It is part of our offer that I talked about earlier, the one we designed specifically for elderly customers. It is absolutely fantastic, not just in terms of the software that it simplifies but even little things that you would not think about. The angle on the tablet, for instance, is slightly different, because elderly people have longer fingernails that typically bounce off a tablet. The thought that has gone into it in terms of designing it and making it accessible is fantastic. I think the gender point is really significant. I go to a lot of technology policy events, and I have to say it is brilliant I am on an otherwise all-female panel today because often there are more iPads in the room than there are women. It is shameful.

One of the things I think we have to do is respond to the specific concerns that we heard particularly in those focus groups, and that is a lot around online safety. A lot of people told us they did not know how to keep their family safe and they were worried about the risks, so that is about industry coming forward with filtering products like TalkTalk—and, to be fair, other providers—have done. We must speak specifically to those concerns and not presume that there is a one size fits all solution and that what motivated the early adopters to get online will be the same thing that motivates the harder to reach people to get online.

The Chairman: Just to warn you, we will come back to all of you at the end to say what would be your one thing that we ought to be telling the Government in this report. We are particularly concerned about joining the dots and scaling up. You are all talking about exciting things but they are all quite little at the moment. One of the things that we are concerned about, as a Committee, is that there is lots of great little stuff happening all over but how the heck does it all come together? So I will just warn you that we will come to that at the end.
Mary Payne: We talk a lot about confidence, and at UCanDoIT we target the people with disabilities furthest away from the labour market. They are in total isolation. Since 1998 we have been going into their homes on a one-to-one basis and training them in how to use the internet. What safer place can you learn how to use the internet than in your own home? We do not go in there and think, “How are we going to train you is going to last you a lifetime”. What we do is go in and give them the confidence to be able to start and then go to their community centres and libraries.

Lord Lucas: I do not mean to be beastly to you both just because you have had the grace and courage to come here, but TalkTalk first. You talk some nice things, but if you go on to “Shall I buy a TalkTalk package?” there is no link to it at all that I can see. It just assumes you know why you want broadband. There is nothing there to say, “This is what we can do for you. This is the way we can support you”. The first thing you see is, “Hang on, the pricing is getting confusing here”, and it is starting to feel like an alien world.

Age UK is not much better. You get chucked straight into some independent comparison site. You are not given support; you are not given help as to what is going on. If the object is to support these people, you have to support them at the point they hit your website—not, for the people who are not familiar with the web, at some point where you would get if you knew.

Iain Wood: Absolutely. I would be the first to admit there is more the industry can do to make that information transparent. I can assure you that buried further back in the website—perhaps we need to move it further forward—there is an awful lot of good consumer advice on safety, cybercrime and things like that that might concern people. If people have specific questions and are able to ring our helplines, we have trained agents who can talk through a lot more of the broader points that you talk about. But certainly, as I say, I think there is more the industry can do.

The Chairman: Ms Hastings, a challenge to you.

Lucy Hastings: That is fine. All of our local Age UKs, or most of them, provide all sorts of support in getting online. I accept that our national website does not necessarily give all that advice, but what people do is come into our services because they are not online. They are accessing lots of other services and they are introducing technology through those other services; people do not necessarily go on our national website to learn.

Lord Lucas: That may be, but when I am talking to my mother-in-law, I am showing her my iPad, and I am saying, “Look at Age UK. You have your Age UK button. Let us see what they offer. Oh, cannot see anything”. There is no link through to anything.

The Chairman: We are throwing the challenge back to you.

Lucy Hastings: Yes, I will take this back to them and say it has been raised here.

Q134 Earl of Courtown: We have heard much about the huge pace of change in technical and digital technologies, which is likened by some to another industrial revolution. How do delivery bodies keep up to date with latest technology changes, because these are happening all the time? I would be interested to hear what you have to say.

Mary Payne: From my small charity’s point of view, with a lack of funding, a lot of it falls back on the tutors themselves developing their own skills. We look out for training sessions and take them on training courses as the technology advances, but we have started from the
top as well. Everything seemed to be going all right on the bottom and we have looked at the top. We have looked at our governance. Our new chairman, Dr Michael Taylor, is a professional digital engineer. We have recently recruited trustees who are involved in the digital industry so that they themselves can bring their experience and skills into the charity and let it cascade down, and look at the gap analysis of what is within our charity and within our workforce. That is how we have personally tackled it.

*Iain Wood:* There is a range of things. First, the pace of technology change should not necessarily be seen as a challenge because there are all sorts of opportunities there, particularly around tablets. We have all seen the stats. Tablet use among the elderly between I think it was 2012 to 2013 tripled. So the technology is changing, but in some senses that makes it easier.

I think also the pace of technology change decreases the cost of technology, and we know that cost is a barrier for a lot of people. So when we at TalkTalk are talking about giving deals that involve £50 tablets, that pace of technology change is making it easier. It is also about a collaborative approach, which I know is often an opt-out, but in this case I do not think it is. There are some fantastic charities working together with the industry. We have worked with Code Club in the past and with fantastic charities through our Digital Heroes Awards as well. We can blend that expertise, so we are trying to get I think it is half of our employees in the north-west to be digital champions, working through the Tinder Foundation and its UK online centres to deliver training. There are all sorts of brilliantly collaborative ways that we can tackle this, but I do not think there is a one size fits all solution, and I do not think it rests either with the Government, with charities, or with industry. Everybody has to play their part.

*The Chairman:* How can that be joined up? That is one of the issues. Some of you were here for the previous session and we heard that very clearly.

*Iain Wood:* Absolutely. I think there are scale models available. The Tinder Foundation has reached over 1 million people over the last four years. I was looking at some Go ON stats and they have worked with over 700 organisations in their rollouts in the north-west, north-east and Northern Ireland, so there are scale models there. The Tinder Foundation, in particular, has managed to reach over 100 million people with £3 million to £4 million of government funding, so there are not huge, astronomical fees next to a lot of this.

If you think that we, as a country, are spending over £1 billion on digital infrastructure in terms of government subsidy for broadband, with £3 million to £4 million of support the Tinder Foundation has reached over 1 million people. If we are to take a much more holistic view of what the digital economy needs, absolutely the focus on infrastructure is welcome, but that is partly why I welcome this Committee so much. I think digital skills has been a neglected part of that, and the funding allocations in Government reflect that.

**Q135 The Chairman:** Ms Sutcliffe, tell us about to what extent Code Club is working with industry or what support you get from industry.

*Clare Sutcliffe:* A huge proportion, and I massively agree with you. I think that it is a combination of efforts. I do not think one particular group is going to fix this problem. Some 55% of our volunteers are from within industry. It is interesting that the other 45% are teachers, but I will come back to that later: 55% are from within industry. We like to go to companies that are technology-focused, recognise that what we are doing is trying to help
their industry in the future, and in return they encourage their staff to volunteer for us. It is better when it comes from the top down because staff members feel supported in their volunteering. They do not have to try to bargain for it, and the more that employers can give flexible working hours to volunteer and, even better, actual free time to go and do that as part of their CSR policies, the easier it is for us to train them to be volunteers.

They are the things that get in our way when it comes to approaching a company and taking away volunteers. We went to see Morgan Stanley, who are our kind of poster child for this really. They had all the things in place that I just spoke about, and we came away with 60 volunteers, which is pretty good going. That is what we try to replicate around the country.

Lucy Hastings: Age UK do work with industry. At the beginning of September we had a very successful partnership with EE, National Techy Tea Party, where Age UK invited and promoted lots of older people to go into a high street store and get support for an hour or so, one to one. That was extremely successful, and I think what was successful was it was an intergenerational opportunity. It was the younger workforce in EE sitting down and really understanding and learning about how to communicate the complicated technological language about buying broadband to an older generation—and they learned as much from the sessions as the older people did about technology. So we do embrace working with industry to do that.

You asked the question about keeping up to date with technology. We are very much driven by what older people want, and I do think that we are still very much at the basic skills level. But older people, when they do get excited about technology, do push us to learn more about it. We work with other voluntary organisations, such as Digital Unite, to understand more about the latest technology or applications. We would not replicate that.

Q136 Lord Lucas: How can skills delivery be linked more closely with industry? In particular, how can we make sure that the skills that are delivered actually meet industry requirements? How can someone who is setting out to educate themselves be sure that the courses they are being offered will meet employer requirements? Who is best placed to facilitate all that?

Iain Wood: I think industry has to accept a huge responsibility for this. We as a business think we have a huge responsibility to help those 9.5 million people get online—but, to be perfectly candid, we also have a huge incentive. That is potentially 9.5 million new customers, so why would we not be playing a huge and active role in supporting this?

I think there are several things we can do. At a schools level, the changes in the computing curriculum are really welcome. One of the things we are also looking at doing is supporting STEM specifically, so we are working with the Government on their Chairs programme, where they take post-docs and put them in—a little bit like the Teach First model, but they get a very significant increase in salary paid for by a partner, who is then able to work with that academic. They spend part of their time teaching but then part of their time doing academic research with an employer, which from our perspective is hugely encouraging. That is one way that we are trying to encourage an improvement in STEM teaching and specifically around STEM education. We heard this morning about the careers service not necessarily being particularly au fait with the best opportunities, so that is one way we can address it.
There are all sorts of other ways we can do it. As a business, we have gone down the digital champions route, so a lot of our staff are trained and volunteer their own time in UK online centres, teaching people. We have also done it through awards and funding awards, so we run the Digital Heroes Awards every year. We are in our seventh year and every year that gives funding of £5,000 for individual winners and then £10,000 for an overall winner. We have our awards ceremony coming up in Parliament later this month. Over the last seven years, that has given away nearly £500,000 in funding to small-scale projects. This comes back to the point of how do we scale those up? Fundamentally, they do need that support at a grass-roots level that gives them the seed funding to expand their work, and Code Club has been an organisation that we have worked with on that.

One of the other things that struck me about industry is better working relationships with local universities. We are going out of our way now to create a much more strategic relationship with set universities that have specific courses that speak to our skills gap as an organisation. Rather than simply waiting for universities to give them a production line of people and then possibly complain because the people did not meet their needs, I think organisations like TalkTalk have to get much more involved with the universities, and help design courses that meet their specific skills gap. Partly that will be funding, partly it will be running skills events on campuses and partly it will be about employability events.

Those are the sorts of things that we are doing as a business that I think are a bit of a model for how the private sector can get more involved, both from a responsibility perspective but also from an incentive perspective in terms of developing the business.

Clare Sutcliffe: Yes, I massively agree. We hear a lot about universities not outputting the kind of people that have the right skills to then go into work, and that computer science graduates are one of the least employed sectors.

The Chairman: We could not quite believe it when we heard that first.

Clare Sutcliffe: It seems such a crazy gap to me. Why are we not finding out more about what is actually required in the workplace? I am talking about programmers here rather than those with general digital skills. How can we work with universities to make sure that their courses are producing people who are ready for work? I think that is one of the main reasons that you go to university to do a computer science degree, because you can argue that you can do it, but you could go for other reasons.

I am not sure I have much more to answer on that really, apart from that lots of people complain that not enough people are going to university to do computer science. I am sure you have heard time and time again about the pipeline problem and how there are gaps all over it. Code Club is trying to introduce children to the pipeline. At the moment, we only run to 11, so we would like some support to be able to do this in secondary schools.

The Chairman: You are only in primary schools at the moment?

Clare Sutcliffe: We are only in primary schools at the moment. We would like to go into secondary schools as well, but at the moment the kids just drop off a cliff. They are all excited. We get them all excited, and then they go to their secondary school and the likelihood is that there is no computing GCSE. What is the point? Then even if there is, maybe there is no computing A-level either, so the pipeline is—

The Chairman: You are really cheering us up, I must say.
Clare Sutcliffe: I am sorry. There are things that can be done about this. One of the most important things is that computing GCSE and A-level are offered consistently across the country. I know that it is easier said than done and I know that that costs a lot of money, but I think that that is one of the ways that we can make this a lot fairer.

There is a chap called Peter Kemp, who you might or might not have heard of, who has done some research that suggests that low socioeconomic groups have less access to computing and A-level qualifications, which I am sure you already know. That seems drastically unfair to me, and I think that is one of the ways that we can fix the gap.

Q137 Lord Janvrin: Coming back on to the area of in particular how the third sector co-ordinates within itself but also with industry and with universities, the impression I get from what you have been saying so far is that you see very much at local level that this happens most effectively: how you work out or how you connect with local universities or the local workforce to produce your Code Club people. Could you comment on what is best practice locally, why does it work in some localities and not in others, whether there is some national framework, and what kind of national framework do we want to fit over that to encourage that kind of local co-operation?

Clare Sutcliffe: I will go for that one, if that is okay. This might or might not be a surprise to you, but we found that programming professionals tend to live in cities because that is where their jobs are. Therefore, the most densely populated areas are the ones with the most Code Clubs. It kind of follows logically. We do not think that that is fair either. We are only teaching nine to 11 year-olds, and you do not actually have to be a computer science graduate to do that. You need to be an encouraging, enthusiastic adult who is just one step ahead of them, because that is all you ever need to be. So what we are going to be focusing on this year is training non-computer skilled people to be able to go to their local primary school and deliver a Code Club. I will let you know how that goes, but that is our attempt at trying to reach as many people across the country. That training will be online. It will be for free and it will also be face to face, backed up by the regional co-ordinators that we have working around the country, so I hope that makes a difference.

Lord Janvrin: Your regional co-ordinators are crucial to orchestrating that?

Clare Sutcliffe: They are currently working at the moment in encouraging the local development communities to volunteer for Code Club. So we are still grabbing the last of the low-hanging fruit there, but then they will be reaching out to parents groups and going to schools and saying, “Right, if you want your school to have a Code Club, it is time to step up”.

Iain Wood: I would add that as a private sector company we see a disparity in the level of enthusiasm that there is at local level. I talked earlier about our fibre-to-the-premises network that we are building in York, and one of the reasons we picked York, frankly, was the huge enthusiasm from the local authority. It is very determined to be the digital capital of the north and sees this being a huge advantage to York. Alongside the infrastructure, what they have, which I talked about earlier as not necessarily being replicated at national level, is that they understand that skills and inclusion need to sit alongside infrastructure, because just building it will not guarantee it is used.

As a national private sector company, one of the chief things we can do is continue our regulatory efforts to reduce the price. I think Ofcom has done a fantastic job of introducing
competition into the market for existing copper broadband. Because we have high levels of competition, we have some of the lowest copper prices in Europe, but we have very serious concerns about the fibre market. At the moment it does not have that competitive regulatory architecture and, as a consequence of that, we see much lower levels of competition and much higher prices. We think fibre is overpriced. At a wholesale level, it is about twice the price it should be, and we are on record as saying that if, through more effective regulation that introduced more competition into the market, we can bring down that wholesale price, we would bring down retail prices. If you think about the barriers to getting people online, as a private sector company helping get that price down is going to be a huge achievement and it will make a huge difference. We have seen evidence from the Tinder Foundation about the number of people citing price as a barrier to getting online actually going up over recent years, which is not surprising given the economic climate. It is absolutely crucial we get more competition in the fibre market to get the price down.

Q138 Lord Macdonald of Tradeston: I wanted to pick up on Lord Janvrin’s point about the national framework. Clare, you obviously have had a very successful initiative there; to have got to 2,000 schools is splendid, but it is still probably only about 10% of the primary schools in the UK. In terms of a national framework, has there been any guidance from the Department for Education saying to primary schools, “Code Clubs are good. They are easily set up. Get to work on it now, and we will give you whatever support there is and, by the way, there is a Code Club already existing who no doubt will be willing to help”? We cannot wait until you get to 50% in 2018. How does the Department for Education push that through in a national framework?

Clare Sutcliffe: I am not entirely sure, to be honest. We have had some match-funding from the Department for Education for Code Club Pro, which is our teacher training part of our project.

The Chairman: We are not putting you on the spot. We can take it as read that that is not there on the table for you at the moment.

Clare Sutcliffe: Yes, I do not know. They could obviously encourage schools to set up their own Code Club. I am not sure how.

The Chairman: They are not doing so at the moment?

Clare Sutcliffe: Not to my knowledge.

Lord Macdonald of Tradeston: There are no other competitors in the market then at your level—the nine to 11s in primary schools?

Clare Sutcliffe: Essentially, yes. There are other people who do a similar thing to us but on a smaller scale, and with a slightly different model, but I think Code Club is the largest of its kind.

Q139 Baroness O’Cathain: There are two points following on from Lord Macdonald’s question. They fall off a cliff at 11, but surely there is a huge opportunity for somebody to replicate what Code Club does in primary schools in secondary schools? Has anybody seen that gap in the market and are they going to go and do it?

Clare Sutcliffe: I have seen people try but they have been very small-scale—nothing that has grown to the same size. For a little light sunshine though, we are planning on writing
materials and projects for 11 up to pre-GCSE and widening our reach that way. Obviously, that requires more volunteers.

Baroness O’Cathain: And more money?

Clare Sutcliffe: Yes, probably.

Baroness O’Cathain: Anyway, good luck to you. The second point was following Mr Wood’s point about York wanting to become the digital centre of the north: is there anything published about that that we could have? Should we get straight on to the council?

Iain Wood: The council is certainly on record, and the leader and chief executive are very passionate about it. I can find out more information.

The Chairman: That would be great. We have a session looking at the local delivery, so it will be useful if you would attend to that.

Lucy Hastings: Age UK is part of Go ON, as TalkTalk is, and it does regional rollouts. Every six months it has chosen a region and done a big promotion and marketing campaign about generating interest about getting online. The BBC has been part of that, too, and it has been very successful. What we want to do, though, is make sure that after that finishes there is the long-term support that follows it. It is being done with Go ON, and we have voluntary, private and public sector partners on that.

Lord Kirkwood of Kirkhope: Who orchestrates that?

Lucy Hastings: Go ON, the actual organisation itself, which will participate.

Baroness O’Cathain: Does it involve local radio?

Lucy Hastings: It involves local radio.

Baroness O’Cathain: Because local radio is much more popular a medium than most people realise.

Lucy Hastings: BBC, TV, radio and local authorities have all signed up, and lots of local businesses. One of the big agendas is about encouraging small to medium-sized enterprises and charities to increase their digital skills among their employees, and that seems to be the hardest thing, the challenge for us at the moment.

Q140 Lord Haskel: We have heard all about the wonderful work and important work that you are doing, but we have also heard that there are 5 million people who have never been online. The obvious question is how can this be scaled up so that everybody has the experience of being online? Do we do it by allowing many flowers to blossom or do we do it by getting some kind of an organisation behind it?

Lucy Hastings: It is a travesty that 5 million people are offline and there are very clear reasons why they are offline: cost, motivation, interest, fear, and lack of access to equipment. I am not going to beat about the bush. If there was a significant funding pot, we could do an enormous transformational programme in the voluntary sector to help a large majority of those 5 million people online, but what I would like to say is there will always be people who do not want to go online for many reasons, or cannot. The Government’s digital by default programme is very important, but if you ask me my policy question at the end, it would be to ensure that nobody is discriminated against by choosing or not being able to go online. That is the point that you made earlier.
Iain Wood: I will add to that. I think funding is absolutely key to all of this. If you look at the savings potentially generated by digital by default, we are talking about £1.7 billion a year. The total cost estimated to give everybody basic online skills is about £800 million. In terms of the funding priorities, and particularly when you consider the spending, as I say, of over £1 billion on infrastructure, I think we need to reorientate policy. Infrastructure absolutely matters. I would not want to suggest in any way that we hold the development of infrastructure back, but let us not presume that just building infrastructure will be enough.

We need to think far more holistically about the skills that people need, but also demand stimulation and addressing some of those concerns. When we did our polling, 25% of the people told us they have already been a victim of some sort of virus or scam online; 75% expect that to get worse. The vast majority of parents told us they want more information about how to keep their children safe online from inappropriate content. We have to start addressing some of these concerns and that is not going to be done by treating skills in isolation or infrastructure in isolation.

I was slightly dismayed by the Government’s digital communications infrastructure strategy, which is all about predicting the future infrastructure that Britain needs. In it they specifically said that digital skills did not form part of their consideration. I do not understand how you can map future infrastructure demand unless you are talking about the 10 million people who are not currently online. Surely that is part of the same demand coin, so I think that trying to get this message through to government that we need more holistic, joined-up thinking and more joined-up funding is absolutely crucial.

The Chairman: Thank you very much. Anything to add, Ms Payne, or do you echo that really?

Mary Payne: Yes.

Q141 Lord Kirkwood of Kirkhope: I am getting a sense in this session that there is more urgency about the extent of the problem. Just listening to the evidence, as Mr Wood has said, we are rightly investing and there are a lot of optimistic suggestions about how we go forward, but I am very frightened that people will get left behind. I am interested that Ms Hastings was talking about discrimination as maybe a part of the toolkit that protects people. One of the questions would be: do you think it would be sensible to start using this kind of lack of access as part of the discriminated categories in some of the rights legislation that we already have? Is that a way forward? I am very worried. It is not just a question of we do not have any money, because we do not have not any money, but any money that we are spending is going in promoting cleverer, better access for those who have it, and we are creating a bigger and deeper problem for those who are left behind.

Lucy Hastings: I do think there is an equality issue here. The Equality Act 2010 says that businesses have a legal obligation to their customers, and their employees as well, to ensure that services are accessible, so this is not just about the government agenda. This is about the goods and services that should be made accessible to everybody and the protected characteristics, and it comes down to the digital by default agenda to make sure that people are not left behind or disadvantaged in any way. One of the biggest disadvantages is financial disadvantage as well. People will become poorer because of this issue if it is not made sure that they are assisted with digital government services.

Baroness O’Cathain: That is balanced by what they save on shopping and everything else. That is what has to be sold to them.
Lord Kirkwood of Kirkhope: Is there a social cost factor? Is it mainly poorer people who have never been online?

Lucy Hastings: More poorer people are offline and in lower skilled jobs, so one of—

Lord Kirkwood of Kirkhope: But do we know that? Has that been captured by ONS or somebody?

Iain Wood: I think it is 70% of DE demographic households are offline.

Lord Kirkwood of Kirkhope: Whose figure is that?

Iain Wood: I will need to check.

The Chairman: Can you send that to us?

Iain Wood: Absolutely.

Lucy Hastings: One of the issues about the low-skilled job market is that people lose their jobs and then want to reapply for jobs. More and more jobs these days are posted online, so if you are applying for a job at Tesco, you do not need digital skills to do the job but you need digital skills to apply for the job.

Lord Kirkwood of Kirkhope: Jobcentre Plus requires you to use job maps.

Lucy Hastings: Absolutely, and some Jobcentre Plus workers refer people to Age UK to get the training to help write the CV or fill in the job applications.

Lord Kirkwood of Kirkhope: Did I understand Mr Wood to say that there was an £800 million cost to doing all this properly?

Iain Wood: It is the forecast I have seen, and I will dig it out and send it through to the Committee.

Lord Kirkwood of Kirkhope: That would be very useful. We need to crystallise the costs of dealing with inclusion properly. Nobody has any money, and this Committee is long enough in the tooth to know that it is not going to make unrealistic recommendations, but we need to understand what it would look like trying to address it over a period of time. Even if you start at the beginning and it is a continuing spend, people then recognise that there is work to be done and will get more involved in trying to address the problem.

Iain Wood: Absolutely. I think we also have a responsibility to talk very positively about the savings and potential uplift in GDP that comes from that and not just view this negatively as a pot of money when we have a tight fiscal climate—I think it is Booz & Co that said there was a £63 billion uplift in GDP possible from being a digital leader. When we are talking about costs of £800 million to get basic online skills, we have to balance that against the potential uplift.

The Chairman: Perhaps you can collectively send us any hard evidence and facts on that, because we have had various figures thrown at us. We have found it quite hard to pin some of it down, and we are very clear that we want to make the economic case for this, so that would be extremely helpful. Ms Payne, I know you were trying to come in.

Mary Payne: From a coalface point of view, we go into homes of people who are on the lowest incomes possible. It is not just affording the hardware, the computer, which we supply; it is not the internet, the connection; it is also the specialist software. A piece of
screen reader software will cost more money than a laptop. A specialist screen reader can cost £600 to £800. Now you can get a laptop for £300.

**The Chairman:** That is not covered by any discrimination legislation at the moment? There is no right to get any of that provision?

**Mary Payne:** No. As a charity, we go in and fundraise and supply it, but without people like our small charity going in, assessing them—we are linked with another organisation called AbilityNet where we carry out assessment of need, find out the IT needs, what equipment they need, fundraise, and put it in—they would just stay there. We have evidence within the charity of people with the severest disabilities where you could be forgiven for going in and thinking, “This is just not going to happen”, and 10 weeks later we actually have them shopping online.

**Q142 The Chairman:** I think there is a discrimination point. That is very helpful. Can I come to the final question? It is fine if you want to repeat the point that you have already made, that is completely fine, but we actually want your one key suggestion. We are very clear in trying to produce this report. It is such a huge area that the more we can be hard and focused in our recommendations the better, and so we are looking for everybody’s help in getting us there. If each of you could think about what the one key thing is you think would change things dramatically, it would be very helpful to hear that. I will start with you, Ms Payne.

**Mary Payne:** I think with charities like ourselves who are small but yet doing big things, it is more localised commission and smaller contracts. A lot of the time what happens is the tendering goes to the bigger private organisations, bigger charities. We are the little people, and we do not have the capital to compete with schemes that get paid by results, so we get left behind.

**Iain Wood:** I would aim for a much more comprehensive digital economy strategy that puts digital skills right at the heart of debates around infrastructure, and particularly puts the funding priorities next to that. Within that, there are several things that need to happen. We need to continue our focus on having competitive markets so that there is competition that brings prices down and stops poverty being a barrier. We also need to restructure skills training—we heard about fantastic examples this morning—around much shorter courses that are much more accessible and speak particularly to the harder to reach people who are never going to sign up for a three or four-year course. Within that, clearly there is budget restructuring that needs to happen.

**Clare Sutcliffe:** For me and from my point of view, it would be about strengthening or giving more responsibility to industry for passing on information about the skills that they require but also actually delivering training as well and passing on some kind of requirement for them to do this. It should not be left to just the larger companies to try to address this problem. I am sorry, I do not know any answer to it, but that will be the most helpful thing for our project, and I think for so many others as well.

**Lucy Hastings:** I have mentioned that government online services need to be high-quality and easy to use, but nobody should be discriminated against if they cannot or choose not to use them. My second point, if I could have one, is that access to the internet should be treated as a utility service, the same as others, and that means the Government should
recognise the significant cost of getting and staying online and nobody should be digitally excluded on cost grounds.

**The Chairman:** From what you have all said this morning, in a sense if we can establish the economic case, that is an easier argument for us to have.

**Lucy Hastings:** I think it is becoming a more and more essential service for daily living.

**The Chairman:** Yes. Thank you very much indeed. That was very useful and added very much to the first session, so thank you very much.
Andrew WS Ainger – Written evidence (DSC0015)

A 3D Virtual World where Users fly over hills and down valleys can be an attractive even addictive environment. When the Users (Residents) of this virtual world build their own houses and fill their houses with items they like (eg: web links) and then we add some social media, YouTube; and a variety of other User preferred content, then we have the basis of a self-sustaining User generated learning environment. In this Virtual World Residents can visit each other’s residencies; discuss topics of interest and, through challenges; video clips; pictures and other web content, can show what they have done and even show what they have learnt along the way.

It is this type of virtual world that has been created in a large UK avionics company. The work started in 2008, was ‘Highly Commended’ by the Institute of Engineering Technology (IET) in 2009 and has continued to be developed by its Residents for the benefit of all members of staff.

It is this Virtual World that is evidenced here. The lessons learnt, the technology, the psychological aspects, the in-world bank; the tax structures that have all been necessary to promote the in-house learning-earning environment for four and a half thousand UK staff.

- We all learn best when having fun.
- We have time to learn: In the United Kingdom (UK) we spend more time on digital media than we spend sleeping yet we are still at a very early stage in the digital era.
- Technology that facilitates learning is readily available: There are a plethora of applications in everyday use by tens of millions of people that can be utilized in, what has to be, the every-day learning and skills enhancement process.
- In addition, there are exciting new technologies waiting to be harnessed that will foster and encourage the adoption of the learning-earning lifestyle.
- There are three perceived barriers to the uptake of this learning-lifestyle, all three can be addressed through a concerted and joined-up approach from: industry, academia, Government and Wiki-like input from the British public.
- An industrial avionics team of sixty two staff volunteered to generate a fully scalable prototype Virtual Reality (VR) world for over four thousand five hundred staff in which Residents create in-world challenging content that improves staff skills within a practical business environment. It is the experiences and lessons learnt from this practical and operational prototype that has both driven this submission and is discussed below.
- The time is now right to address the perceived ‘barriers’ to VR implementation through innovative thinking, mutual support and cooperation.

FACTUAL INFORMATION

Challenges for Economic Growth

1. There was a time in business when return on investment (ROI) was king. It still is a king, however a country’s health, wealth and happiness is now determined not by one, but by the
three kings of: Trust, Cooperation and Learning; or more precisely, the rate of learning (ROL). If these three aspect are aligned then there will be no competition worth mentioning.

2. “Trust is one of the strongest predictors of a country’s wealth; nations with the lowest levels of trust tend to be poor.” The Digital Initiative can do little in this area, luckily the UK has one of the highest trust indices in the world.

3. Cooperation is not known as a UK strongpoint, however it is steadily improving as both UK and European joint research and industrial projects demonstrate the benefits of close cooperation.

4. The objective here is not to state the obvious that the continued learning, of digital skills in particular, by UK citizens is key to the prosperity of the British economy, but to evidence how a large UK Avionics company started the ROL journey: was, in 2009, ‘Highly Commended’ by the Institute of Engineering Technology (IET); progressed and improved the project through the ever changing technological landscape to establish a scalable, tested and proven ROL model for large scale use.

5. Learning lessons from the industrial ROL project over the past seven years has been painful and expensive in terms of time, cost and has been psychologically and emotionally exhausting. Keeping the volunteer team together for such a long period of time whilst maintaining and sustaining the effort required with minimal budget has been extremely difficult. However, now key members of the team are leaving the company (new jobs/retiring) and key knowledge is about to be lost. It will no doubt be re-learnt at some future date, however, the ROL Project Team are eager to contribute to the current digital skills initiative in a full a way as is possible as we wish the UK to benefit as quickly as possible from our experiences (for all our sakes).

**Virtual Reality (VR) the Leading Innovation**

6. The objective of the rate-of-learning (ROL) project was to create a Virtual Reality (VR) world which improved members; skill, knowledge and understanding of: the STEM competencies; the company’s products processes and procedures; improved cooperation throughout the company and do all this in a fun and entertaining way. This far reaching goal has been achieved through immersive and challenging game play in a networked, virtual reality environment.

7. The unique mix of technology; game theory; viral communications and social networking, combined with current networks; applications and a basic virtual world is proving to be very effective. The use of Virtual Reality (VR) is not new, however the concepts behind generating the VR world content has not been a practical reality until now. By configuring and using multiple applications in a new way it is now possible for the Team, the Residents of the Virtual World, to create their own: homes; game-plays; Challenges and other in-World content that bridges both social and business environments.

8. The ‘Residents’ of the Virtual World have been innovative by jointly creating the prototype World. Not only has the Company’s premises been modelled, but also a village, some islands, houses, a church, a bank and much more. Embedded within the Virtual World are In-World Challenges or tests which, if answered correctly, earn the Resident credits.
9. These credits can be banked in the in-world bank. Residents who successfully completing the Challenges and scoring (learning) the most win the month’s prize. The in-world bank was found to be a key psychological driver and made the difference between system adoption and abandonment.

10. The Team has created a symbiosis of technology and didactic function facilitating the generation of skilled and knowledgeable staff forming an agile, collaborative and proactive organisation.

**How has the team recognised the relevant market needs?**

11. Each member of the team has identified a need in their own field and has addressed it either collaboratively or at an individual level. Members of the team are called Residents, and each brings a different skill-set to the Virtual World. These skills are utilised and shared with the other Residents through the use of in-world challenges and mini self-created courses.

12. The Team have recognised relevant market needs through research and through the generation and feedback gained from both individual and Teams of Residents; specific business Challenges; courses and other Team-generated challenge material.

**How has the team created and implemented appropriate ideas?**

13. The Virtual World Team have implemented appropriate ideas by generating specific and focused in-world templates. These templates have been refined and improved over time and have been completed by the Team, and others, for use within the Virtual World.

14. The Challenge-Templates and short Mini-Courses form the backbone of the Virtual Reality environment. In order to do their job, the templates are not only technically complex, but the design of the User Interface together with the psychological aspects have been considered in detail.

**How has the team utilised professional engagement with peers and/or professional bodies and captured the potential value?**

15. Networking within the companies eight hundred members of on-site staff has ensured a wide reach and has captured as much of the potential value of the Virtual World as possible.

16. The initial ideas were agreed with the Managing Director in early 2008. Since then a Director has led the approach providing invaluable input and contacts as necessary. This has expanded the network and brought valuable ideas into the Virtual World.

**How has the team then brought these ideas to life and delivered them through effective management, organisation and processes?**

17. The ideas of the Virtual World Team have been brought to life through unconventional and largely counterintuitive management techniques and work package structures.

18. The initial founding team consisted of twenty three volunteer staff. In addition to their current jobs Team members (Residents) contribute to the ROL work through very small work packages. This means that each Resident was picking-up and putting-down the work many times. This is normally considered an inefficient way of working. However, this type of small
work-package structure means that the ROL VR project work can be fitted around their current job (or favourite TV program?) relatively easily as any few spare minutes can be utilised.

19. The management of these many, small time-span activities is also different. The Team holds very few meetings, but at these meetings only the goals of the work are communicated and infectious enthusiasm has taken hold. Actions are not chased and progress is monitored monthly at most. If activities are late then blame is not apportioned, but assistance and advice is available as necessary. By using this positive mentoring culture it was found that some staff put in significant amounts of extra effort to achieve the goals coming together to demonstrate success at the peer group reviews.

How can the Digital Sector be supported?

20. The digital sector needs an increase in both specialist and generalist skills. The proposed Virtual Reality project will foster both, as skilled people will create content for the lesser skilled. (Rather as some YouTube video clip content does now) Also the virtual world will encourage both young and old to give-it-a-go and to contribute and participate. It is realised that this type of environment will not be taken up by all, however we have found that once word-of-mouth takes hole then take-up is dramatic as nobody wants to get left behind.

21. The digital sector for the ROL VR project consists of many elements, the most critical of which are:

a. Application technology
b. Infrastructure technology
c. Organisational technology & associated psychological aspects
d. (Including: Learning Templates, In-World Rules, Laws & Guides; Tutorials and the in-World tax structure!)
e. Marketing

22. The application technology for the ROL VR project is already available and is being improved and further developed at an alarmingly successful rate. The infrastructure is likewise well developed, however, it is this infrastructure technology that is not available to all. Making this type of technology available is a non-trivial task. Some large organisations may be interested in cooperating and in providing, at least in the short to medium term, suitable server farms as it will be a significant opportunity for world-wide exposure.

23. The organisational technology and related psychological aspects that have been learnt over the past few years by undertaking the ROL VR project are key. If any aspect in this area is mishandled then it will be years before any further attempt can be made. Public opinion will be against the ROL VR activity and a generation of learners will be lost for ever.

What Skills do Future Workers Need?

24. We do not know what digital skills will be needed in the future. In fact the top ten jobs in 2010 were not available in 2004. The best we can do is to facilitate the learning process, and rapidly. There is little point in teaching current technology as half of what we lean in the first year of a four year degree course could be out-of-date by the end of the course.
However, we must learn something every day, otherwise, as the saying goes: “If we fail to learn we will, eventually, fail to earn”.

25. There are two key skills future workers will need, these will be the ability to learn rapidly and to teach new things they have learnt.

26. Teaching is not the preserve of teachers and lecturers. Apprenticeships used older, more experienced colleagues to teach-by-example. That practice is a dying out (unfortunately – despite encouragement in a number of areas). We need to learn from the successes of apprenticeships and consider becoming Digital Apprentices ourselves.

27. Technology is changing so rapidly now that we can be a Digital Apprentice in one area and a sage in another. Just as there all the different trades and skills in the business world, so there are numerous skills and expertise in the digital world.

What are the Barriers for Business?

28. There are just three main barriers to business for the up-take of the proposed ROL VR project:

a. National Infrastructure (we need a minimum of three Server Farms)
b. The courage, fortitude and tenacity to carry it through.
c. The reluctance of Business to embrace the concept of ‘having fun’ in the workplace!

29. The first two points (a & b) can be resolved relatively easily, however it is the third point that has been and still is a problem. Seeing staff ‘playing’ in a virtual world whilst learning, scoring credits by passing game-like courses and challenges is an anathema and is antithetical to most of today’s traditional managers. This situation will change but only slowly. When business leaders become digital-natives (as opposed to the current mostly analogue-natives) then new horizons and opportunities will open up for us. The sooner we become Digital Apprentices and learn new things the better for all of us.

30. Unfortunately we cannot wait for the younger digital-natives to become managers as this will be happening all over the World almost simultaneously. We (the UK) have to be in front of the curve to maximise the benefit to UK plc.

What Infrastructure is needed to Support the Knowledge-Driven-Economy?

31. For speed and reliability we need three geographically separated server farms. They need not be very large or expensive, but they must be reliable and highly available (99.999%) We found that if a User/Resident attempted to access the VR world a couple of times and failed then they would not try again for many weeks, if at all.

32. Word-of-mouth (or in today’s terms; Facebook/twitter/WhatsApp) are extremely powerful messaging services that must be managed at all times. One wrong statement in any media could be the death-knell of the project.
RECOMMENDATIONS

33. First we must give the Virtual World a name. We cannot call it the ROL VR project. At Selex Electronic Systems we call it, not surprisingly, SELEXworld. The name is very important, however for the time being let’s call it the UK Digital Apprentice (UKDA).

34. The next action must be to form a small industrially-led team. The team should be skilled in all aspects of the proposed UKDA world: Politics; Marketing; Infrastructure; Applications technology; Teachers; Lecturers; Academics; Virtual Reality specialists; Game Makers; Game Players; Tax specialists (yes tax - we have found that the virtual world really needs a tax office, a police force amongst others) Graphic Designers and, most importantly, applied psychologists.

35. We then have to create a UKDA prototype of the rapid Rate-of-Learning (ROL) Virtual Reality (VR) environment and measure the improved digital skills and learning engagement on a closed focus group.

36. Then we throw it all away and start again! It is only the third version that we could consider rolling for wider public consumption.

37. It may be possible to use influence and persuade suppliers to donate some of the necessary infrastructure. Some of the suppliers will be very interested in providing some of their currently spare server-farm capacity for the right sort of media coverage.

38. The marketing team must be in on the project from the start. It will be difficult to sell the fact the people having fun in the virtual world will be in fact be doing actual work and learning, fast. (Tom Sawyer’s fence?)

39. Finally, we select and invite the best team to contribute to the UKDA World creation. We need some initial VR structure to attract a critical-mass of Residents so that the project becomes educationally self-supporting. When this occurs it will also be financially self-sufficient as many will want to get on-board and paint ‘Tom Sawyer’s fence’.

INTRODUCTION TO: Andrew WS Ainger BSc. CEng. FIET.IT Portfolio Manager (UK), Selex Electronic Systems (Ex-Marconi)

Having completed a traditional engineering apprenticeship and worked in industry for over twenty five years in over a dozen European countries and, for four years, in South Africa, I have found that maximum business benefit can be achieved when combining two or more traditional specialisms. A particularly good example is the amalgamation of technology and psychology in the pursuit of continued learning. I started a company in this area and have worked for, amongst others: BAE Systems; Racal Electronics; Marconi; ICL; BICC and Selex-ES and have been invited to speak at Harvard and several European Universities on the industrial application of these techniques.

I am convinced that a company’s wealth relies on three factors: People; Organisation; Technology, but a countries wealth relies on the three basic levels of: Trust, Cooperation & Learning. Currently, the last item (learning) is something in which the UK is lagging behind. Fortunately this can be remedied relatively quickly and easily with existing technology and at relatively little expense.
The UK is ideally placed to exploit the current media revolution and create an evolution in learning. We have exactly the right mix of: technology; skills; geography and now a willingness and foresight to progress to put the great back into Great Britain!

Referenced Documentation/Articles/Web-Pages

16. https://www.youtube.com/watch?v=B1L_SRT1ve4
17. https://www.youtube.com/watch?v=rlQrTHrwxyQ&src_vid=1dLK9MW-9sY&feature=iv&annotation_id=annotation_256243 Tangential Learning
18. https://www.youtube.com/watch?v=1dLK9MW-9sY Gamification
19. https://www.youtube.com/watch?v=7ZGCPap7GKY Google gamification

Other Links of Interest

19. https://www.youtube.com/watch?v=B1L_SRT1ve4 serious games
22. https://www.gamification.co.uk Gamification
24. https://www.youtube.com/watch?v=VJ56Kia8dTU MMORPG
26. https://www.youtube.com/watch?v=7ZGCPap7GKY Google gamification
27. https://www.youtube.com/watch?v=2QJVGtKPjNc Dinner Invite!
28. YouTube (industrial)

26 August 2014
Sanjeev Appicharla – Written evidence (DSC0042)

1. About Submission:
This submission is a personal submission and is not endorsed by professional institution, IET, of which author is a member.

IET, the professional engineering society, had invited author to make a submission but author was unable to meet the deadline. Author thanks the Committee for inviting contributions. Author is a naturalised British citizen since 2006.

2. Education:
Author of this submission graduated as undergraduate in electrical (power) engineering in 1983. Since then, he has worked in various industries like Chemical, Iron and Steel and Railways in various capacities.

3. Summary of the Submission:
Author of this submission drawing upon the independent evidences available from consultancy and newspaper agencies and his own employment and research experience concludes that term “digital skills” is very broad sense and can be treated as covering people with engineering or managerial knowledge and skills to be able to specify, write, develop, test, verify, validate and implement Computer, Internet, Communication and Related Smart Technologies. These may be needed for traditional railways, road and other physical infrastructure industries as well as new online industries as well. Improving passenger information and communication are likely benefits to the user community and savings in physical infrastructure maintenance costs and enhancing capacity are the upside benefits. But there are downside risks as well.

The so called “digital skills” demand new system safety methodologies to raise awareness and deal with risks created due to less than adequate specifications and over-optimism biases and mis-representations of these Smart and ICT technologies in the traditional physical infrastructures. Introduction of such process methodologies is hampered by the legacy thinking (mind sets) prevailing in some GB industries and institutions.

The evidences for the foregoing conclusions are given in the Report. The conclusion may require reform of regulatory thinking and approaches in some industries like road and railway transport domains.

4. Author’s Research Experience and Methodology
Decision making models in the 1950s, 1960s, 1970s and 1980s assumed that human subjects are rational and are able to foresee danger and adapt their behaviour. Prof James Reason showed due to cognitive under specification and inability to balance safety and economic goals led higher level decision makers to commit latent errors that manifest accidents at a later date (Reason, 1990).

Based upon this premise, author commenced his research. Author has published six peer reviewed research studies in system safety engineering at IET System Safety Conferences

The System for Investigation of Railway Interfaces, SIRI (not to be confused with Apple’s Intelligent Assistant Device) was conceived in response to RSSB’s Signalling, Telegraph, Communication and Electrification Staff and Managers request to provide for an systems engineering methodology how to apportion legacy railway rules and regulations to duty holders.

The System for Investigation of Railway Interfaces, SIRI, is a process methodology composed of proven methods for hazard identification, hazard analysis and risk analysis like HAZOP, Fault tree analysis incorporating Skill-Rules-Knowledge Framework and Bayesian Risk Analysis to model, analyse and assess risks associated with manual or automated operations in multiple duty-holders context.

Author research has shown that it is necessary to take a social –technical approach to system safety concerns due to growing complexity of technologies being used and chances of dysfunctional interactions between sub-systems that compose the system of interest. This type of approach is needed to elicit differing stakeholder’s perceptions in order to reconcile them and generate viable course of action for eliminating risk that may manifest in operations. When decisions (latent errors) are taken without reconciling the differing perceptions then situation may emerge that can lead to unacceptable societal risks.

The differing perceptions of risk regulators, government, industry, users and members of pubic with respect to hazards and resulting risks lead to gaps in understanding and oversights despite the best intentions on the part of stakeholders due to operations of human bounded rationality and satisficing heuristic as Nobel Laureate Herbert A.Simon observed (Reason, 1990) (Appicharla S. , 2010), (Kahneman, 2011), (Appicharla S. , Analysis and modelling of the Herefordshire Accident using MORT Method, 2011). The effect of bounded rationality and satisficing heuristic can be observed in the case of railway assets like railway crossings that pose fatal risk to its users. The satisficing heuristic has led to non-application of the Health and Safety at Work etc Act 1974 due to regulatory oversight (Appicharla S. K., 2010), (Appicharla S. , 2010).The Law Commission has issued a Report to reform the Law that applies to level crossings which is now awaiting Ministerial Response¹.

In behavioural economic terms and GB Railway context, risk seeking behaviour manifests when a decision maker is faced with challenges from new technologies or digitising existing analogue infrastructures or removing barriers for new entrants to the market and by placing reliance upon subject matter expert’s intuitive judgments (Kahneman, 2011).

In an unpublished paper in 2014 author argued that such reliance on subject matter’s judgement may lead to non-recognition of optimism and misrepresentation biases by decision makers who rely upon judgements of subject matter experts (Kahneman, 2011). Author does not think use of heuristics as essential being a wrong approach to gain more

¹ http://lawcommission.justice.gov.uk/areas/level-crossings.htm
knowledge as Jens Rasmussen and others cognitive scientists may have thought so, because
heuristics approach has been formally used by Nobel Laureate Albert Einstein (Rasmussen,
Pejtersen, & Goodstein, 1994), (Einstein, 1920). It is an essential property of human nature
to believe first, think later and subsequently succumb to peer pressure in organisational and
group working context can be learnt from the works of Noble laureates Daniel Kahneman,
Albert Einstein and Herbert A. Simon. Therefore, a scientific consensus is necessary to
overcome the diversity of opinions and biases such as status quo and optimism biases that
prevent introducing necessary changes to improve railway safety risk management.

Author wishes to extend the same conclusion to cyber-physical system as well. This
conclusion is valid as public utilities that rely on digital infrastructure to provide services to
their direct and end customers as well may contain latent vulnerabilities due to design flaws
or errors in specifications of IT or Electronic Systems used for public health, and transport
services.

5. What is the pace and change of the future digital technology landscape over the next
five, 10 and 15 years? What are the leading innovations?
The current level of usage of internet by UK adults is 36 hours and 49 minutes per month as
per figures of UK Regulator Ofcom². The cost of computing has fallen continually and is
postulated to become zero in 2030 as per CEO of UK CISCO in a lecture given in 2012³ on the
theme of Smart Infrastructure and the digital economy.

Smart cards with face recognition, biometrics and connection to the Cloud and 3D Printing
and Robots with near human vision are some of the future technologies that can be
expected as a norm in the Industrial Sector. The social trend is towards Supercomputing
clusters in the immediate term to reduce the time for drawing information for vast data available⁴.

Machine learning is making inroads into road and railway transport domains. A famous
example in popular and technical domains is the much discussed Google Driverless Cars. This
is expected to be ready in next five years. However, the technology is not yet mature and is
in experimental verification stage. The MIT Report discusses the case⁵. The Report argues
that risk debate over Google Driverless Cars does matter as a solution to the risk problem of
1.24 million people dying every year due to traffic accidents. The risk in terms of subjective
chances of death over whole human population of six billion is .02%. Some decision experts
like Paul Slovic may advance an objection that Google is relying upon denominator bias
when it quotes an absolute figure of 1.24 million deaths in road accidents (Kahneman, 2011).
However, it is matter of conjecture whether all of these deaths can be attributed solely to
human road driver error ignoring social, cultural and environmental factors influencing the
behaviour of the road driver as Prof James Reason argued in 1990s and we may jump to the

³ https://www.youtube.com/watch?v=Msk3VvM1H10
⁴ http://www.bbc.co.uk/news/uk-scotland-highlands-islands-29014946
erroneous conclusion that digital technological solution is the only option as a safety intervention part from road widening to ease congestion\(^6\) (Reason, 1990).

The problem of using radio based navigational technologies with adaptive filters for information processing (like Kalman filter) in Intelligent Control and Protection Systems is that they cannot detect whether the obstacle ahead is a rock or a paper and vehicle will tend to navigate around the object irrespective of what it is. The aim of intelligent filters like Kalman filters to reduce the error due to noise present in automated sensors that measures a vehicle’s position and velocity. The design relies upon using the idea of random errors exhibit Gaussian mean and co-variances and updates of measurements of data using different sensors can improve the accuracy and reduce errors. However, if the systematic errors are present in the whole scheme then Kalman filter does not help. Members of public came to know this type of risk called Black Swan Risk, an idea popularised by Economic Crisis of 2008\(^7\). This awareness has been there in the aviation and space community that have used Kalman filter for data sensor integration since 1960s\(^8\)\(^9\) but has made inroads into railway domain in the late 1990s. This fact is admitted in the MIT paper cited earlier in the discussions. However, despite this awareness, there is a Phd research project being undertaken at the Imperial College London in the hope that it is possible to overcome the problem of error in train position measurement for train controlling purposes\(^10\). There is another Phd research project being undertaken at the Imperial College London to generate Safety Case for ERTMS technology\(^11\). The initial research brief of the Phd project shows that there are safety concerns that need to be resolved and proposes to undertake research to solve the problem of integrating digital systems into physical infrastructure.

Author of this submission has presented a draft Report to RSSB Management (a railway safety body) in 2010 saying that generating a Safety Case for ERTMS type Technology requires a departure from Yellow Book type of Engineering Safety Management System and adoption of process methodology like System for Investigation of Railway Interfaces as specification of requirements and safety analysis for introduction of automated systems has been less than adequate (Appicharla S. K., 2010). However, without realising the potential problems associated with the ERTMS/ETCS Technology as pointed out by author or Imperial Phd projects, duty-holders and safety bodies like Network Rail, ORR and RSSB have committed to proceed with implementation of such projects by 2030\(^12\). The recent cancellation of CBTC Signalling Contract by Transport for London and its review by KPMG raises the questions over supplier and client ability to critical review the system capability. The necessary skills to challenge the assumptions at the outset were simply lacking is learnt from reading the Review Findings published by Greater London Authority\(^13\).

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\(^8\) http://en.wikipedia.org/wiki/Kalman_filter


\(^10\) http://www3.imperial.ac.uk/transportriskmanagementcentre/research/etcs

\(^11\) http://www3.imperial.ac.uk/transportriskmanagementcentre/research/ertms

\(^12\) http://www.networkrail.co.uk/aspx/12275.aspx

Further, the problem associated with the development of embedded smart devices is that suppliers may claim functional capabilities far beyond what the technology or smart devices can offer\(^{14}\). For example, the solution of Active Traffic Management Pilot Programme\(^{15}\) (ATM) has shown limitations on the ability of ATM to improve upon generic rear end accidents as evidenced from the Three Year Safety Review shows\(^ {16}\). Despite this, author accepts the argument advanced by ATM Project Sponsor that fatal accidents have been nil during the Review Period and this can be a valid justification for the safety case based upon three year review\(^ {17}\). However, as noted by Prof James Reason, errors in safety case specification do not reveal themselves in such a short period, and Industrial automation systems shall be designed taking into account human error. Therefore, author rejects the process methodology of Hazop and Fault Tree Analysis used to identify hazard causes of risk presented by generic road accidents as presented in the safety paper for the Active Traffic Management Pilot. The process methodology did not take into account types of human error and their role in contributing to road accidents. The references for the papers are cited in the footnotes\(^ {18,19}\).

Growth of application of information models in design and construction activity like Building Information Models (BIM) and location dependant computing during the last decade has helped various sectors of the UK Economy to utilise digital infrastructures. Further, use of safety critical software intensive systems\(^ {20}\) in automobiles, aviation, railway, shipping and road transport, other processing industries like oil and gas industries and UK health care industries\(^ {21}\) have increased to support to front operational personnel and users as well as enhance efficiency of service delivery.

Railways and metro-rails are likely to use digital infrastructure by way of information processing by electronic means, electronic switching and dynamic scheduling. Smart metering and Smart Grid are proposals put forward by energy sector as well\(^ {22}\). On the computing side, changes have led to Cloud and mobile computing\(^ {23}\) to take a greater share of computing in the market of computing and communications and desk top computing has declined as indicated by the slide in share of Microsoft of the total market. Digitisation has invaded arts and humanities sector as well. However, it is vital to note that hackers have kept ahead of technology and are likely to take advantage of user’s inattention.

In the retail sector, emergence of social media platforms like Facebook, Google+, Instagram etc have led to increased information sharing and electronic commerce apart from their common usage in the off line retail shops like Tescos, M&S etc.

\(^{15}\) http://www.its-uk.org.uk/about/aboutus
\(^{16}\) http://www.highways.gov.uk/knowledge/publications/m42-mm-monitoring-and-evaluation-three-year-safety-review/
\(^{19}\) http://www.publications.parliament.uk/pa/cm200405/cmselect/cmtren/218/218we82.htm
\(^{21}\) http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)61099-0/fulltext#article_upsell
\(^{23}\) http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6774331
Laurent Romary\textsuperscript{24}, Director of DARIAH, the Digital Research Infrastructure for the Arts and Humanities writes in 2014 paper that creation and storage of digital content is likely to continue and gives rise to several challenges.

The social and economic trends to gather, and share information both in industry and retail sectors is bound to increase in the future as well. The participation of government sector in the social media has been slow relative to the private citizens\textsuperscript{25,26}. The Future Vision in 2020 is SMART Everwhere\textsuperscript{27}.

6. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

In terms of readiness for the new digital world, the Economist Intelligence Unit had ranked the UK in 14th place. Here is the link to the Report\textsuperscript{28}. From the perspective of delivery of successful IT initiatives, the skills, knowledge and productivity of IT Staff in delivering project benefits and ability to plan for success is in doubt as per 2012 Mckinsey and Oxford study of 5,400 IT projects\textsuperscript{29}. This study has shown that 45% of IT initiatives had cost overruns with 13% of them failing due to specification problem( shifting objectives and lack of focus), 9% failed due to problem of requirements ( due to shifting requirements and technical complexity ), 6% due to lack of skills or know how to implement, 6% due to unknown causal factors and 11% due to planning problems. The most famous case of failure is that of £12 billion NHS Project that came to public attention in 2011\textsuperscript{30}. The UK Health and Safety Executive released a Guide for managing Safety Critical Projects in 2003 to prevent IT System failures due to lack of proper specifications and methodologies and the lack of progress in skills in this area since 1995 till 2003 is noted\textsuperscript{31}. However, whether management methodologies like Managing Successful Programmes (MSP) will deliver the skills and knowledge is in doubt for three reasons. Using the information on Mckinsey-Oxford Case studies, the likelihood of successful management(read as focussing on project cost control and cost benefit analysis) having an positive influence on the outcomes of the project is limited. This inferences is deduced after applying Bayesian analysis to the Mckinsey -Oxford IT projects data shows that 87% of non-management related causal factors dominate both successful and failure case scenarios as the ability to select and set the right goals amongst competing objectives and execute them properly require a process of good decision making at all levels of an organisation (Rasmussen, Pejtersen, & Goodstein, 1994), (Kahneman, 2011). Further, all type of benefits assumed in the Business Case cannot be measured even after the project delivery. This assertion is true can be evidenced from reading the 2012 National Audit Report on Assessment of HS1 Transport Benefits where it is stated that the measurement of Regeneration Benefits cannot be audited. Further, the Report states Transport Benefits achieved are lower than what were assumed in the Business Case in

\textsuperscript{24} http://hal.inria.fr/docs/00/99/22/20/PDF/Romary_HAL.pdf
\textsuperscript{25} https://ec.europa.eu/digital-agenda/en/system-systems
\textsuperscript{26} http://www.phil-fak.uni-duesseldorf.de/fileadmin/Redaktion/Institute/Informationswissenschaft/heck/Mainka_uid_HICSS_2014_Publikation_01.pdf
\textsuperscript{27} https://ec.europa.eu/digital-agenda/en/future-vision-smart-everywhere
\textsuperscript{28} http://graphics.eiu.com/upload/EIU_Digital_economy_rankings_2010_FINAL_WEB.pdf
\textsuperscript{29} http://www.mckinsey.com/insights/business_technology/delivering_large-scale_it_projects_on_time_on_budget_and_on_value
\textsuperscript{30} http://www.bbc.co.uk/news/health-21044514
\textsuperscript{31} http://www.hse.gov.uk/pubns/books/hsg238.htm
1998\textsuperscript{32}. It is important to note that good performance of HS1 Line in terms of reliability case rests upon the French Signalling Technology TVM 430.

Investment and risk management activity in large programmes cannot be decoupled into different management practice areas as Nobel Laureate Daniel Kahneman has shown in behavioural economics. This is due to errors in information processing by the analyst in processing causal and statistical base rates in risk analysis and investment analysis are likely (Kahneman, 2011). Author is of the opinion that integrated management process to implement the management information system requirements as stated in the IEC international standard 15288 may be more useful (Commission, 2001).

From a safety and security perspective, the vulnerabilities and hazards inherent in the interactions between digital, physical infrastructures and human interfaces give rise to residual concerns over risk management of societal risks (Appicharla S., System for Investigation of Railway Interfaces, 2006). Moreover, from a social-technical perspective, the ability of the response systems to detect these vulnerabilities ahead of hazard situations and manage them is a serious concern due to complexity of the systems involved, cognitive limitations of human information processing abilities and less than adequate risk policies being pursued by GB transport regulator (Appicharla S., System for Investigation of Railway Interfaces, 2006), (Perrow, 1984/1999), (Reason, 1990), (ORR, December 2012). Author’s 2013 paper provides an indication of the nature of challenges involved when digitising existing analogue signalling principles for radio based communication systems to be used in the European train control and protection systems (Appicharla S., Technical Review of Common Safety Method using System for Investigating Railway Interfaces( SIRI) Methodology, 2013).

National Audit Office is collating information on Lessons Learnt from Railway Infrastructure programmes with large capital expenditure like HS1 and is likely to publish its results in autumn 2014. But as per earlier reported cited in the first paragraph, we must pay attention to the fact tax payers are burdened with £10 billion debt upto 2070 at 2010 prices.

Author agrees, with past IRSE President Francis How’s observation in his 2012 Lecture, that role of Institutional Schemes like IRSE Licensing and Certification have tendency to promote silo thinking amongst IRSE engineers who are unable to see the Big Picture\textsuperscript{33}. Given the fact there are multiple management tools and techniques for the evaluation of risk, projects, quality and performance management such as Multi-criteria Decision Management for Optioneering\textsuperscript{34}, Cost-benefit analysis for ALARP judgements\textsuperscript{35}, Six Sigma for Performance Management\textsuperscript{36}, and Managing Successful Programme\textsuperscript{37} there is a concern that these analytical techniques and practises may raise conflicting observations leading towards sub-optimisation of goals and enforcing status quo bias in the conservative industries when it comes to digitising legacy data, standards and automating operational practices. Therefore industry, engineering institutions, regulators and technology suppliers in the railway

\textsuperscript{32} http://www.nao.org.uk/wp-content/uploads/2012/03/10121834es.pdf
\textsuperscript{33} http://www.riagb.org.uk/data/files/FHow%20Presentation%20to%20NR%20Conference%20Nov%202012.pdf
\textsuperscript{34} http://eprints.lse.ac.uk/12761/1/Multi-criteria_Analysis.pdf
\textsuperscript{35} http://www.hse.gov.uk/Risk/theory/alarpcb.htm
\textsuperscript{36} http://www.bqf.org.uk/lean-six-sigma-academy/training
\textsuperscript{37} http://www.msp-officialsite.com/
transport sector have to abandon the traditional statistical led approaches to risk management that were suitable for generating and verifying risk hypothesis that accident rate is acceptable or not towards a more robust system approach to safety taking into account systematic (latent) errors due to a conjunction of gambling fallacy, false hypothesis due to optimism and mis-representation biases and erroneous practice of following the traditional economic utilitarian calculations (Kahneman, 2011).

7. What is the employment impact on the UK’s labour market? What are the regional differences?
As per the Telegraph Report Estimates from the Science Council suggest that the ICT workforce will grow by 39 per cent by 2030, and a 2013 report from O2 stated that around 745,000 additional workers with digital skills would be needed to meet demand between now and 2017

The proportion of adults with a broadband connection is only 77% as per Ofcom presentation in 2014. The penetration of broadband creates a disadvantage to those who are not able to use it. The figure of 17 million people not able to use broadband technology is a cause for concern and lack of skills on how to use is of more serious concern. As per the research by analysysmasons cited in footnote 12 there is a growing consensus that a 10% increase in broadband penetration results in an increase in GDP growth of between 0.9% and 1.5%; therefore, broadband is important for UK’s economic growth and development.

Improvements in broadband connections and digital infrastructure may narrow down the concentration of FTSE 100 companies in London. This fact of business concentration can be evidenced from Sir David Higgins Report.

In other words, improving the digital communications infrastructure and technology in a right manner, may ease congestion problems on the road and railway transport and may give rise to a more balanced economy in terms of geographic distribution. Author is unable to comment on whether it is better to invest in HS2 or Broadband Infrastructure as author does not have relevant facts at hand to enable form an informed judgement.

From an educational perspective, author does not accept the idea that learning how to apply geometrical skills like Pythagoras Theorem is sufficient to educational success as Professor E.D Hirsch thought because cramming such knowledge may lead to educational success but may not lead to critical thinking. Nobel Laureate Albert Einstein’s relativity physics proved that ancient Pythagoras Theorem is not always true (Penrose, 2004). Further from economics perspective, it is not true that Nature plays probabilistic games with individuals as Nobel Laureate John Harshanyi thought. Teacher–student interactions cannot be treated as as Bayesian Games from learning perspective. Creative students may be able to surprise their teachers. In summary, content of computing courses at the GCSE level may have to be made have to be designed in a careful manner. As author does not have expertise in setting

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38 http://www.telegraph.co.uk/education/educationnews/10985961/Britain-faces-growing-shortage-of-digital-skills.html
39 http://news.bbc.co.uk/1/hi/technology/7736389.stm
42 http://www.bbc.co.uk/news/education-20041997
curriculum for computer education and realises the fact the problem of education and curriculum in general dates back ancient Platonic times or even earlier\textsuperscript{44,45} and therefore, author refrained from making detailed comments on how to increase the skills and knowledge content of labour inputs to the Knowledge Economy.

8. Works Cited


ORR. (December 2012). \textit{ORR guidance on the application of Common Safety Method on Risk Evaluation and Assessment}. London: ORR.


\textit{2 September 2014}

\textsuperscript{44} http://classics.mit.edu/Plato/republic.1.introduction.html

\textsuperscript{45} http://en.wikipedia.org/wiki/Advaita_Vedanta
1. About Submission:
This submission is a personal submission. This is an additional submission extending the submission dated 02 September 2014.

2. Education:
Author of this submission graduated as undergraduate in electrical (power) engineering in 1983. Since then, he has worked in various industries like Chemical, Iron and Steel and Railways in various capacities. For research experience and methodology, readers may please use the information furnished in the previous submission dated 02 September 2014.

3. Executive Summary:
The previous submission by author drew reader’s attention to the following facts:
- 745,000 additional workers with digital skills are needed by 2017 as per Daily Telegraph Report dated 3rd July 2014
- 17 million users do not have Broad band connectivity
- 10% increase in broadband penetration results in an increase in GDP growth of between 0.9% and 1.5%
- Road and railway transportation industries will continue to employ digital automation to increase capacity, reduce congestion, enhance safety, provide better ticketing and information facilities and railways(main-line and metro railways) may embrace complete automated services by 2030
- Road, railway transportation industries and NHS lack process methodologies to identify, analyse, and mitigate risks arising from the application of immature digital technology at the time of conceptualising their operations. Examples of radio based technologies like CBTC Bombardier Project cancellation; difficulties with the application of ERTMS/ETCS Technology in the railways; and Highway Agency Active Traffic Management Programme in Road Transport Sector were briefly discussed to support these ideas. A hypothesis was advanced that root causes for these failures are “optimism” or “mis-representation” biases when conceptualising these projects. These biases can be mitigated by adopting systems engineering based process methodologies
- An assertion was made that process methodologies that rely upon cognitive system engineering or heuristics based approach are not supported road and rail industries was made that based upon Prof James Reason’ 1990 work on Human Error and author’ own research
- UK ranking 14th in a league table of 70 nations in terms of digital economy. These rankings were published in 2010 Report by the Economist Intelligence Unit and IBM
- UK Law Commission published its Report in 2013 calling for Legal Reforms in the manner Safety Risk at Road Rail Interface
- An assertion based upon statistical Bayesian analysis of data, drawing from 5,400 IT projects studied by Oxford-Mckinsey Study in 2012, was advanced that non –

46 http://digital-library.theiet.org/content/conferences/10.1049/cp_20060197?crawler=true
management factors were 87% responsible for the success and failure scenarios of 5,400 IT projects. Another assertion that enhancing management training in the IT sector may not provide desired utility as statistical base rate shows that only 13% of the projects are either failed or succeeded due to influence management factors

- This submission will draw reader’s attention to the following facts:
  - The dimension less metric called “digital deficit” of ratio of workers with lack of digital skills to workers lacking jobs which is calculated to be 27.59% based upon 2014 ONS data\(^{47}\)
  - The dimension less metric called “struggling for a job” as ratio of workers lacking jobs to those seeking jobs but not seeking seeing un-employment benefit to workers lacking jobs which is calculated to be 200% 2014 ONS data
  - The absolute number of individuals who can be targeted for employment in industrial sector to train for digital skills on the 272,200
  - A large number of 1.7 million SME organisations surveyed by Lloyds Bank and Accenture in 2014\(^{48}\) did not possess digital maturity and are unable to connect to the internet
  - The UK Tax payer is paying more than 30% than other tax payers in funding rail costs as per 2011 Sir Roy McNulty Study\(^{49}\). But this report did not take into account the fact large rail programmes failure is due to biases cited above can be seen from reading the 2011 Report
  - As per the US Naval Public School hosted web based Systems Engineering Cost Risk Advisor\(^{50}\), COSYMO, model that cost effort for very high risk technology and very low risk technology for a $10,000 per man-month project is of the ratio of 2.48 and 1698 Person-months to 683 Person-months is of the ratio 2.48.
  - Research on System Safety of Helicopters, Cycling Safety and Safety at Level Crossing Safety using SIRI Methodology drew attention of House of Commons Transport Select Committee to the causal factors causing safety risk in the domains studied and were published as Published Written Evidence\(^{51,52,53}\)
  - Reading the SIRI Published Written Evidences reveals inherent weakness in conceptualisation of application of digital technologies by statutory authorities and operators responsible for risk regulation

4. Conclusion

Author wishes to conclude that cognitive systems engineering methods do not find support in large enterprises like road and railway transport industries and NHS and immature digital technologies are selected for implementation. This is a serious concern as failures of large programmes lead to loss of support amongst members of public for these programmes

Based upon the publicly available data and author’s own research, author requests the members of Digital Skills Committee to kindly make a recommendation to adopt cognitive system engineering methods in the physical infrastructure industries like road and railway

47 http://www.bbc.co.uk/news/business-22870886
50 http://csse.usc.edu/tools/ExpertCOSYSMO.php
52 http://www.publications.parliament.uk/pa/cm201415/cmselect/cmtran/286/28613.htm
53 http://www.publications.parliament.uk/pa/cm201415/cmselect/cmtran/289/28914.htm
transport industries. This is to enable establish true causes for risk factors that may lead to unsuccessful implementation of large projects and raise awareness of less than adequate conception of benefits and immature digital technology at the concept stage such that actions can be taken to eliminate or mitigate risks upstream. Such application will lead to better delivery and changing perceptions amongst members of public that IT projects inevitably run into problems and fail.

5 September 2014
Apps for Good – Written evidence (DSC0080)

I. Introduction: About Apps for Good

1. Apps for Good is an open-source education movement that challenges the way computing is taught in schools. Our aim is to create a generation of problem-solvers and entrepreneurs who can build digital products to solve problems that matter to them.

2. We partner with schools across the UK, where Apps for Good trains teachers to deliver our course to their students aged 10-18. The Apps for Good course covers all the key aspects of product development. Students work in teams to find real-life issues they want to tackle and learn how best to solve them through mobile, web and social applications. The majority of our schools deliver this course within curriculum time as part of their ICT/Computing curriculum.

3. The backbone of the Apps for Good course is our online dashboard. Teachers use the dashboard to access course content and training, manage their Apps for Good classes, review student work, connect with our Expert community of technology professionals, and enter students into the Apps for Good Awards.

4. In order to offer our course for free and to help us bridge the gap between education and industry, Apps for Good develops long term partnerships with companies and foundations that share our mission of changing technology education; current partners include Google, Facebook, Samsung, Thomson Reuters, Barclaycard and Nominet Trust. As well as financial support we have over 800 tech volunteers who work with students and teachers remotely via Skype or Google Hangout.

II. Our reach

5. In 2014/15, Apps for Good is partnering with over 460 schools across the UK, who are teaching Apps for Good to more than 23,000 students. This represents massive growth since our launch in 2010, when we worked with two centres and 50 students.

6. In 2013/14, we had 213 schools and 17,000 students and 42% of schools were above the national average for the proportion of students per school that are eligible for free school meals. 67% of Apps for Good schools delivered the course as part of the curriculum, 7% in timetable enrichment time and 26% as a club. The gender split of students was almost even: 48% of students in the cohort were girls. Note that most of the evidence in this submission is based on the 2013/14 academic year, for which data is now available via our annual Impact Report survey of students and teachers.

III. Response to Submission Questions

(5) How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

7. Apps for Good is changing technology education. We want young people to be not only consumers of technology, but also creators and makers. Our aim is to build a global generation of problem solvers and digital makers: students who are savvy-enough to tap
into the transformational power of technology for their communities. In addition to learning about coding, the course is designed to boost multidisciplinary 21st century skills, including communication, teamwork, critical thinking and problem-solving.

8. This is done through three main approaches: equipping students with fundamental digital skills, developing 21st century skills and bridging the gap between industry and education.

A. Fundamental digital skills: Coding within a context

9. It is clear from recent research and the UK for Computing Education (UKForCE) submission to this Committee that digital skills will be critical to the vast majority of future careers. However, simply by telling students something is important or making it mandatory does not necessarily motivate them to learn it.

10. While some students will be interested in technology and coding for its own sake, the majority of students will be motivated to learn coding if they understand what they can do with it. By helping young people to see the vast opportunities for making, creating and problem solving that coding offers, we will best encourage them to learn coding and computing skills. Students should focus on their own passions and interests and understand how technology can be a part of this.

11. There is a key rule in the Apps for Good programme: the teacher can’t set the agenda – the learning must be driven by the students. This starts with the students choosing the problem or issue their app will aim to solve. This ownership of learning allows students to understand how technology can be a part of their own interests and passions. It also helps drive the creation of a product they are proud of, giving added motivation and resilience to their learning.

12. For computing education to be effective, STEM is not enough; our approach should be STEAMED: science, technology, engineering, art, maths, entrepreneurship and design. If the workplace needs students who are not just tech savvy, but confident problem solvers and makers, then STEM is not the answer. Computing education needs to encompass creativity, entrepreneurship and design.

13. In our 2013/14 Impact Report, 62% of educators reported an improvement in their students’ coding and programming skills. 40% of educators reported that their students were interested in choosing GCSE’s in Computing or ICT because of the Apps for Good course. Furthermore, over 1 in 5 students stated that because of the Apps for Good course they would like to carry on coding/programming.

B. Building a generation of problem solvers and digital makers

14. Computing skills in isolation are not enough. Education must go beyond coding and arm students with the skills to make the most of whatever challenges and opportunities arise in the 21st century. Students should learn how to identify a problem, and then develop, build and launch their solution. The Apps for Good course teaches computing, while also developing skills in problem solving, communication, teamwork and critical thinking, key future work skills. We aim to produce more able, self-confident, collaborative young people, ready to make a difference to their world.
15. Teamwork is fundamental to the Apps for Good pedagogy. Students must work in teams to develop their app idea. From the very first module of the course, we ask students to think like a start-up business, considering how they will communicate with each other, make decisions and divide the work. In 2013/14, 77% of students reported an improvement in their team working skills and 92% of educators said students’ teamwork skills were improved because of the course.

16. As explained above, the Apps for Good course is built around students finding a problem they want to solve and building a solution. The course takes them on a journey of developing a ‘pipeline’ of ideas that they scope through market, technical and user research, finally selecting the most viable idea and building a working prototype to solve the problem. In 2013/14, 92% of educators said that students improved their problem solving skills because of the course.

17. Skills and knowledge are crucial to young people’s success, but self-confidence is a vital component to achievement in education and beyond. For young people to be ready to make a difference in the world, they need the self-confidence and resilience to try, and if they fail, to try again. In 2013/14, 72% of Apps for Good teachers said that their students were more confident as a result of participating in the course.

C. Bridging industry and education: Apps for Good Experts

18. Too often, industry doesn’t know how to engage with education and education doesn’t know how to engage with industry. But for education to properly prepare young people for the world of work, the two sectors need to work together so that education is able to keep pace with industry needs, and industry is ensured that a talent pipeline is in place. Apps for Good is bridging this gap.

19. At the heart of Apps for Good are our Expert volunteers, technology professionals who mentor the students on their app ideas; the majority of sessions are conducted via video conference software such as Skype or Google Hangout, enabling even those schools in remote locations to access the Expert community. We currently have over 800 technology professionals registered as Experts on our website, 26% of whom are women (almost double the industry average of 17%).

20. Experts provide real world insight and help keep education relevant to industry, as well as act role models and help change perceptions of technology and business. 92% of Educators stated that the Expert mentoring was helpful for their students, and, furthermore, over 75% of students said that Expert mentoring was helpful or very helpful.

(6) How are schools preparing to deliver the new computing curriculum in an innovative way?

21. At Apps for Good, we believe that the more we can enable and support educators, the greater and more long-lasting our impact on young people will be. Teachers need ongoing support and training, as well as exposure to innovative pedagogy in order to confidently deliver the new curriculum.

22. We provide teachers with our course framework to deliver the course, which is updated to reflect the latest approaches in the technology industry and flexible for teachers to adapt
to meet the needs of their classroom. We provide online training for teachers – a scalable approach to directly train the over 900 teachers at our 460 education partners, allowing them to access materials when and where suits them.

23. But training and content are not enough. To support teachers in delivering the new curriculum, we help teachers to deliver an **innovative pedagogy to drive student learning**, facilitate the **sharing of best practice** and **connect teachers to industry experts** to enhance core knowledge and help teachers stay up-to-date in this fast moving field.

**A. New pedagogy**

24. The Apps for Good pedagogy draws on three key approaches: a coaching model, the flipped classroom and student-led, project based learning. These are all proven methodologies, but ones that are too often neglected in the IT/Computing classroom. As outlined above, this approach gives students more freedom to be creative and drive their own learning, alongside developing a solid understanding of digital skills.

25. In 2013/14, 69% of our teachers reported that they had developed new teaching methods and 65% believed that their confidence in teaching had improved as a result of the Apps for Good course. 83% of our teachers said that the Apps for Good course had made an improvement in their subject knowledge and 78% said that the course had taught them technical skills.

**B. Linking with Experts and sharing best practice**

26. Among the greatest challenges in teaching computing are the constant changes and innovations within the field of technology. To help overcome this, we offer our teachers access to our network of industry Experts who mentor the students. This allows teachers to draw on the experience of professionals who help teachers tackle any areas of the course they find challenging and make computing education more relevant to industry.

27. We share and showcase best practice and celebrate our most innovative school through our ‘Ninja Education Partners’. Appointed annually, Ninja Education Partners provide support to other schools, share best practice and help with the implementation of the course in the classroom. To enhance the sharing of best practice, including across geographic restrictions, we are planning to allow teachers to post and answer questions via the Apps for Good dashboard.

**7) How can the education system develop creativity and social skills more effectively?**

28. As outlined in response to questions (5) and (6), creativity and social skills are at the heart of Apps for Good. These are proven pedagogical approaches that should be encouraged and supported across the education spectrum to help prepare young people to meet the challenges and opportunities of the 21st century.

*5 September 2014*
Introduction:
1. This response comes from the Association of Learning Technology (ALT). ALT is the leading membership body for those using Technology in Learning and Teaching. It has about 1500 individual members and over 200 organisational members from industry, education and government.

2. The correspondent is the Development Advisor.

3. In this response we have mainly commented on those areas wherein we and our members have expertise, specifically those about the future workforce and digital skills and the educational infrastructure.

4. We accept the stated dichotomy between the need for general digital skills and the need for specialists. We should not forget that the latter group includes specialists in learning processes facilitated by technology.

Qn 1. What is the pace and change of the future digital technology landscape over the next five, 10 and fifteen years? What are the leading innovations?
5. The main innovation will be the increasing personalisation and interactivity of the digital landscape and its increased integration into everyday activities and devices. This will proceed at the pace with which the relevant human beings can cope. This will vary between countries and regions. Nearly all industries will be affected.

Qn 2. What are the main challenges for economic growth as the UK transitions to a knowledge–driven economy?
6. Having as much human resource that can cope with the changes, by understanding and adaption, as possible. This includes leadership and management of change skills.

7. Having specialists available, locally or by import, to support technical development in all areas. This implies recognising their value and the individual anticipating at career decision moments that this is likely to be the case. Currently this is hard and educators do not always know enough to help effectively nor are they always sympathetic to would be specialists.

Qn 3. What is the employment impact on the UK’s labour market? What are the regional differences?
8. Increasingly those without the ability to cope with digital ways of doing business will find it hard to obtain and maintain satisfying employment. This will apply at all levels. Regional differences will be driven by this. There are already considerable differences of such skills between regions (Oxfordshire and Cambridgeshire are for instance very high in relevant skills at all levels) – this is likely to increase through migration and regional policy.

Qn 4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider
workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

9. Technical understanding skills – they must be able to understand the work environment and its technology in order to perform their role effectively.

10. Organisational skills – they must be able to manage their work effectively within the boundaries set by technology and management.

11. Social skills – they must be able to have effective interactions with others within the boundaries set by technology and management.

12. Creativity skills – they must be able to take a critical view of their work and make and implement suggestions for improvement.

13. All of this involves the ability to enquire and learn in a self-critical fashion.

14. Specialist skills, whether in security, communication, computer science, specific industry systems (including education), system specification (currently visibly lacking in many areas where it is needed), or management. This is an area where the UK is traditionally weak, given its preference for the all-rounder, articulated strongly in for instance in various aspects of government employment (military, civil service etc.)

15. The requirement for specialists is clear but is likely to have less impact on overall employment. Specialists are in a strongly global market. They will arise from their being valued (or others being less valued). Successful UK regions and counties import a considerable proportion of their specialist technology workforce. Less successful ones export.

16. The current supply chain for the overall population is patchy – Higher Education is well placed due to previous and ongoing investment. Other parts are starting to try to catch up led by various advisory groups.

17. The supply chain for specialists is rather worse. Educators in general do not encourage a specialised route. Useful is still often equated with lower ranking at many levels. UK universities increasingly import research workers and staff in engineering disciplines.

Qn 5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

18. Again this is patchy. A major purpose of degree level work is to develop graduate skills. Technology makes the need deeper and more widely spread across the workforce.

19. Logical thought at all level is a precursor and recent developments with Mathematics may help make the workforce more problem solving oriented.

20. The key is to expose learners and society in general, to situations where they have to cope with technology and other changes routinely as part of their learning. The development of the functionality of .gov.uk is part of this process. It is done in higher education where
nearly all courses expect and assess the intelligent use of technology, expect and assess the development of social skills such as learning together, and expect and assess self-criticality.

21. The biggest improvement will come from those teaching and supporting learning having the relevant skills and especially knowledge of the technology, located in the discipline being taught. This needs addressing through Initial Teacher Training and Continuing Professional Development for teachers at all levels (preferably delivered through learning technology). Acquiring the relevant skills is also reflexive – they are best learned collaboratively and using technology with good role models available.

Qn 7. How can the education system develop creativity and social skills more effectively?

22. This is essentially the second half of Qn 5 recast. To create people who are versatile in this area and can use technology effectively they need to be taught/supported by people who understand the issues. If these cannot be found then they need to be (partially) imported or developed, using technology as necessary or collaborative learning techniques. In most cases what is required is CPD for all involved in teaching and an appropriate emphasis in initial scheme, well led at the establishment. A step forward has been taken by ceasing to ghettoise and trivialise technology skills education. A problem has been the ability of many involved in education to “duck” this agenda. It could be that, along with other key areas for those in supporting learning such as diversity and health and safety, a minimum standard of understanding of the area of supporting learning, social skills and creativity skills in a technology environment is needed to be maintained. This will need tuning to level.

Qn 11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

23. It seems that increasingly these are not the relevant groups about which to be worried. Females are now taking up more technology - there may be more of a case for pursuing social skills for males. In the case of age there is a workout underway and plenty of activity – older people now have good reasons for using technology. Technology is of considerable benefit to many with disabilities and is widely used to remove or ameliorate resultant impairments.

24. Some people avoiding engagement with technology are those with sufficient standing and resources so to do. A workout is underway but there will be divides with new technologies.

Qn 15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

25. In some areas of education the UK is well placed. The UK was early to identify the problems of providing learning suitable for a future workforce that needed more technology. As a result of initiatives by funders, the networking infrastructure for Higher Education (HE) and Further Education (FE) is especially good. The diversity of background and circumstances of the UK HE student body has helped to drive the development of flexibility in learning provision.

26. As a result of speaking English the UK has access to many pieces of educational infrastructure for human development when compared to others (e.g. most Massive Online
Open Courses are developed and delivered in English worldwide. The UK, led by Scotland, is at or near the forefront in the use of Open Educational Resources to support learning.

27. The UK has developed in all its countries Higher Education systems that provide opportunities and encouragement for learning of the type required.

28. In ALT there is a professional body for learning technology which allows recognition and development of skills in those supporting developments.

29. The problem is that of converting initiatives into mainstream practice across the system. Until all educational managers and senior practitioners are required to have the relevant knowledge and skills to understand and practice, then the problem will persist and provision remain patchy. Rapid progress could be facilitated by changes in assessment practice.

30. All of this puts us ahead of many but still behind a few in different areas (usually other members of the English speaking world). However it is very easy for other countries with will and leadership understanding to overtake – they may have more drive to bring it about or political systems that allow more rapid progress. Literature from parts of Asia, Australasia, North America and some parts of Europe suggest that the problem is being taken very seriously elsewhere.

5 September 2014
The Association for UK Interactive Entertainment – Written evidence (DSC0086)

Introduction

Ukie is the trade body for the UK interactive entertainment industry. Over the course of this Parliament, Ukie has been working to address the talent shortages in our industry through the Next Gen Skills campaign. Ukie has contributed to government consultations on curriculum reform, the recent Philbin taskforce on UK Digital Skills and sits on the advisory Board of UKForCE.

This submission should be read in conjunction with those of NESTA, UKForCE and Computing at School (CAS) as well as the original Next Gen report.

The NESTA Next Gen report\(^{54}\) and the Next Gen Skills campaign\(^{55}\) were established to ensure that the flow of high calibre talent from education to industry in the creative economy is enhanced in the United Kingdom. The Next Gen report set out how we can transform the UK once again into the world leader for video games and visual effects industries. The Next Gen Skills campaign believes that increasing the number and quality of computer science graduates is now fundamental to the public policy goal of promoting growth in our hi tech economy more generally. We strongly argue that policies to implement this objective should be the outcome of the current review.

We believe that every child should learn the concepts and principles of Computing and Computer Science from primary school age onward, and later have the opportunity to specialise in Computer Science if they wish. We welcome that Computing and Computer Science are now recognised as a fully-fledged subjects, taught in school on a par with other scientific subjects. Like the other sciences, it will have a practical as well as a conceptual aspect and can be taught alongside compatible subjects like Art or Design (‘STEAM’). It is crucial that government, industry and educators alike share this common purpose and work together to implement policies which makes this a reality: at the moment support for the new subject lags behind others.

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

From the perspective of the video games industry, the potential for growth is vast. The global market for games was worth $75.5bn in 2013, which is more than film and music

\(^{54}\) NESTA, Next Gen: Transforming the UK into the world’s leading talent hub for the video games and visual effects industries A Review by Ian Livingstone and Alex Hope (2011). http://www.nesta.org.uk/library/documents/NextGenv32.pdf

\(^{55}\) Next Gen Skills is an alliance between the biggest names from the UK digital, creative and hi-tech industries and the UK’s leading skills, professional and educational bodies to ensure the UK can out-educate every country on earth when it comes to Computer Science, so the UK, like the US, succeeds as a global technology leader. The campaign is led by games and interactive entertainment trade body UKIE (including major international companies with UK interests such as Microsoft, Sony, Nintendo, EA, Activision and SEGA, plus leading UK creative development studios such as PlayGen and The Creative Assembly). Other supporters include Google, TalkTalk, Facebook, the British Screen Advisory Council, Guardian Media Group, the Design Council, Intellect, IPA, British Computer Society, Abertay University, Creative Skillset, GuildHE, E Skills, the Education Foundation, NESTA and UK Screen (representing some of the world’s leading visual effects businesses, including Oscar winners Double Negative and Framestore). www.nextgenskills.com
combined. The market is predicted to reach $102.9bn by 2017. The UK’s biggest selling entertainment product was a game in 2012 and 2013, and a game is the world’s fastest-selling entertainment product of all time. A forthcoming Ukie/NESTA report will show that official figures underestimate the UK games industry, with our contribution to GDP likely to pass £1bn and a primary workforce of over 15,000.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

The most important medium term policy priorities identified by games firms are to secure access to finance, strengthen the talent pipeline and develop international business opportunities. Ukie’s Manifesto for the next Parliament calls on the government to also facilitate high-value immigration and invest in infrastructure and broadband development.

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

Ukie’s Next Gen report identifies and makes key recommendations in this area in relation to the creative digital industries.

Increasingly industries will rely on create value by finding new patterns in data and building new products and services – ‘Big Data.’ This is already happening across the tech sector making competition for talent data analysts more intense. As other sectors are challenged by the Digital Revolution more employees will be required to show high levels of competency in design thinking, systems thinking, and socio-emotional skills. While these are largely unaddressed by our current education system, we believe there is scope to develop exciting new curriculum-based lessons and qualifications: for example by developing parallel programmes to those of the Institute of Play and Glasslab in the United States. Ukie’s Digital Schoolhouse Programme, set out below, is one such opportunity.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

The embedding of rigorous new curricula in schools is a proposition distinct from other areas of National Curriculum reform, in that resources will have to be identified to build a new teaching infrastructure by training current and new teachers. There needs to be recognition that we are introducing a new subject and that unlike other GCSE subjects we will need to train or re-train a new generation of teachers.

In other countries the ‘teacher issue’ is seen as both fundamental and extremely problematic, given the status of the subject as a ‘new’ discipline and the propensity for teachers to be self-taught. We believe the issue of appropriate qualifications and Continuing Professional Development for Information and Communications Technology and

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57 http://www.instituteofplay.org/about/
Computer Science teachers to be extremely important - the Royal Society has concluded that there is a shortage of teachers who are able to teach beyond basic digital literacy: in 2012 only 35% of ICT teachers held a relevant post-A-level qualification in the subject.\(^{59}\) Recent NESTA research on the implementation of the new curriculum in advance of 1 September confirms this deficit: A recent survey by NESTA and TES found that ‘just 7 per cent of polled teachers are “very confident” in their ability to teach computing. More than a third (35 per cent) are “not at all confident” and a further 25 per cent are “not very confident’’.\(^{60}\)

Providing a ‘step change’ in school technology has been attempted before. Funded by the National Lottery new Opportunities Fund, a broad ICT training for teachers and school librarians programme was launched in 1999 and lasted until 2003. During this period over 485,000 teachers and school librarians signed up for training with one of a range of approved training providers.\(^{61}\)

Successful implementation in as many schools as possible depends on proper understanding and support for school leaders. For this we need to signal a clear direction of travel for educators. The Next Gen Skills campaign recommends harnessing the dynamism across sectors in a partnership approach between government, professional bodies, industry, schools and universities, rather than risk leaving development to ‘early adopters’ and industry goodwill alone. Such a partnership could be manifested in a public ‘Route Map’ agreement with tangible objectives for partners to create a common understanding around the measures which need to be in place for success.

Suggested elements of a Computer Science Route Map 2014-2020 include:

- Funding support for teacher training to levels equivalent to Maths or the other sciences.
- Set a target ambition for the take-up of Computing in schools by 2020.
- Address the teacher deficit in Computing by investing in CPD and initial teacher training, as recommended by UKFORCE and others.
- Invest in careers guidance: leverage industry expertise via (e.g.) Video Games Ambassadors/STEMNET to inform schools careers advice to highlight routes through to new jobs in hi-tech professions.
- Greater assurance on quality or teaching and curricula between primary and secondary schools by championing Computing with school heads and leaders
- Assistance with engaging school clusters, local authorities and LEPs in their dialogue with local employers.
- Finally support for the new Computing curriculum should start from an early age: Ukie’s Mayor of London Digital Schoolhouse programme should be extended around the country.
- The Digital Schoolhouse London Programme is a primary-to-secondary project focused on the teaching of computing in inspiring new ways. Co-ordinated by Ukie, each Digital Schoolhouse will establish a dedicated computing suite in a secondary school, to be visited by local primary schools. Over 2015 each of the 10 London Digital Schoolhouses

\(^{59}\) Royal Society, Shut Down or restart: the way forward for computing in UK schools (January 2012). Chapter 7.

\(^{60}\) http://www.tes.co.uk/article.aspx?storyCode=6437084

\(^{61}\) http://www.biglotteryfund.org.uk/prog_ict_school_librarians_wales?regioncode=uk
will grow and support a network of hundreds primary teachers to deliver creative and cross-curricular lessons with computing at its heart. The extra contribution of the video games industry will be to link educators with creative industries to create exciting new lessons and to map products with the new curriculum.

- The Digital Schoolhouse works by providing free enrichment days for visiting primary school pupils with an aim to both inspire and engage them in the new curriculum. In addition, continued support is provided for primary school teachers through ongoing free Hub and a range of CPD events. The Digital Schoolhouse model is designed to be flexible and responsive to the local context and need.
- The Digital Schoolhouse acts as a network of local primary schools which benefit from being able to visit the facility and to engage in curriculum co-construction.
- Resources such as lesson plans developed by a Digital Schoolhouse are freely shared within the Digital Schoolhouse community.
- The Digital Schoolhouse facility is inclusive and accessible to all with sufficient resources to enable pupils with special educational needs to access the curriculum on an equal basis with others.
- Digital Schoolhouse curriculum promotes a view of Computing based on the simile “Computing is like driving the car whilst Computer Science is about designing the car”. The definition of Computing promoted is Programming, Information Technology, which covers the creative use of software with a purpose, and Digital Literacy which covers critical understanding technology’s impact on society, including privacy, responsible use, legal and ethical issues.
- Digital Schoolhouse lessons and resources link to other curriculum areas such as literacy, numeracy, science, geography and history, art, physical education and philosophy for children.
- The Digital Schoolhouse actively builds relationships with business/industry, universities and educational visitor centres to provide ‘real life’ scenarios to engage and stimulate pupils.
- Visiting class teachers are provided with continued professional development opportunities through team teaching and through using DSH lesson resources. The aim is for primary school teachers to gain confidence in delivering similar lessons in their own school and opting to use their next DSH booking to experience a different lesson.

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

Following the NESTA Next Gen report recommendations we believe that the following steps should be considered:

- Extend and make permanent the Skills Investment Fund: Deliver a new plan for the fund for 2015 and beyond. Re-define the criteria and process for accessing funds to make it simpler for games companies to access.
- Reinvigorate Creative Skillset Accreditation of university games courses: Recognise and support higher education courses which best prepare students to join the games industry. Aim to have a number of the UK’s higher education games-related courses recognised as amongst the best in the world, in terms of education quality and vocational relevance.
• Set ambitious targets for apprenticeships: Work with industry to set a target for apprenticeship numbers over the next five years as part of expected job growth.

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

The government should reform its approach to high-skilled immigration to recognise the challenges of the tech industry. Specifically, there should be a smoother visa process for high-skilled creative and technology workers, and ensure SMEs and start-ups are not disadvantaged by the system.

8 September 2014
Association of Information Technology in Teacher Education – Written evidence (DSC0050)

Preamble: ITTE is an organisation that supports and represents the interests of teacher training and education with specific reference to all aspects of computing, i.e. computer science, information technology and digital literacy. ITTE’s response to the House of Lords’ Call for Evidence therefore addresses mainly the questions that relate to education.

There is an increasing body of evidence which supports the use of digital technologies in classrooms, schools, and post-16 education as well as innovations such as MOOCs and wider aspects of informal learning or workplace training. For example, ITTE’s own peer-reviewed Journal of Technology, Pedagogy, and Education is a long established contributor to the continuous development of evidence-based research. More widely the evaluation and contextual application of research evidence is under constant review by many policy and strategy groups. Among the most notable perhaps are the recent report “Shut Down or Restart?” (2012) and “Digital Skills for Tomorrow’s World”. Both documents contain substantial bibliographies that reference important examples of the research base that underpins much current thinking.

However, much of this research evidences specific aspects of education for digital skills rather than a the formulation of a whole strategy to develop digital skills across the nation particularly in order to ensure a consistency of experience and outcome for all stakeholders. In its response ITTE aims to draw attention to some of the wider considerations that might be taken account of by the House of Lords Digital Skills Committee.

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

The rate of change in digital technology is a major challenge for education. The technological future has a high degree of uncertainty. For example, whereas in the early phases of the ‘digital revolution’ (circa 1950-1980) the idea that digital technology could or would assume a core role in the everyday social life of people was still somewhat contentious, today we find that digital technology has moved well beyond the merely functional into deeply psychological aspects of human life. Digital technology increasingly assumes an active and contributory role in everyday life, so much so that some predict a tipping point when digital technology will become in some important sense more intelligent than people and will therefore become even more significant in social, economic and political decision making.

62 Technology, Pedagogy and Education, Routledge
64 UK Digital Skills Taskforce: http://www.ukdigitalskills.com/
This implies the emergence, already apparent, of autonomous robotic devices that can in some sense take care of human affairs from devices that can provide palliative care to the infirm, or adaptive support for the disabled, through to advanced search and rescue operations and of course automated warfare. It implies the emergence, already apparent, of financial management systems that make their ‘own’ decisions about significant economic transactions, the development of automated newsgathering and dissemination up to an including the production of texts and videos without direct human intervention, and of course advanced, subtle and automated surveillance of vast swathes of human social life.

At the same time digital technology provides powerful tools that have the potential to improve human life. The diagnosis of disease and the molecular design of new drugs to combat disease or prolong life, the mapping and discovery of the planet’s remaining resources as well as the effective expansion of human activity to the Moon and Mars during the 21st Century are just three examples of the ways in which digital tools can have macro effects on human life. At the individual level too to the emergence of the ‘Internet of Things’ in which our everyday devices such as televisions, domestic heating, food storage and consumption, and even the domestic production of physical spare parts for broken devices or perhaps the ‘printing’ of entirely new devices are all now realistic possibilities and in some aspects are already available.

We also need to maintain awareness of the fact that ‘digital technology’ itself, as we understand it, may be supplanted. We may say with confidence that the ‘digital’ will give way to some other forms of computational technology and that this will begin to emerge during the next generation. Already, ‘silicon’ which was once the material that symbolically expressed the essence of the digital revolution is giving way to a whole new range of materials that offer faster, smaller, more complex physical embodiments of digital information and which thus can move the entire computational effort forward (e.g. molybdenum67 or carbon nanotubes68). Such investigations into the information handling properties of fundamental materials will perhaps leads us into a new type of computational technology based on the quantum properties of matter, possibilities that have been predicted at least since the 1980s69.

Such technological transformations are likely to happen during the lifetime of today’s infant school children, at least in part, and many of these changes will have a significant impact on their daily lives in economic and social settings. It is therefore important to ask ourselves how we can intellectually and practically ‘future-proof’ today’s children against a future that will be based on more sophisticated forms of computational logic (e.g. the qubit70) using new kinds of materials (e.g. nanotubes), and fully embedded in the social world (the ‘third age of computing’71 aka the ‘internet of things’).

67 Purdue University: http://www.purdue.edu/newsroom/releases/2014/Q2/silicon-alternatives-key-to-future-computers,- consumer-electronics.html
2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

Changing skill set. Students and tutors need to be digitally wise and confident users of new technologies. Need to understand data visualisation, processes and develop high level of computational thinking. Recognising that mobile technologies are here to stay, at least for the present, and rather than banning them from schools learning to work with them and help children access them and use them confidently and safely.

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

Skills and confidence need to be embedded at primary school, and developed through secondary and HE so that all the workforce is adaptable in their approach to using digital technologies, has a high level of transferable skills and having a vast range of knowledge to draw on.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

Not at present. We need to have digital literacy embedded overtly in all subjects, and an investment in CPD for teachers who also need access to and a flexible approach to mobile technologies. Our experience is that new teachers develop the required skills, knowledge and understanding but quickly become out of date as technologies move quickly. Existing teachers who have not trained within the last 2-3 years receive little digital literacy upskilling and we are reliant on those who have an interest and enthusiasm for these resulting in an inconsistent experience for students. We would recommend a system similar to that of lawyers and doctors whereby teachers have to develop digital literacy in their classroom and evidence this as part of their CPD, possibly via an ePortfolio.

In addition, apart from teaching students about technology and encouraging them to use and develop it, it is equally important to teach them to question the value of it and to make considered decisions about when and when not to use it – while they can!

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

There is a lot of time and effort put in by some schools, but not all, and a variety of approaches are being used. There is some excellent practice but no clearly defined way to share this practice, since the demise of Becta, other than voluntary organisations such as ITTE, CAS, Naace and those organising local hubs which some teachers attend. This is unsatisfactory and will lead to lack of opportunity for students and a lack of a consistent experience.
7. How can the education system develop creativity and social skills more effectively?

Through supporting CPD for teachers with a requirement that they need to evidence development of digital literacy in their classrooms, developing a problem-solving curriculum and supporting initiatives such as Apps 4 Good and providing opportunities for dissemination through such organisations as ITTE.

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

Through the continuation of embedded opportunities in all courses to develop their digital literacy skills, knowledge and understanding to become digitally wise and sufficiently flexible in having a wide ‘toolbox’ of digital technologies and transferable skills. This will only happen in a consistent way with the support of Government and the requirement for teachers to be digitally wise and confidently use digital technologies appropriately in their classrooms. The challenges that face us are potentially enormous and we need to have a long term vision rather than short-sightedness and quick fixes which are not appropriate or sustainable.

We may also see, but cannot predict when it will happen, a fundamental shift in the nature of computation away from the present paradigm of binary logic towards a new kind of computation, i.e. so-called quantum computing.

In summary: during the next 15 years, i.e. the time it will take for today’s infant school children to complete their secondary education and be ready to enter tertiary and higher education or directly into employment we will see three major developments that are already underway:

- The rise of autonomous and intelligent systems that can make decisions, offer guidance and make judgements about courses of action (artificial intelligence);
- The reliance on the network as a space for storing, retrieving, and analysing information (the ‘cloud’);
- The subtle but intensive integration of computational devices into everyday life (the ‘internet of things’).

5 September 2014
Executive Summary

1. There is no doubt that we are in the middle of a revolution in the way that we live our lives that is as profound as the first industrial revolution. This has implications for the skills needed not just in the workplace, but also more generally for citizens in carrying out simple tasks such as shopping for goods, accessing information-based services, and communicating with others. The societal shift that took place 150+ years ago led to some people feeling left behind and disenfranchised. This risk is even more acute in today’s globalised world, and the desire not to leave anyone behind is perhaps one of society’s greatest challenges.

2. The workplace skills issue is, of course, about ensuring that the UK has sufficient talent to enable us to compete internationally when it comes to the digitisation of the global economy – so for example mathematics, digital design and computer science become ever more important. The issue is also about upskilling and reskilling the entire workforce to deal with the changing demands of consumers. This is much more than simply ensuring that everyone knows how to use a smart mobile device – it is about infusing our workforce with sufficient digital know-how to ensure they can keep the businesses that employ them in-touch with demands. Indeed, we should not think about this as just a “workforce issue” – it is about the person as an individual and not just as an employee.

3. At Barclays we started with a very specific challenge – a desire to help customers understand how to use the new technology we were making available but with an experienced workforce who, themselves, felt uncomfortable with it (which, therefore, had an impact on customer take-up). We decided to address it by developing a small pilot initiative called the “Digital Eagles” - 20 'non techy but tech savvy' people seconded to teach others their digital skills, helping them feel confident using the new internal systems and showing customers how to get the most from banking innovation. The Digital Eagles experiment was a success as not only were there high levels of take-up, there was also an increasing sense of pride and emotional attachment from, to being with, employees. This led us to expand the programme and experiment with helping customers gain digital skills too. To start we focused on older customers and in partnership with Age Concern we launched “Tea and Teach” sessions. Giving primarily older people (not only customers) the ability to participate in the digital revolution which they had feared was profound. It also demonstrated a key learning which we hope is helpful: one-to-one face-to-face demonstration and participation works best. Many people are embarrassed by their lack of knowledge and need face-to-face reassurance and support. There is no “quick-fix” to helping the non-savvy become tech-savvy, but for Barclays what started as a necessity has become part of how we do business. We believe initiatives such as this aimed at reskilling and upskilling the UK population can have a really beneficial effect – both on society (by helping reduce the number of people left behind), but also the economy.

4. We are only too happy to share our learnings as there is clearly an issue with Digital Skills that we can best resolve by working together.
The issues
5. Barclays believes that it is best-placed to comment on questions 4 and 5 ("Future Workforce", 11 (inclusion) and 13 and 14 ("Industry").

Future workforce
4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?
6. The wider workforce these days is expected to be “digitally literate”. Service industries such as financial services expect their employees to be capable of using digital technology in the fulfilment of their roles. Increasingly, as customers look to self-serve (from obtaining bank account information to booking a holiday), the key requirement of employees is to be able to help customers when they encounter problems, and in some cases to re-train the customer in how they interact with a company.
7. There is also a requirement for the UK to be able to compete in sectors which are changing to become more software-based. This means requiring people with advanced mathematical, computer science and design skills, who would be assets in both manufacturing and information-based sectors. Many manufactured products now incorporate digital technology (for example, proprietary CCTV solutions are now software-based, internet-enabled products) to such an extent that customers expect it. This means that many professions need a significant level of digital understanding.
8. From Barclays point-of-view, our customer-facing staff working in the community need increasingly to understand how to use digital technology in their normal working day. However, in order to compete effectively in a challenging marketplace, we need good designers and coders to enable us to create products and services that are more useful, useable and helpful for our customers than our competitors. Digital capability is becoming an increasingly valuable competitive asset, both for companies and, therefore, potential employees.
9. LifeSkills created with Barclays is our free education programme which aims to equip one million young people with the skills they need to enter the world of work. Since launching in 2013, LifeSkills has been delivered to some 491,000 young people. Entirely based on research and with materials written by teaching professionals, the use of creative digital delivery for content has been a principle of the programme since inception. Teaching materials for schools cover three core modules: People Skills; Work Skills and Money Skills. Understanding the importance of digital activity and supporting students to understand that whilst they need to plan for their careers, many jobs that they may like to do or industries that may like to work in have not even been created yet form part of the content. Activities aim to build on the skills that students, as digital natives already have and fine tuning them for the world of work. Specific examples of this include activities to demonstrate to students the importance of managing their online reputation, how they can use digital means to seek employment and the roles which exist already which draw heavily on digital skills.
10. What is particularly interesting is the juxtaposition of younger “digital natives” with older more experienced people who are less comfortable with digital. There must be an opportunity to be creative and use each group to support the other, helping to bridge the digital divide whilst at the same time supporting younger people into the world of work.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

11. Our experience with our Digital Eagles programme demonstrates that face-to-face interactive learning is particularly effective at delivering strong results, particularly in the workplace. There may be scope to harness the knowledge of less-work-experienced (and unemployed) but digitally-savvy younger people to help the more experienced elements of the workforce to bridge that divide. The quid pro quo could be peer-to-peer sharing whereby experienced employees support younger people in other areas.

12. The UK’s approach to education has not changed significantly since the first industrial revolution. Similar hours, similar holidays, similar environments. There are many reasons to change this, not least to reflect the different needs that businesses have of their employees. For example:

- We need to move from a culture of teaching until age 18 or 21 to a culture of lifelong learning. Education should not and need not stop at a specific age. The pace of change is such that people need to continue to adapt to change, rather than to be taught the fixed rules of an inflexible society.
- Using new technology within the classroom is one approach to creating more flexible and more engaging learning. Whilst it is still early days to be able to assess the impact of digital technology such as iPads on young people, it is clear that young people like to self-learn, and do not all respond positively to old-fashioned methods of education.
- Evolving platforms such as the Digital Driving Licence enable people to continue to develop, whilst also allowing the range of modules available to also expand as new uses for technology develop.

Short- and medium-term support to the digital sector

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

13. Barclays agrees completely that there is an inclusion agenda relating to digital skills in the workplace.

14. The average length of service in the Barclays branch network is 23 years. This could have meant that, as we changed some of our processes (such as using iPads in-branch rather than fixed terminals) we risked alienating our more experienced members of staff who may have been less comfortable with new technology than others. It was, therefore, vitally important to create programmes that meant that these more experienced people continued to see a future for themselves in Barclays and it was this that led to the creation of the initial Digital Eagles programme. We created a community of self-appointed “Digital Eagles” whose initial role was to work with other colleagues to build up each other’s capability. The programme
was so successful that we are now able to offer the support of Digital Eagles to customers, so that we can help bring the benefits of the new digital economy to older customers as well as older members of staff.

15. Digital technology can be enabling, too. Talking ATMs enable partially-sighted customers to use ATM technology, for example. Widespread broadband can enable colleagues who cannot travel long distances to work from home. Barclays believes that the increasing usability of digital technology can be a source of inclusion – but that companies need to dedicate time, resource and thought to ensure this is the case.

Industry

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

16. For businesses to compete effectively in a global economy, they need to address the shift in society to digital provision and digital delivery. In making this shift, they need to bring both their customers and their workforce with them – both rationally and emotionally. At Barclays we know how challenging this can be and initiatives such as the Digital Eagles, providing Wi-Fi to customers in-branch, delivering services from iPads rather than standalone terminals, have helped. However, there is still so much more that can be done by us, by business generally and by Government. The future competitiveness of our vitally-important SME sector depends on their identifying and resolving this challenge. We believe that there is a case for Government working with business to identify best practice that SMEs can draw upon – it will be a focus for many businesses over the next 5 years and therefore an issue that no Government can leave to chance.

17. There are already a number of ways that businesses can support their employees in continuing to develop new skills. One initiative we’re working on in Barclays is the Digital Driving Licence (DDL) which is a modular qualification that enables businesses to add new modules which can then be used by employees of other subscribing businesses. New ways of learning – such as using video, games and real-life examples – are replacing classroom methods as they are more appropriate for the 21st century employee student.

CONCLUSION

18. Barclays is passionate about helping society navigate the changes we are now seeing from what we could term the “second industrial revolution”. Regular re-skilling and up-skilling, in markedly different ways to that of even 10 years ago, is crucial to ensuring the UK is a winner in a competitive global digital economy.

5 September 2014
TUESDAY 2 SEPTEMBER 2014

Members present

Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Baroness Garden of Frognal
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Lucas
Lord Macdonald of Tradeston
Baroness O’Cathain

Examination of Witnesses

James Thickett, Director of Nations and Market Development, Ofcom, Helen Milner, Chief Executive, Tinder Foundation, Professor Patrick Barwise, Chairman, Which?, and Emeritus Professor of Management and Marketing, London Business School (speaking as an independent academic), and Phil Fearnley, Director, BBC Homepage and myBBC, BBC

The Chairman: Good morning and thank you for joining us. You have a list of interests in front of you that have been declared by Committee members. These were also declared orally at the sessions on 8 and 22 July. This is a formal evidence-taking session of the Committee and a full note will be taken. It will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and if you want to make minor amendments to any errors, that is fine. This session is being webcast live and will subsequently be accessible on the parliamentary website. You are also welcome to submit supplementary evidence. Particularly where we have delved a bit but need some
more information, we encourage you to do that. Finally, I suggest that you speak up reasonably clearly in here. It is not bad, but it always helps if people speak clearly. I will ask you to introduce yourselves and to make any opening remarks you wish to make. You do not need to, and we can go straight into the questions. It is entirely up to you.

James Thickett: Hello, My name is James Thickett. I am director of research and cover media literacy and digital literacy at Ofcom.

Helen Milner: I am Helen Milner. I am the chief executive of Tinder Foundation, which is a not-for-profit, staff-owned mutual dedicated to digital inclusion. I am also on the Speaker’s Commission on Digital Democracy. It might be interesting to think about how democracy and digital skills work together.

Professor Patrick Barwise: I am Patrick Barwise. I am emeritus professor of management and marketing at London Business School. I am also chairman of Which?, but I am not here to speak for Which?

The Chairman: We understand that.

Professor Patrick Barwise: My understanding is that you have seen the note I wrote two years ago about the investment case for digital inclusion. You may or may not have had time to read it. I will not test you.

The Chairman: We have. Thank you very much.

Phil Fearnley: Hi, I am Phil Fearnley. I am director of Homepage and myBBC, the future media department of the BBC. I run a number of the digital products within the BBC and also have oversight and responsibility for our digital media activity in the context of our plans for 2015 around digital creativity.

Q103 The Chairman: Let me kick off with a broad question. Can you describe for us what you see as an effective digital literacy strategy and how we measure success? That is pretty broad brush to start with.

James Thickett: As you know, Ofcom has a duty to promote media literacy, which it fulfils through carrying out research. It has been doing that since 2005. Ofcom has produced two fairly weighty reports every year, one on adults and one on children. Ofcom has done a lot of work on this area.

In answering this question, I shall focus on four elements around digital literacy and digital skills. The first is about getting people online in the first place. Over the past five years or so, we have seen an increase in the number of people who access the internet on a regular basis. It is now 83%. That has grown quite a lot over the past two or three years, largely down to the impact of tablet computers and smartphones. Only 42% of over-65s and only about one-third of the over-75s have access to the internet, so there is quite a substantial minority who are still not accessing it. About 70% of people on lower incomes are not accessing it either.

The Chairman: Seventy per cent?

James Thickett: Seventy per cent of people in the D and E income groups. That is the first of the four elements.

The second element is confidence. This is something that has been measured over time. Ofcom did work this summer on measuring confidence and aptitude. What was found was
Professor Patrick Barwise, BBC, Ofcom and Tinder Foundation – Oral evidence (QQ 103-112)

quite surprising in one sense, but probably not in another. People’s peak of digital confidence, understanding and aptitude peaks at 15 and goes downhill after that. That is good news in one sense, but 6 year-olds have more confidence in online than 44 year-olds. There is clearly a job to be done here.

There is a correlation between confidence and the next thing I will highlight, which is technical skills or technical user skills. This was measured by showing people 34 separate activities that they might use online. They ranged from sending e-mails, going on social networking sites, blogging, hosting a website, internet shopping, engaging with government services, engaging with the local council to going on an e-petition. There was a raft of them.

We found that the average UK adult engages with nine out of these 34 activities on a quarterly basis, which is perhaps less than many of you might have thought. Among younger people—the under-24s—it is 14, which is higher than the average, but is still not hugely high, and among older people, particularly the over-65s, it is about two. We are finding that people who are relatively new to the internet, mainly the older age groups, are using the internet in a very narrow way so they are not getting the most out of it.

The Chairman: Is there a group that is absolutely at the top, or was it young people?

James Thickett: It is young people. It varies. Young people use the internet more for communicating with each other, whereas the middle-aged group is more likely to use it for government services or shopping.

Ofcom is particularly interested in the fourth area, which is what is called cognitive skills. It is basically being able to use your judgment when you are using the internet. This is often overlooked and under-researched, but Ofcom feels it is very important because it is an area where people tend to get into trouble. It is about understanding when a website is legitimate or whether listings on Google are objective or paid for, and it is about password protection and understanding when to give your personal details away. We measure a host of these. We find that there is a correlation with confidence. The more confident you are, the more likely it is that you are going to ignore a lot of this stuff. Younger people who are very confident tend to be more lackadaisical in the protocols they use when they are accessing the internet. They are likely to be less judgmental in the way they use it. Older people or newer people coming on to the internet tend to exercise more judgment as they have less confidence, so it hampers their ability to do more.

Those are the four areas. It is important that as the UK we look at each one of them and have strategies to address them. There is not a one-size-fits-all for digital skills. You need to look at where the problems are in those four areas and which are the groups that need help and address them that way.

Helen Milner: Building on what James has said, I would like to make sure that we understand that it is not just about older people. It is also about poverty. The two groups are older people and poor people. Of people who earn more than £40,000, 98% of them use the internet and 95% of people with a degree use the internet. Only 60% of people who have no qualifications use the internet.

The Chairman: Is that regardless of age?

Helen Milner: Yes. Five per cent of 15 to 24 year-olds do not have basic online skills. We have to be really clear. This goes back to the questions that Lord Kirkwood was asking. I hate to say it, but some people say to me, “Old people will die, and the problem will go away”.

69
You will also be looking at high-level digital skills. This is absolutely about making sure that as a country we are pushing the top-level skills and the bottom-level skills. It is nice to see that Andy is here because it is exactly what the Leitch review found in 2006: if we do not concentrate on the bottom as well as the top we will never be a truly competitive economy.

Focusing on the people on the bottom, you asked about a strategy. It has to be about local—David Hughes was saying this to you before—but it also has to be about digital. We work with 5,000 local organisations: public libraries, community organisations, such as mosques and churches, community groups, cafes, restaurants, private-sector factories, prisons et cetera. In the past four years we have helped 1.25 million people, so this is a scalable model. We scale that because we use digital technology to deliver the learning. At local level, the people who need the help are motivated to come along because they get the support that they need, but all the learning is delivered online, so you make it once and use it many times. Also, you can respond very quickly to changes in the curriculum. If more people walk in asking for Skype or for help with Universal Jobmatch, you can change the curriculum and those tens of thousands of local volunteers and staff helping people can use that curriculum.

We are not a membership organisation; we are much more like a club or a movement. It is about a shared vision. Those people are out there and want to help. Cuts in local authority funding have dramatically made a problem. If you cut hundreds of millions, billions, of pounds at local level those community organisations suffer first.

**The Chairman:** Where actually a bit of money releases a lot of volunteers.

**Helen Milner:** Absolutely. A lot of work that we have been doing over the last few years relies that infrastructure. The infrastructure is still there. We have 5,000 hyperlocal partners and about 50 new organisations joining us every month, but 50 are also leaving because their funding was cut. Their people have developed those relationships and local partnerships with organisations like Jobcentre Plus.

You asked about measures, so I will talk about those. It is important to set a baseline of what I like to think of as digital life skills; Go ON UK and others are working hard to do that. I agree with David Hughes that we should put basic digital skills alongside literacy and numeracy. The baseline that we are currently working with in the sector is a framework of communication, searching, transacting and staying safe. You will notice that I said “communicate” rather than “use e-mail”, because we want to make sure that this responds as society responds. Because we have a digital platform called Learn My Way, in which we take people who have never used the internet before and help them to learn about the internet through online learning, we can gather all that data about them and what they are doing. We also do surveys 364 days a year, both online and by telephone, and because we do that all the time we have made it cost not very much. We do deep-dive research because this cannot be just about mass, it must be targeted as well. We work with national organisations such as Age UK and Mind, but we also have specialist networks for people who are disabled, unemployed or who live in social housing, as well as older people. We also do some volumetrics and cost-benefit analysis. We make sure that we measure the impact of people for example “channel-shifting”: moving their contact with government from offline—face-to-face or telephone—to online. We have done the maths with the data and surveys and they are saving around £50 million a year by taking people who would not otherwise have made that shift from offline to online services.
We are a digital inclusion programme, not an unemployment or work programme. In the last four years, if you look at the number of people who have gone from being unemployed into jobs, we have helped more than 80,000 people get work; the Cabinet Office numbers for that represent more than £640 million in benefit. We currently receive around £3 million to £4 million from government and the rest of our funding comes from the private sector. We sell goods and we also get grants from trusts and foundations. A mixed model works and a mass model works, while focusing very much on the hyperlocal level, not just the local level.

This is not about local authorities and jobcentres; this is about mosques and public libraries. This is about where people are on the street. We know where people who are older and poorer live, and we can absolutely target investment.

Q104 The Chairman: I will pause you there. As we go through the rest of the questions, I want you to think about how you would summarise what would take you on to a big scale so that we can have clear recommendations from you at the end. That would be helpful.

Professor Patrick Barwise: There are two sides to your question. One is about strategy and one is about how we would measure success. On strategy I would not say anything very different from what I wrote two years ago. We have now got about two-thirds of a strategy. The missing piece is that there is no marketing strategy, no umbrella brand, to put it all together. I do not think it would be that difficult to add that component and the sooner we do it, the better.

On how we measure success, we need measures at three levels. At the macro level, the best measure is the UK’s international ranking by credible third parties such as BCG, Google and the World Wide Web Foundation against other countries. We are currently ranked very high on the use of the internet; the Nordics are a bit ahead, Holland is about the same and for the US it depends on which measure you are using. There is an independent macro-measure, and I would embed that into the strategy. The aim is similar to what we do in business schools. We care a lot about the FT rankings. We grumble about them, but I think that is a very good objective measure.

At a middle level, GDS, working with Go ON UK and its partners, has now developed a broad digital inclusion scale for individuals and an equivalent business digital index for organisations; both James and Helen have talked about some of the components of that. You are forcing a multidimensional thing into a single dimension, from least capable to most capable. We now have something that we can standardise on, and we should do so. We have a lot of very good research in the UK, including from the BBC and Ofcom but also from GDS, the LSE, the Oxford Internet Institute and so on. But having a single, agreed way of measuring individuals and organisations, and categorising them, is helpful. Having said that, we also need much more specific measures on things like coding skills in different groups and the extent to which specific government services are now being accessed online rather than using much more expensive channels. We need three levels, including very micro.

Phil Fearnley: Clearly, the BBC has a central role in educating and informing all audiences and, within that, in raising awareness, encouraging learning and inspiring the next generation. That is our mission here. We set out strategy out under three umbrellas: getting connected, getting smart and getting creative. In the former, we have already heard about the percentage of people who are connected and the disproportionate impact on the oldest and the poorest. Having said that, 80% of people who are not connected say that that is
because they lack interest. The measure that we have used over the last few years, from Ipsos MORI, says that that number has not really changed, so we are still looking at how you move that on.

The other side of that is that, of those people who are connected, some of the basic skills such as accessing information, searching, filling out forms and so on, around 1.4 million additional people do not have the fundamentals even though they have access. In each of the three areas that I described earlier—getting connected, smart and creative—we have a range of programmes of activity that are both supportive online materials and outreach activities. For instance, we have BBC WebWise, which is targeted at adult learning. We have Bitesize for formal learning, which you may have seen we relaunched yesterday, including 40 new learning guides supporting key stage 1 of the new GCSE curriculum. I was looking at them this morning and they are absolutely terrific materials: a range of animations, graphics and video materials that both individuals and teachers can use. We are directly supporting that.

Alongside that, we do a range of activities that use the BBC brands, whether they are channel brands or programme brands, to access particular segments. As James described, one of the issues is that there is probably no one stop shop where one size fits all. We therefore have certain difficulties with tapping into certain audiences. We have a fairly substantial programme which we are rolling out next year, which I cannot go into too much at the moment because we have not finalised all the partnership deals and content announcements and so on. As you might have seen, Tony Hall announced in October last year that there will every year be a themed series of activities around education. This year it was World War One, and next year it will be around coding and digital creativity. That stretches from support for the formal Bitesize learning to a much more extensive range of programming across the channels, with a celebration of Britain’s digital heritage, raising overall awareness of digital and computing skills, whether that is Charles Babbage or Ada Lovelace and so on. Alongside yesterday’s Bitesize announcement, we announced some of the related children’s programming. There is a programme called “Technobabble”, looking at current apps and games, with the same people who do “Newsround” doing that kind of youth-based “Here are things that are interesting” presentation.

We have also announced a programme called “Appsolute Genius”, which is a Dick and Dom special. There is already a programme called “Absolute Genius”, and now we have “Appsolute Genius” in which we will interview people who have made a whole range of things from Sonic the Hedgehog to Pacman. At the end we will set a challenge for pupils to submit ideas for a video game and then we will create one. At the end of the programme the game will be made freely available for mobile phones and on the web. There are a number of opportunities for us not only to use our mainstream brands but to create some specific programming. As I say, there will be more of those coming through in the future.

Q105 Lord Janvrin: I want to dig into why people get engaged in some of these programmes, particularly, as Helen was saying, at the street level. Ms Milner, you mentioned the problem of lack of interest. Why do people get engaged and how can one learn from that in order to address the lack of interest problem? This goes back to the basics of how these programmes are designed and how to do something about these issues.

Phil Fearnley: Perhaps I may give a couple of examples of things that have worked well in recent times. We used one of our brands, “Radio One Big Weekend”, to run an academy
during the last event in Glasgow where 35,000 people were able to engage with workshops and experience different types of things that they may not have encountered before. There were programming workshops and events around women in technology, for instance, which were quite a challenge. There were activities around making apps and a whole range of different things that sought to stimulate a degree of interest. We got a phenomenal response from those people. They had come for the music rather than the show, as it were, but actually they discovered something new. We have used the closeness of the brand to do that. We have also done something similar with “CBBC Live”, which has been running for the past two years. Again, it is an introduction to the CBBC brands. The Dick and Dom characters were there for a weekend in Leeds. Again, we had a large number of people looking, in this case, at a prototype of a game that they could develop. The feedback was encouraging and showed that 15 is the best age for these activities. Parents and teachers said that they did not realise that all this could be done. We have found an environment where we can use different mechanisms to access those people who would not necessarily have expressed an interest. We have found routes that have resulted in 80% of people asking afterwards how they could get involved because they wanted to know more about coding and so on.

The other thing I would say is that the structure of our programming next year focuses very much on the creativity side of things. People want to do things for a reason, and those reasons change through their lives. As we have talked about, in the middle period it is all about accessing digital services or buying things online. For the younger groups it may be about creating your own music or art. You therefore have to structure these things to appeal to different interests. Those interests are both professional and about getting through life. They are also about accessing people’s passions and interests. The notion is that of using technology and tools that allow people to tap into their creativity alongside some of the more basic things such as just being able to communicate. My mum uses an iPad and is able to Skype her grandchildren, and that has been a revelation to her. She now uses it for e-mails and does things that she would not have done before. You get into these technologies in myriad ways.

Helen Milner: We have around 150,000 people a year, a third of whom have no qualifications. So I think that what Phil is talking about is good, but actually there are those for whom society has delivered a lot of bad luck. They have low self-esteem and very low levels of confidence, and we really need to focus on them. About half of them are still self-presenting and saying, “I feel left out”, “It's about time”, “I have resisted this for too long”. Jobs are a big motivator, and Jobcentre Plus is now forcing people to go online. They have to use Universal Jobmatch. That is mandated and you have to do whatever the DWP says. On the ground, people think that you have to use this online DWP system. Sometimes it works. People are mandated to come along and they look for work online. They then come back and learn other skills. Sometimes it backfires; they say, “I have been forced to do this. I don’t like it and I am not going to come back. I am just going to get a job and I will then go away”. There are still 625,000 parents who do not have basic digital skills. Some of them are saying, “Actually, to understand what my child is doing, I need to get online”. It is about understanding those motivations. Obviously our model is to be there in the local community with a local brand, be it the Heeley Development Trust or Sheffield Libraries. But we also do what we call learning digital skills by stealth, which is similar to what Phil has been talking about. We ran a campaign called “Baking with Friends”, which was about cooking. It was shortly after “The Great British Bake Off” to see if the echo effect worked. We combined
digital skills with baking and with maths. People turned up and talked about baking. They looked at some recipes, decided what they wanted to bake, and then they went online and ordered the ingredients. Part of the grant that we gave out was in the form of vouchers for an online shopping site. People bought the ingredients and talked about what they were going to cook. They came along the next week and those ingredients had turned up. They did it in twos and threes so that not everyone had to touch the computer if they did not want to. They downloaded a recipe and looked at it on the computer, and then they went on to make it. In another programme people were doing whatever interested them at the local level, whether it was gardening or soup making. Again, iPads were being taken out into the local community. They did not talk about the technology; they talked about gardening, soup making or local history.

We also have a programme to help those with extremely low levels of English language. Again, that is done on an online platform that uses a strongly blended learning approach. People learn in groups with a tutor. They are learning English language in partnership with the BBC and the British Council, and it is funded by the Department for Communities and Local Government. We say that this is about developing very basic English language skills, but because some of it is being done on a computer and people are watching videos they are being helped to feel more confident about taking the next step. It is all about “people like me” and it takes place in the local area. Every day we see people literally being dragged in by their friends, who say, “I couldn’t do it six months ago, but now I can”. Word of mouth is fantastically important.

Professor Patrick Barwise: To build on what Helen was saying, it should be clear that there is a very strong emotional dimension to this. You should not rely on the view of technologists and economists. There is a lot of fear, there is lack of confidence, there are people without self-worth and so on. Therefore the way we communicate has to allow for real people with all those issues, particularly now that we have got to around the 80% level. It needs more resources. It does not need massive resources, but at present there is a ludicrous imbalance between the supply side and the demand side. Central government giving the Tinder Foundation £3 million a year is ridiculous. It is far too little. This battle has to be fought mainly at the local, especially the hyperlocal, level.

However, there is a third component which is, in my view, still the missing piece. We have to recognise that this is also a marketing problem. It is a rather complex marketing problem, but this is what we do in marketing; we are used to dealing with people who are emotional as well as rational. This is what we do. As it happens, in the UK we are rather good at this. The largest marketing service business in the world is WPP, which is a British company.

If you ask what the practical implications of that are, one of them is that we need to involve more people with high-level marketing experience in this. A second is that we need to develop an overarching branding strategy so that people can see that all these initiatives, of which there is a huge number and which are confusing because there are so many, are part of an integrated programme.

The Chairman: We were having exactly that conversation with our previous witnesses.

Baroness O’Cathain: Before I go to my question, it suddenly struck me that you need to have carrots to give to people. The carrot that one energy supplier gives is about £100 off your energy bill if you do all of it online. I am one of those who sees the thing, writes a cheque and sends it off, but there are people who really do not have the ability to do that, and I do
not think this is being marketed well enough. It is in the interests of the energy company to do just that, and it is in the interests of many suppliers on the retail side to give an incentive to get people asking the right questions and then to go online. You hear people on the train saying, “I only paid £9 for my return trip to Birmingham”, or wherever, “because I booked online”, and then you think, “But they don’t advertise it enough”.

**Professor Patrick Barwise**: I absolutely agree. Poorer people pay higher prices than everyone in this room.

**Baroness O’Cathain**: They do.

**Professor Patrick Barwise**: There is a massive social dimension to this.

**Baroness O’Cathain**: That is where you came in about poverty. It is not about skills; it is about poverty.

**Professor Patrick Barwise**: It is both.

**Baroness O’Cathain**: We are still in silo government. We need cross-silos; we need somebody, some great guru, to do that.

**Professor Patrick Barwise**: The strategy which GDS announced in April puts a lot of what I call supply-side pieces into place. It is doing an extremely good job with this extraordinarily difficult task of getting government departments to be more customer-focused. It is using agile development processes rather than enormous undeliverable projects with the big US companies and so on, so we are doing it on the supply side. On the demand side, we are doing a lot at the local level, but it is very fragmented and under-resourced. The missing piece is what I would call a marketing strategy to 2020.

**Helen Milner**: The lack of joining up is absolutely shocking. Think how much money the Government spend on the winter fuel allowance. There is a whole department somewhere looking at fuel poverty. Are any of them thinking about training those people to pay their utility bills online? Have any of them even said those words?

**The Chairman**: Or is there any suggestion that instead of the deal being that you get some insulation, the deal is that the energy companies need to put some money into training on digital, for example?

**Q106 Baroness O’Cathain**: This is very true because they save in manpower. Sorry about that, but it is important to mention that you need carrots. Not only can you see in the dark with them, but you need them. My question is: how has the demographic of people accessing digital literacy services changed over time, or has it not, and what does this tell us?

**James Thickett**: I think Helen or Phil might be able to give us more accurate figures about what they are seeing in their markets. The biggest trend that we have seen recently has been higher online access in older age groups. We are now seeing that 90% of under-55 year-olds and two-thirds of 55 to 64 year-olds now have access to the internet. We are seeing very low access to the internet among the over-75s at around 33%. As time goes on, it is going to get harder to convert these remaining cohorts, particularly older people who say they have no interest. I would treat that with caution because a lot of “I’m not interested” is about them not having the confidence, or they may have physical or mental impairments, or they just do not have the functional literacy skills to do it. One piece of good news—this has been a big jump in the past year—is that 27% of people who say that they do
not have access to the internet are actually doing it by proxy. They are getting their friends or family to do those tasks for them. They have no interest in getting a computer or getting online, but they are asking for some of these tasks to be fulfilled by their family. That is a really interesting insight that can be taken onboard going forward.

The other cohort that we talked about is the lower-income cohort, which also has shockingly low levels of access. It is about 70% now. This is an area which Helen and Phil are probably better qualified to talk about.

**Helen Milner**: They are poorer. That is it, full stop. They have lower qualifications, lower levels of literacy and lower-skilled jobs, if they have a job. The basic point is that people who have slightly more motivation and slightly more reason to do it and have worked out that they can afford it are getting online through help from our organisation or others or by themselves.

One really interesting statistic is that even three or four years ago, the number of people who said that cost was a major reason for not going on the internet was quite small. It was less than 10%. Now it is more than 20%. That is a good illustration of financial poverty, of not being able to afford it. I have met people who have said that they are scared, particularly people who have been sent by the jobcentre. They have said, “I don’t want to learn how to use the internet, because if I do I might like it, but I can’t afford it”. There is this real perception that it is something that they might like or find incredibly useful but they cannot afford it. I have no idea what government should do. I know it is a difficult area for government. It is the whole *Daily Mail* fear about giving poor people free computers that they will sell. All those headlines have been there before, have they not? It really is an issue, because all of us are on the internet all the time, we have multiple devices, but the people we are talking about who lack those very basic digital skills have no personal access while the internet is becoming more personal. They can go to a UK online centre or to a public library, but that is not the same as how we use the internet because we have it in our pocket as well as on our laptop and at home.

**The Chairman**: Anything to add? Please do will not repeat anything, so say only if there is anything different.

**Phil Fearnley**: It is broadly the same. It is mostly the oldest and the poorest. It is interesting that 27% of them are ABC1s.

**Lord Lucas**: What is the source of all these statistics? Where do we go to find the original lode that all these figures are coming from? They are not evident on Google.

**James Thickett**: You can find the whole archive of Ofcom’s media literacy research on our website going back to 2005. The latest adult survey—

**Lord Lucas**: Linked under what, because I did not find it?

**The Chairman**: We circulated it in the papers.

**Baroness O’Cathain**: It is Ofcom’s adult media research.

**Lord Lucas**: So it is. So those are the figures on which you all rely?

**Professor Patrick Barwise**: Behind your question, one thing you might want to look at, again as part of joining things up, is that there should be one place where you can look. The answer to your question is that we have Ofcom. The BBC has figures, GDS has figures, Go ON
UK has figures, there are several different academic departments. Perhaps it would be a good idea to have a single place where you can look, so that it is all there in one place.

**Q107 Lord Lucas:** It would be useful for me to know where to go to get behind the figures that you are citing, because we need to understand exactly who we are trying to get at. It seems from some things that you are saying that the focus of dealing with the younger poor is within the scope of government expenditure. If you are dealing with only a few million people, you can do it for less than it would cost to provide free school meals for kids. It is the sort of thing that the Government could do at a whim, rather than something that requires a big policy decision.

To pick up on the other thing, it is very important that we get evidence of what little things work, too. Tinder’s evaluation—the one I have been looking at on its website—is pretty basic. Is somebody doing decent research into what actually works?

**Professor Patrick Barwise:** I would say, “Yes, up to a point, but it is very fragmented”. Sorry to keep harping on, but—

**The Chairman:** So it is the same story.

**Professor Patrick Barwise:** This is a marketing issue. In marketing, you research real consumers, not imaginary consumers, and you do diagnostic things about return on investment. There is not enough of that, and it is fragmented. We have quite a lot of good research in the UK, more than most countries; but there is not enough and it is fragmented.

**Lord Lucas:** Can you point us to it?

**Professor Patrick Barwise:** The Oxford Internet Institute is, in my view, doing some good stuff. Its survey is frankly rather basic. I would like to see the OII doing more diagnostic work. The LSE is doing very good work on this, but again I would like it to be more diagnostic, with more focus on return on investment

**The Chairman:** Right. Yes, that would be helpful.

**Q108 Lord Macdonald of Tradeston:** How might delivery be upscaled? That would have to be predicated on what Patrick Barwise and others have been talking about. You say that there are various sources, but they are also sources of confusion at present. Before we can reach our conclusions, we need a better mental map of the territory. Can you produce a simplified scoping of this for us? Helen talked about her 5,000 centres and 2.5 million people. From those metrics, can you give a start to give us a proper look at the market where supply and demand might have to be activated? We might then be able to put a cost on it, but we feel that we need that overarching picture that you talk about. Why does that not exist inside government? Is it sitting inside DCMS or the Cabinet Office?

**Professor Patrick Barwise:** In my view, it is not. GDS is the place from which this should be driven, in my view.

**The Chairman:** That is within government, is it not?

**Professor Patrick Barwise:** It is within government, but it is not in an individual department and the Cabinet Office is in a relatively powerful position. I think it is doing a very good job on the supply side. For instance, it has just announced a usability lab in its office, which is using technology to do something that does not come naturally to either technologists or civil servants. That is to be truly user-focused. There is only one way to have government
online public services that are truly user-focused. Well, there are two. One is that you bring in people who do that sort of thing. The second is that you test it on real people and see what they find difficult and what they find encouraging, et cetera. GDS is doing that and has pulled quite a lot of data together. I would hold GDS's feet to the fire on this to say that we are delighted with what it is doing on the supply side; but on the demand side, within government it is the one place where data should be pulled together. I think it needs more marketing expertise: full-time, part-time or advisory.

**The Chairman:** But it is not given that responsibility at the moment in any way?

**Professor Patrick Barwise:** It is and it is not. Two years ago it was not. When I spoke to Mike Bracken two years ago, he said that he had such a big agenda—which was absolutely right—that the one piece it had on the demand side was assisted digital, which is of course crucial. I think it was late last year when it announced a work stream—I like to think, partly because of my lobbying—on digital inclusion, but it is not very well funded and is not very big. It needs more resource to pull it all together and have a proper strategy to 2020.

Pulling the data together in a successful way is something that GDS could drive, working with Go ON UK and its partners. In my view, given that Go ON UK has been reluctant to look at an overarching brand other than Go ON, which is not really a brand because the public do not know about it, GDS is the place I would look to for that.

**Baroness O’Cathain:** I just ask about your programme, which I think is called Learn My Way.

**Helen Milner:** Learn My Way is the online program, yes.

**Baroness O’Cathain:** Have you done anything about grandparents and grandchildren?

**Helen Milner:** We have some financial literacy for older people but, to explain the program, there are 5,000 partners. We provide them with leadership, product, service and support and we give about 5% of them in grant money, but they all do different things. Some will be a school working with children in a local sheltered scheme. Some will be a fish and chip shop that is engaging its customers to teach them the basic online skills. There may be a mosque running a women-only group on a Friday afternoon. We provide them with the glue, the platform, the motivation, but at local level all those people design those programmes.

I do not actually think that the data are confusing. There is a handful of data sources. They all say basically the same thing. We all know that mass programmes work, mass marketing works. We put out what we do, we work with lots of people. We network that together and lots of people come through. We also need to target it. Half of all disabled people are not online. We need dedicated programmes targeting disabled people.

Please do not recommend a programme of research—

**The Chairman:** I think that you can be reassured that we will not do that.

**Helen Milner:** I just hate the idea that we will just wait when we know what works.

**The Chairman:** Absolutely. We are clear about that.

**Q109 Lord Holmes of Richmond:** Good morning. I turn to digital careers. It is pretty clear that large swathes of parents and hordes of school professionals do not have the knowledge of the digital skills market to advise or inspire children to go into that market. What should be done in that area? Is there a role for the BBC, Ofsted and other organisations to advise,
encourage and enable parents and everyone involved in the school process to be able to inspire children into digital skills and careers in the digital market?

**Phil Fearnley:** Yes to both. We already are, and the plans for 2015 are about doing just that. The activity that we already have in place for children includes the Bitesize materials that I mentioned earlier, which are available to the classroom and teachers. The same material can be used as classroom aids or as workbook-style guides for children to use. Those things are already in place and are available to parents as well as children.

The plans for next year are as much about raising the awareness of careers and futures in the whole range of digital skills as they are about learning any one skill in and of itself. I think you will see there, as I think I mentioned earlier, a range of things from drama-based programming to some of our major programme brands, character lines and storylines within them being more reflective, if you like, of the challenge that is being discussed today.

There is a whole range of things. Obviously, I cannot pre-announce them, but those are the plans for next year. Alongside the programmatic and formal learning that we described, there are significant plans afoot at the moment to try to act as an amplifier and a brokerage point, if nothing else, to the myriad things that are already going out around the country locally. When we started working on this about a year and half ago, there was a focus on the shortage in coding skills, to take one particular thing. When you go into the market you see myriad people, groups and functions. Helen has talked eloquently about what she is doing, but there is a whole range. There is no point in the BBC trying to do anything other than a point to people who are already doing great stuff.

I think that what you will see in our plans for next year is that, rather than trying to do what we did 30 years ago with BBC BASIC and the BBC Micro—we are no longer in the game of providing hardware or programming—there is much more about working with existing initiatives and partners who are already doing things in the local area and making them more visible through mass brand and programme activity on BBC1 and BBC2 but also on local radio and the news channels. There is an awful lot that we can do, that we are doing and that we have plans to do next year.

**Q110 Baroness Garden of Frognal:** You have talked about the different issues around getting people to have basic digital literacy, and given us some ideas about how you continue to progress in digital literacy. Do you have any further suggestions about how, once people have taken that first step, they can be encouraged and supported to continue in learning?

**Professor Patrick Barwise:** Quite a lot of what the BBC is doing is in that space for people who are already online and are upskilling. It is mostly aimed at young people.

**Phil Fearnley:** They are mostly aimed at young people. There is a range. There are things like My Web My Way, which is targeted particularly at people with disabilities. The WebWise materials are available for people who are just at that starting point. I am sorry; I have just lost the thread of the conversation.

**Baroness Garden of Frognal:** Once you have started with basic skills, it is about having a support system, encouragement or motivation to keep learning, particularly for people who are not naturally self-motivated.
Helen Milner: We obviously do things around financial literacy, and we now do English language and job seeking. It is about taking the basic skills and making them relevant to their lives. We also have quite a lot of people who go on to formal learning around other basic skills, particularly literacy and numeracy. There is an absolute paucity of the use of technology in formal adult learning. Again, this goes back to joining up. Within formal adult learning, £210 million a year is spent through the Skills Funding Agency. If there was a requirement that even 10% of that was delivered through online in a supported, blended way, then we would be making sure that people who progress to other learning do so using technology. It is very important. The other thing I would say from our experience and evidence is that people need access at home. Once they have the basics, understand why they do it and have the motivation, they practise it, use it, begin to be inquisitive and go and do something else. The people who do not have access at home, who cannot afford it, are a big problem for us—they include the 500,000 school-age children who do not have computers and the internet at home as well.

Professor Patrick Barwise: I agree. I think the access point is the most difficult one to crack, because that is about serious money. Quite a lot of what the market is doing is going to upskill people. If we genuinely have in two or three years’ time online public services that are so good that the great majority of people prefer to use them, you will see a natural learning process for what I call the mass market. That will not teach people coding, so I think you need some targeted activities; young people are absolutely crucial for that. In my view the biggest weakness at present is the very large number of people who have or could have access but who, for behavioural reasons, are not routinely online. That is a solvable problem, it just has not been taken seriously by government. The estimated savings from digital by default are £1.7 billion a year.

The Chairman: So if some of that was put into the bit of hand-holding that is needed to move people into that—

Professor Patrick Barwise: It is a tiny proportion of the total cost. For the marketing aspect we are talking maybe £50 million or £100 million a year. That is an order of magnitude less than we are putting into superfast broadband, never mind the big public services.

James Thickett: Can I just make the point that it is not just about developing technical skills either; it is about the wider cognitive skills, being able to make judgments and keep yourself safe while on the internet, particularly for children? This is very important and often gets left behind in the race to get everybody skilled up to be good citizens.

Q111 Lord Kirkwood of Kirkhope: We have dealt with a lot of this and we are very short of time. I am fantastically worried about inequality as a consequence of what we are doing. I am absolutely in favour of digital development and growth in skills, but I am frightened to death that we are going to end up with seriously increased levels of inequality.

I am interested in the point you just made about home provision. You say that it is a big ticket item financially, and so it might be, but the hardware is getting a lot cheaper. Mobile computing is a cost that I do not think you could expect low-income families to meet at the moment, but maybe there is something that we could do. I am determined to try to persuade my colleagues on the Committee that we need to say something significant about this. We cannot just say, “Let’s get on with this, we are doing okay”. We need to say
something about exclusion. Having said that, it is very difficult to fix, but home access might be worth thinking about further.

**Helen Milner**: Yes, definitely. It is also something with which the private sector can help. There are movements in that direction, among the broadband providers in particular. It is always when it comes to the commercials that they start having troubles, where they need to credit-check people, for example, or you need a credit card even to sign up for a free program. It is almost about working together with the private sector on a programme for home access, under which people with credit cards who pass credit checks can still join a free private sector-funded scheme, but the Government could provide some help with the risk presented by those who do not tick those boxes.

**Lord Kirkwood of Kirkhope**: If you get any further thoughts about that, I know that would be really helpful.

**Helen Milner**: Going back to the joining-up point, inequality is not just a problem. If the people at the lowest point in our society can get digital skills, the whole of the internet is available to them. There is lots of free learning for all kinds of things. They can look at jobs or start up their own business. I heard you talk earlier about riots, but this is about people who really need an opportunity.

**The Chairman**: This is about economic growth.

**Professor Patrick Barwise**: Of course, that segment represents the heaviest users of public services. The big savings from online public services will come from this segment, so, duh, can we please join them up? I am really pleased that this inquiry is happening, because you can make a noise about this. It is such a no-brainer that we have not got it right.

On whether there are practical ways of cracking the access thing—maybe not completely cracking it—everything that I am describing, which is more on the marketing side, will reduce inequality but will not crack the access thing. You therefore need a work stream that looks at the economics and doing deals with the private sector. By the way, one of the long-term economic benefits from this, if we do it right, is that the UK can become a world leader in the development of services for poorer people in richer countries.

**The Chairman**: We are really tight on time, but if you have any international evidence of anybody who is doing this well, please send it to us. That would be incredibly useful. I suspect you do not, because nobody is.

**Professor Patrick Barwise**: Exactly.

**Lord Lucas**: What, in terms of capabilities, constitutes home access of the NHS-spectacles equivalent, the basic level that we should be giving people free?

**Helen Milner**: Right now you probably need some kind of keyboard, but the basic, basic thing would be a tablet computer and wi-fi internet. That could be mobile or fixed broadband.

**Professor Patrick Barwise**: It is a Chinese tablet and 2-4 Mbps.

**The Chairman**: That is really helpful.

Q112 **Lord Aberdare**: I want to cheat a bit with a preliminary. Mr Thickett raised cognitive skills. If we just focus on access and basic skills we will get into terrible trouble with
cybercrime, children being exploited and so forth. If Ofcom has anything to indicate what sort of approach it is taking to that and what the sorts of issues are, that would be helpful.

This is the question that we have been asking all our witnesses, as you will have heard from the previous session, to help us do our work. Do you have one key suggestion for a change that this Committee could recommend to the Government, specifically with a focus on improving UK competitiveness in respect of digital skills and with an indication of how it might be made to happen and what the cost implications might be? You have given us lots of good suggestions already.

**The Chairman:** It is fine if you want to say, “Of what I have said, this is the big thing”.

**Phil Fearnley:** In answer to your preliminary question, on 11 February this year we supported Safer Internet Day. Some 15 million people heard the message around safe internet use. We did a whole range of things including strips on the BBC “One Show” and “Newsround”. We had an additional 1.5 million people see news articles about the issue, and we used local radio. The effect of all that was that 25% of children heard the message about safe internet use and what it means, and 48% of the 25% actually changed their behaviour as a result. These things can be incredibly effective when they are done well. I would come back directly to broadband take-up as an important issue, and doing things along the lines of what has been described.

**Professor Patrick Barwise:** Very briefly on your preliminary question, GDS has an identity assurance board and a relevant workstream. It is a topic that everyone thinks is enormously dull, but it is hugely important for the reasons you have described and that James has mentioned several times.

My main recommendation would be to ask GDS, in collaboration with Go ON UK and its partners, to add a five-year branding and marketing strategy to its current excellent supply-side strategy, the aim being that when BCG and Google do their world rankings in 2020, we will still be up there with the Nordics. That seems perfectly doable to me, and the sort of money I am talking about to make it happen, if it is properly executed, is between £50 million and £100 million a year; in other words, not an enormous amount of money relative to the other things we are talking about.

**The Chairman:** Can you send us a short note on precisely what the content of that would be? That would be really helpful.

**Helen Milner:** I think you should have a target for helping almost 100% of people to achieve basic online skills by 2020. We did the costings for that in our recent report by Catherine McDonald. It will cost around £850 million. We recommend that that is £50 million a year from the Government over the period of the next Government, and that is already being matched by the voluntary sector. It is already giving the Government around £50 million a year. The private sector should be asked to match the figure both in cash and in kind. If we do that we will be as good as the Nordics, and perhaps better, and we will definitely be the world leader in basic online skills. If we do not do it and continue at the present level of investment, we will leave 6.2 million people behind by 2020. That is what the trend analysis shows. I would say that it needs to be both mass and targeted. We could do fivefold what we do now, so obviously we would like some of that, but others on the list would be Unionlearn and employers with large low-skilled workforces, social housing providers whose tenants may have low skills, and disability charities that have a local presence and would like to do
this. I would put that alongside joining up, so it is nice to think that the money may come from multiple departments. We already get some funding from NHS England, which recognises that health inequalities and digital inequalities go hand in hand. Perhaps we could persuade others to ensure that it works, such as through Work Programme 2. Let us make sure that we do not have a Work Programme that does not include basic digital skills as a fundamental element.

In the formal sector there is a paucity of online learning, which needs to be improved, and there is an over-reliance on qualifications. Many large employers train people only up to a level 2 qualification, which actually excludes basic online skills.

The Chairman: I think that that was four recommendations and that perhaps you cheated a little.

James Thickett: My view is that we need to look at cognitive skills as being as important as basic digital or technical skills. Whenever we think about developing a digital skills strategy, we should consider incorporating cognitive skills because not only do they prevent negative online experiences, they equip people with the skills to get more out of the internet. It is particularly important to mould children and young people because they are most at risk from not having these skills. As they get very advanced in coding and things, there is a risk that they become overconfident and subject themselves to risk.

The Chairman: Thank you very much indeed.
The major change that has taken place over the past few years is that computing has moved from a technical activity to a creative activity. As the technology has become more accessible and efficient, so more people have engaged in learning the necessary skills. We live in a transliterate world, where to be skilled requires the ability to "read" not just words, but images, sounds, code, platforms, devices, etc. It is crucial that education and training wakes up and adapts to this new reality.

Almost every potential student I have encountered has worked outside their A-levels (or other courses) to develop an impressive range of skills that includes coding, design, business and social interaction. They are often driven by curiosity to explore areas that the schools largely dismiss, but which actually are crucial to success in the global digital economy. These areas include gaming, animation, software development, digital art and music, etc. They work in the cracks between disciplines.

Nor does all this apply only to youngsters. There are many people in middle and old age who are enthusiastically adapting themselves to the digital world. This involves acquiring new skills, often through online networks and local friends. These people are often highly accomplished in other spheres, and could easily be re-trained for the global digital economy. Most apprenticeships and training schemes end at 24: an absurd cut-off point when the world is changing so much.

Universities and colleges are also slow to respond to this rapid evolution. Computing is taught at further/higher education level in a way that all too often fits with an outmoded model of the workplace. We need a much better match between the real needs of digital businesses and the content and design of academic courses. The many companies and employers with whom I collaborate all have a common complaint: the typical computer science graduate, while technically skilled, lacks interpersonal skills and creativity. Companies do not want mere 'drones', who will undertake boring tasks to order. They know that the key to success now is creativity and collaboration. But they cannot find people with all the skills: technical knowledge, creative imagination, business savvy, collaborative abilities. We need to join up the dots, and stop dividing the curriculum into silo-driven subject areas that exclude one another through their technical language and scholarly preoccupations. The future is transdisciplinary.

The fact that computing has not been taught in schools is a serious handicap for the UK. The proposed changes to the curriculum are encouraging, but there is a serious problem with lack of skills amongst the teachers who will have to deliver this new curriculum. Teacher training courses need to be rapidly updated to include computing. Even more important is to train current teachers. Initiatives such as Computing at School, Young Rewired State, Appsforgood and TeenTech should be encouraged and rolled out more widely.

At a national level, there is a problem with infrastructure. Quite apart from the fact that broadband is still not available in many parts of the country, the average speed of what is available is generally poor. We are competing with countries like South Korea, which has an average speed of 21 Mb/s, whereas the UK's average speed is a paltry 4 Mb/s. The mobile
phone network coverage and speed is similarly limited. We have overly centralised systems, and a concept of data that requires initiatives like the Open Data Institute to challenge entrenched views. As long as ODI remains in its position as a slightly eccentric example of British nonconformity, rather than the key plank of our thinking about data, we will always lag behind other countries.

Finally, we must teach creativity. I am constantly amazed by the number of people who insist that creativity cannot be taught, that it is some kind of magical ability that you may or may not possess. This view is held even by many people who teach creative subjects in schools and universities! This is not to say that everyone in the country can become Leonardo da Vinci, but simply that creativity is a skill like any other that may be acquired. The right combination of divergent and convergent thinking, allied to the appropriate technical skills, can produce spectacular results, even amongst those who may feel they are not naturally creative.

RECOMMENDATIONS:

1. Amalgamate computing, creative and business subjects, with an emphasis on entrepreneurship.
2. Teach creativity as a core strand in all digital subjects.
3. Produce national standards for transliteracy and make them part of assessment regimes.
4. Plan curriculums in conjunction with industry/public services and make placements mandatory.
5. Invest in a serious upgrade to the UK’s communications infrastructure that makes us comparable with South Korea.
6. Accept the principles of open data as a cornerstone of policy.

18 July 2014
Digital Literacy

1. The BBC is committed to helping people become more literate and develop the skills to better use, understand and create media - especially in relation to new online technologies and services. This includes being able to access and use new technology, find and navigate information, engage critically with the content, understand the context, manage any risks, and create new content.

2. As the UK’s biggest Public Service Broadcaster, we understand that businesses and consumers need to develop digital skills and confidence to engage with and benefit from emerging technology such as superfast broadband or online services like Connected TV – demand for broadband infrastructure is as important as supply.

3. Under the BBC’s Public Purposes, the BBC made a commitment to working in partnership to promote understanding, uptake, and fuller usage of new technologies. We also committed to continue to invest in media literacy in order to promote understanding of the benefits of new technologies.

Digital Literacy Strategy

4. At the heart of this strategy are four overarching objectives which will be supported by our long-term editorial work and a comprehensive online content strategy.

Specifically, the BBC will:

(i) Work in partnership to provide clear messages around benefits of emerging technologies and building digital skills and confidence of those newly online or lacking confidence

(ii) Help all of our audiences develop the digital literacy skills and confidence required to better understand the media environment

(iii) Help parents and children understand and manage the risks associated with online activity

(iv) Encourage audiences to experiment creatively with digital media in order to contribute to the BBC’s output and participate in wider society and engage within and across communities of interest

5. We then categorise our editorial activity as the following:

- **Get Connected.** Centres on encouraging people online and acquiring the basic skills required to benefit from the internet. This will cover a range of online skills; from the basic skills required to access public services online, to more advanced experiences offered via mobile, tablets, TV and PC including social media, catch-up services, extended coverage and integrated broadcast and online content. Campaigns include Give an Hour, First Click, our Webwise resources, and our partnership with Go ON.
• **Get Smart.** Get Smart, focuses on helping people develop the habits, behaviours and knowledge required for safe, appropriate and effective online engagement. Campaigns include Share Take Care, and support of Safer Internet Day.

• **Get Creative.** This focuses on helping the audience develop the creative and technical skills required to fully participate, contribute and distribute content. The Make It Digital programming season across the BBC in 2015 will inspire a new generation to get creative with coding, digital technology and programming.

### Content and Initiatives

#### 6. Make It Digital

The BBC’s Make It Digital season aims to shine a spotlight on the wonderful world of digital, and to inspire people to see their own creative potential within it.

There is a digital skills deficit in the UK yet those pupils who are attracted to the computer sciences are super-served. Although the younger generation do not face barriers of software, hardware, education or peers, they something is stopping them getting creative in the digital world. The BBC as a Public Service Broadcaster can serve this area due to the public purposes of a) promoting education and learning b) stimulating creativity c) delivering the benefit of emerging technologies.

The BBC can act as a discover-inspirer to create awareness of the next generations own aptitudes and the potential of the digital world and their potential within it.

The outcomes of the season can be summarised;

• **Drawing a focus on digital**

  The BBC will produce learning support in the form of Bitesize (resources supporting the new computing curriculum at primary level include over 40 curriculum-mapped computing guides using animation, graphics, video and interaction), teacher packs (for English Computing Curriculum), iWonder guides and in children’s content (for example, Nina & The Neurons, Appsolve Genius - which will challenge CBBC viewers to design and build their very own game, and The Doctor and the Dalek, an online game for CBBC audiences containing puzzles that are linked to the new computing curriculum and are designed to allow children across the UK to pick up core programming principles as they play). The BBC will inspire a new generation by working with the industry and raising awareness.

• **Working with partners**

  To create hardware and software in order to develop skills and deliver events and initiatives that share information and resources to take learning further.

• **The BBC becomes my BBC**

  This outcome will be achieved by inviting audiences in to the BBC and asking them to co-create. This will include younger audiences through activities such as the Radio 1 Academy or CBBC Live
7. WebWise
WebWise (www.bbc.co.uk/webwise) is the BBC’s go-to destination for digital learning resources for adults. We produce a range of films and articles ranging from basic skills like using email and search, to more advanced topics such as understanding online security and copyright.

We are strongly committed to promoting online safety, publishing advice guides for adults, teens and families. Our videos can be embedded on non-BBC websites in the UK, getting our content closer to the audiences who need it.

Examples of current content include; *What is an app?*, *How do I get email?*, *How do I get broadband?*, *What do I need to know about 4G?*, *Five ways to keep your mobile data safe*

The site also offers click-throughs to DigitalSkills.com for learning resources on the web and UK Online Centres which allows users to search for free or low cost computer courses in the area.

8. My Web My Way
This site provides accessibility help, enabling computer users to make the most of the internet whatever their ability or disability. This includes ‘how to’ guides and details of how users can adapt their computer setup.

9. Safer Internet Day 2014
In February, the BBC supported Safer Internet Day.

Highlights of the support in content include a *Newsround* special on cyberbullying, a *One Show* lead film, a BBC Breakfast feature, a 5 live/Radio 1 simulcast, the Radio 4 drama *Craven*, a week of items on *You and Yours*, an online film fronted by *EastEnders’* Jacqueline Jossa, a week of reports on *North West Tonight* and a wealth of written guides and videos on BBC WebWise.

As part of the campaign, BBC Learning commissioned a poll of 2,000 children and their parents. It created headlines with the news that smartphones can be a child’s way to risky content and that many parents are unaware that filters and parental locks are available on phones.

BBC support for Safer Internet Day is a crucial part of our public service brief. The BBC has a public purpose to ‘deliver to the public the benefit of emerging communications technologies and services’.

Audience research shows that more than 15 million people saw or heard the safer internet message on Tuesday 11th February. *The One Show* film had 4.2 million viewers and BBC Breakfast had 3 million. The BBC News Online article based on our poll had 900,000 page-views on the day of announcement, and a total of 31 local radio stations ran related items.

BBC Audiences research released on 3 July showed that 25% of children in the UK were aware of Safer Internet Day, with 50% of those children citing coverage on the BBC and 46% of them changing their online behaviour as a result.
Safer Internet Day is a partnership with ChildNet International.

10. Go ON UK

Go ON UK is a national digital skills alliance with a vision to make the UK the world’s most digitally capable nation. The stated vision of Go ON UK is to inspire and support individuals and organisations that want to share their digital skills with others. In particular, they aim to reduce the number of people lacking basic digital skills and increase the digital presence and skills of SMEs and charities.

In April 2012, the BBC signed a Memorandum of Understanding with the newly-formed Go ON UK and became one of the seven founder members. As part of the membership, the BBC commissioned a significant piece of research which was made publicly available.

The BBC contribute to the Go ON partnership in a number of ways:

- **Editorially.** Where appropriate, we will use our editorial storytelling to focus on media literacy and digital inclusion topics. We have coordinated our work with the Go ON regional programme of activity.
- **Webwise.** We have to ensure that our Webwise films are fully embeddable so that they can be used by Go ON and all partners.
- **Audience research.** We have made a contribution to Go ON through sharing our basic online skills research with Go ON and partners.
- **Shared Language.** We also helped developed a unified language that most effectively communicates with those 11 million people without basic digital skills. This has been shared with Go ON and their partners, as well many organisations across the UK.

**Audience Research**

The BBC has undertaken a significant amount of audience research. This has helped inform our own strategy and content, as well as contributing to the work of other organisations. We publish much of our audience research online on the BBC Learning website - [http://www.bbc.co.uk/learning/overview/research.shtml](http://www.bbc.co.uk/learning/overview/research.shtml)

As part of our media literacy strategy the BBC commissioned Ipsos MORI to conduct ongoing analysis, looking at the number of people in the UK who are under the basic digital skills threshold. This interim update in April 2014 has found that the 19% of UK adults are currently below the digital skills threshold in the UK, slightly down from the 21% in October 2013.

The basic digital skills threshold is defined as being able to; send and receive emails, use a search engine, browse the internet, and fill out an online application form.

This research has been adopted by Go ON and the GDS Digital Inclusion strategy as one of their lead metrics. As a founder partner in Go ON UK we will share the findings of this work with them to help inform their programmes to increase digital skills.

Along with Ofcom, the BBC is a leading organisation in the UK when it comes to understand media literacy issues such as the barriers to going online for instance.
11. Radio 1 Academy – Glasgow (May 2014)
The BBC Learning Radio 1 Academy returned in May 2014 in Glasgow, building on successful events in Hackney in 2012 and Derry-Londonderry in 2013.

The event ran for seven days in Glasgow in the run-up to Radio 1’s Big Weekend in May, providing a programme of inspirational workshops and hands-on masterclasses for young people from the local area. Over 6000 free places were available throughout the week, with much of the focus on developing creativity and media related skills.

Classes included; Sounds Technology for the Live Lounge, Smartphone Journalism, Video blogging workshop and a Q&A with the developers of Minecraft.

12. CBBC Live in Gateshead
In collaboration between BBC North, NewcastleGateshead Initiative, Gateshead Council and Newcastle City Council, and taking place in May 2014, this series of events and live broadcasts were aimed at children from 6 to 12-years-old. Free to attend, 35,000 attendees visited the site over the three days. As well as getting the opportunity to take part in activities and view preview screenings, the children were offered the chance to try new digital content in the interactive zone.

In the digital Creative Zone, children learnt how to create their own computer games. By using interactive games they were taught the basic rules of coding. 80% of those who took part said they understood coding more because they had a chance to try it and 84% said they wanted to find out more about coding.

13. Computing for a new generation
In partnership with Google, the BBC hosted a conference - "Computing for a New Generation" - at our flagship digital centre in Salford.

The conference was attended by over 200 local teachers from the North West who will be at the forefront of educating children in coding and all things digital. This one day conference gave teachers an important insight into computer science, offering them a chance to hear from industry experts, learn about support organisations and get hands-on with new digital kit from a wide range of coding and digital partners who were also taking part in the conference. Partners included CoderDojo, Raspberry Pi, Code Club and Teen Tech.

Sessions at the conference included; Why Coding Matters and the Role of Women in Technology in the Workplace, and How to Inspire Young People about Coding

Training and Development

14. BBC Academy: Digital Skills at the BBC
The BBC Academy has a dual role within the organisation; to provide structured training and development to support the emerging, and on-going, business needs of the BBC, in addition to our charter requirement to train the wider UK broadcast industry.

In 2009 the College of Technology was created to develop training programmes to support the skills to deliver a truly digital BBC.
Over the past 4 years the Academy has worked hard to support digital skills, careers and development within the BBC, with a range of partners externally, as well as in schools and universities. Digital development is at the heart of this, as all BBC output is digital – whether those digits appear on digital BBC television, digital radio or via BBC online. Across the BBC production systems and business tools are also digital, so the majority of BBC training courses are digital by default.

15. Digital and Technology Skills within the BBC

Internally the BBC Academy offers over 100 training courses supporting digital and technology skills.

- These courses cover traditional enterprise technology skills such as desktop applications and financial tools, to web production systems. In addition there is a portfolio of skills to support engineering teams to develop BBC digital services – like the BBC iPlayer, BBC News and other online products – with advanced programmes in software engineering and development practices.
- The Academy also support the BBC’s broadcast teams, with broadcast engineers who all need to understand audio and video engineering, now increasingly over Internet Protocol, satellite links, digital video standards, servers, digital production systems and cameras.
- In total the BBC Academy delivered over 10,000 delegate days of technology training last year through events, masterclasses and face-to-face training. This was supplemented by online training.
- These programmes are developed for the BBC, but also offered commercially to other organisations in the UK and globally, including a training partnership in the Middle East with TwoFour54 in Abu Dhabi.
- Training courses are delivered by a mixture of in-house training professionals, expert freelance trainers and a selection of training companies.
- The BBC Academy works closely with academia and sector skills councils to develop innovative programmes. This includes an in-house build-your-own MSc in Software Engineering and Internet Architecture, developed with Creative Skillset. The programme is jointly developed and delivered by Bournemouth, Bradford and Lancaster Universities. The programme allows staff to grow their own professional skills via short modules, without having to sign up for 1-2 year programme. This learning is reinforced with work-based projects, to support continued professional development, and critical review of working practices.

16. Sharing our skills with the wider industry

The BBC has a role to train the wider broadcast industry. Digital skills have played a vital part of this approach. Over the past 12 months the BBC Academy has worked with the sector skills council, Creative Skillset, to develop two programmes to support recent technology developments:

- **Sound Matters** was a pan-UK programme to help train the industry on the introduction of loudness measurement (via the European R.128 standard) for television programme sound. This new standard changes the way that sound is measured, delivering a more consistent audio level across a channels output. This new approach should stop viewers
having to reach for remote control to turn up or down their volume at a programme junction. Over 500 delegates attended from across the broadcast sector, helping to ensure that production teams and edit facilities would be ready for the new introduction of the R.128 standard later in 2014.

- The BBC worked with the Digital Production Partnership, Sky, ITV, Channel 4, the International Association of Broadcast Manufacturers (IABM), Institute of Professional Sound (IPS) and UK Screen to deliver the events, ensuring that best practice was shared from across the sector. These events were filmed and made available with further online resources, via the BBC website.
- The BBC Academy again worked with Creative Skillset to develop and deliver File Delivery Made Real. This programme was created in partnership with the Digital Production Partnership to assist the UK industry to migrate to the new AS11-DPP file format, which replaces the use of tapes for delivering programmes on 1st October 2014. Experts from across the BBC, Channel 4, ITV and post-production facilities worked together to present, explain and demonstrate the new technologies and skills needed to deliver a compliant, safe-for-broadcast file. The events were also supported by the IABM and UK Screen. Nearly 700 individuals attended the workshops.
- As with Sound Matters, the BBC Academy have worked with experts from across the UK broadcast sector to share these skills and practices online – with a series of introductory and how-to films to support the migration: http://bbc.co.uk/academy/technology/broadcast-technology/file-delivery

17. BBC Academy / Technology Events

- The BBC Academy works with partners across the broadcast sector, as well as via Meetup.com groups to provide a series of events where BBC staff and industry partners can come together to share best practice. Bringing the best industry expertise to the BBC and highlighting cutting edge topics. On average we host 28 events around digital and technology skills per year.
- Over the past year we have worked with SMPTE, the IET, the International Association of Broadcast Manufacturers, Product Tank, UK Screen, IPS, Creative Skillset and a range of other guest speakers to host internal and external partnership events. These masterclasses have been supported with larger industry events such as our Digital Cities events, held in Bristol and in Cardiff to bring together the creative industries within a geographical region to learn together and share their skills.
- In 2013/14 over 6450 people (from inside and outside the BBC) have attended these events.

18. Building skills for the UK

The BBC Academy launched a new website in August 2013, sharing BBC best practice in Production, Journalism and Technology. This has a weekly reach of c.45,000 users.

Digital Skills play a core part of this, highlighting the skills you need to do your job in a modern digital environment, as well as sharing the best of the BBC with the best from across the industry.

At the heart of the Academy’s web presence is a range of job profiles, designed to explain and inspire young people into careers in technology and digital. We are already working with
TechCityUK and e-skills on plans to share this more widely through some of their online programmes.

The BBC has also been assisting e-skills, the sector skills council for IT, by driving innovation in education.

**BBC Women in Engineering Events**

- The BBC Academy hosted three events aimed at women working in engineering and technology roles in 2012/13. Each event was run at BBC facilities in London or Salford and covered topics including; *How We deliver BBC iPlayer, The Role of Broadcast Facilities in Delivering the Future*
- Over 120 women attended each event, and we followed these sessions up with Young Technologist days aimed at young women, held in Salford, London and Cardiff. We worked with Young Rewired State, Stemnet and local schools to run exercises on building the BBC iPlayer and BBC Sport website, and understanding what careers in technology offered.
- The BBC worked with WISE Campaign, WES, WiT, everywoman, Talent 2030, to raise awareness of the events and were supported by STEMNET. We also sponsored the WISE Awards for the past 2 years.\(^{72}\)
- In May 2014 the BBC co-hosted an event at the House of Lords with GirlGeekChic, welcoming over 100 women to hear from high profile speakers from the BBC, Shell and Wearethecity.com.

3 November 2014

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\(^{72}\) The WISE Awards is an annual event to recognise organisations and individuals actively promoting science, technology, engineering and mathematics to girls and young women
The changing technological landscape

Q1 What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

1. It is safe to say that we are currently living in a digital revolution that is only in its infancy and that long term predictions on future technologies are not going to be reliable. E-commerce in the form of Amazon started in 1994, which is all of 20 years ago. Google was founded in 1998, Facebook in 2004, YouTube in 2005, Twitter in 2006. The first smartphone appeared in 2007, all of seven years ago, and the first iPad in 2010 all of four years ago. None of the technologies those companies invented were anticipated; all were disruptive.

2. All we can say for the future is that technology is changing at an ever more rapid pace, yet the underlying principles, concepts and techniques those technologies are built on change only slowly. For example, the Internet still operates on the same fundamental principles that were behind its 1969 predecessor ARPANET, even though particular technologies have advanced hugely in that time. In terms of thinking about digital skills for the workforce, what matters most is that they understand these principles, concepts and techniques.

Q2 What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

3. The main challenge for the economy is to ensure the workforce is capable of constantly renewing their digital skills to keep up with new technology in the workplace, which is constantly changing and where we cannot reliably predict what technology they will be using in 10 years from now. That means the most important skill the workforce needs is the skill to learn new skills.

Future workforce

Q4 What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

4. As we said in Q2 the most important skill the workforce needs in the 21st century is the skill to learn new skills.

5. When we consulted leading captains of industry they were much more concerned with what type of professional does the economy need in the future, rather than specific digital skills. They said for UK PLC to remain competitive we need

- professionals who can invent new digital technologies,
- professionals who can integrate those inventions into technology platforms,
- professionals who can build software applications that address business needs,
- professionals capable of protecting our information, our digital infrastructure and our intellectual property
6. As well as considering what technical digital skills are needed it is also important to consider the other professional skills that are essential if companies are to grow and be competitive. Below is a summary of the high level skills laid out in the Skills Framework for the Information Age (SFIA), which is used by Microsoft, IBM, BT, Visa Europe, Capgemini, Deloitte, O2/Telefonica, Unilever and the Cabinet Office amongst others to help shape the CPD of their workforce. Note, not all of these skills are needed for every kind of job, the set of skills needed will depend on the level of seniority within an organisation. It is important that we develop people with the fullest range of professional skills possible, which will mean we have a workforce capable of creating real business value from their technical knowledge and skills.

7. Business skills, SFIA High Level Summary: An IT professional is capable of creatively and innovatively applying solutions for the benefit of the customer. They are capable of analysing, diagnosing, designing, planning, executing and evaluating work to time, cost and quality targets.

8. An IT professional is able to communicate effectively, formally and informally, with colleagues, subordinates and customers. They are able to facilitate collaboration between stakeholders with diverse objectives. They are able to analyse customer and business requirements and advise on the scope and options for operational improvement.

9. Autonomy, SFIA High Level Summary: An IT professional is fully accountable for their own technical work and/or project/supervisory responsibilities. They receive assignments in the form of high level objectives. They establish their own milestones and team objectives, and delegate responsibilities. Their work is often self-initiated.

10. Influence, SFIA High Level Summary: An IT professional influences their own organisation, customers, suppliers and peers with respect to their own specialism. They have significant responsibility for the work of others and for the allocation of resources. They make decisions which impact on the success of assigned projects i.e. results, deadlines and budget. They develop business relationships with customers.

11. Complexity, SFIA High Level Summary: An IT professional performs a challenging range and variety of complex technical or professional work activities. They undertake work that requires the application of fundamental principles in a wide and often unpredictable range of contexts. They understand the relationship between their own specialism and wider customer/organisational requirements.

12. Turning to school education provided at Key Stage 4, in the UK we currently expect everyone to gain a GCSE in English and Maths at school (although many sadly do not achieve grade C in either subject), and we believe the expectation should be that everyone also has a GCSE in Computing.

13. With regards IT Technicians they need to have completed at least the equivalent of a work based Level 3 apprenticeship that meets global standards. The present capacity for L3 apprenticeships in all STEM related areas is currently far less than is needed by the economy. Currently the UK economy could easily absorb at least three times as many L3 apprentices in IT as there are at present. Last year Microsoft reported that amongst its partners there were 100,000 IT unfilled IT vacancies. Many of these were suitable for IT Technicians.
Q5 How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

14. The new Computing curriculum in England focuses on principles, concepts, techniques and methods that underpin all computing systems. These will remain relevant over the working life of students, whatever new technologies they encounter or occupations they take up. This gives schools the scope to teach students the meta-skills of computational thinking, which means they will be able to easily learn new particular digital skills whenever new technologies enter the workplace. These are exactly the skills that will prepare them for future careers. Note, since technology already underpins many sectors of the economy, from life sciences to automotive industries, computing will be relevant to students in almost any walk of life not just the IT industry.

15. The situation in Scotland differs from England, and we support the comments made by the Royal Society of Edinburgh in their response to the consultation with respect to the situation there. In Wales and Northern Ireland there is still an ongoing discussion about whether and how to introduce computer science into the school curriculum. In Northern Ireland the recent introduction by the Council for Curriculum Examinations and Assessment (CCEA) of GCE Software Systems Development and the review of UICT statements are to be welcomed. However, further consideration is required in developing a coherent computing strategy for teaching computing from Foundation Stage to KS5.

16. There has been significant focus on education in Wales over the past three years, focusing primarily on addressing baseline literacy and numeracy skills, as well as bridging the socio-economic attainment gap. The recommendations of the 2013 review of the ICT Steering Group identified clear reforms for the ICT curriculum in Wales, proposing new computing pathways from Foundation Phase (KS1) to KS4, reform of initial teacher training, strategic engagement with industry and significant investment in CPD and training for computing/ICT teachers. However, the Welsh Government are currently in the middle of a wide-reaching Curriculum for Wales Review, with an ongoing independent review reporting back in autumn 2014. There is concern that the lack of clarity and concrete policy for computing education and digital skills for the economy may disadvantage young people in Wales, as it is likely there will be no significant reform to the ICT curriculum in Wales until post-2016.

17. This question is closely connected to Q7, so we will expand on the point about inspirational teaching in the answer there.

Q6 How are schools preparing to deliver the new computing curriculum in an innovative way?

18. The question is how are teachers preparing for the new curriculum? Most computing teachers have no formal computer science qualifications and have never taught computer science before.

19. When thinking about preparation for the new curriculum it is important to realise that teachers are very short on spare time. This coming academic year is an opportunity for schools to become truly inspirational and innovative in their delivery of computing.
However, we run the danger that due to lack of time for planning teachers will opt to pick up the resource they find the fastest and simplest to deliver; this may not necessarily be the most appropriate for their pupils. Some ‘unplugged’ computing activities (ones that can be taught in class without the need for a computer) can take time to develop. Teachers will need to think carefully about how they are delivering the new curriculum and whether or not they are emphasising/developing computational thinking skills as well as they could. That all takes time that teachers will not have in their current timetable. GCSE’s are changing, and so are the A-Levels, these will receive greater priority in secondary schools than KS3 and will therefore receive less time. Many schools are having to undergo a huge change – it would be helpful for teachers and would help improve delivery greatly if schools could be directed to give teachers more protected time this academic year in light of the changes that need to be accommodated.

20. We believe the most important thing teachers can do to prepare for the new curriculum is to join a local community of professional practice, which we believe provides the best and most effective teacher professional development. Computing At School (CAS) has over 14,000 members and runs over 110 CAS Hubs (entirely for free) across the country, which are communities of professional practice that provide regular events where teachers can meet to share and learn about innovative teaching practice. Many of these groups are supported by their local university computer science department and IT professionals from industry.

21. DfE currently funds the CAS Network of Teaching Excellence in Computer Science, which has helped 14,000 teachers in its first year in partnership with 78 universities. Initiatives such as these are essential for schools to develop the capacity to be innovative as the new Computing curriculum becomes established. Schools in the Network have access as institutions to innovative classroom resources and share best practice as well as organise CPD activities to help teacher development. We believe it is essential for such schemes to be continued for many years to come to ensure Computing does become properly established as a core subject valued by students, teachers, head teachers, parents and employers.

Q7 How can the education system develop creativity and social skills more effectively?

22. When taught well computing allows children to be creative not just through computers, but in their way of thinking in other subjects. For example, qualitative evidence from some primary schools shows that children’s creative writing improves when the children create computer animations that bring their stories to life. Their imagination is stimulated by being able to literally animate their ideas through writing a computer program that brings their characters to life on screen.

23. Giving children open ended problems that require imagination and creativity to solve is a well tried and tested method that works just as well in computing as in other subjects. Allowing children to express their own ideas in the form of computer programs to solve challenging problems inspires pupils and helps them become better learners in other subjects.

24. E.g. writing a simple computer simulation of evolutionary processes in bacteria (note this is suitable for Key Stage 3 students) requires pupils to be creative in how they model
evolutionary mechanisms in a form simple enough for a school computer to deal with. In doing so they discover new knowledge through the act of writing their own computer program, they learn they can tackle problems that seem well beyond them by telling the computer how to solve the problem for them, and they learn how to explore complex ideas in ways that make them accessible, all of which is truly inspirational and hugely empowering.

25. Computing also lends itself well to group projects, paired learning, whole class activities, and cross curricular projects all of which are excellent vehicles for developing team working and other social skills.

Q8 How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

26. The main means for equipping Key Stage 5 students with knowledge and skills are through A-level Computer Science and IT apprenticeships at level 3 and above. Only if students take up these will they have direct exposure to inspirational computing education. Currently there are only around 4000 students who take Computer Science at A-level, and of those less than 100 are girls. Compare this with over 36,000 students (male and female) taking Physics and 88,000 taking Maths at A-level in 2014. As mentioned there is also a severe shortage of Level 3+ apprenticeships in IT. In other words the real underlying issue is of ensuring enough students take up Computing at Key Stage 5 and beyond.

27. It is certainly hoped that now Computer Science is in the KS1-KS4 curriculum the take up of A-level Computer Science will rapidly improve. However, the capacity for providing L3+ apprenticeships will only improve if some way is found for many more employers to provide them.

28. Now that all students will study Computing at Key Stage 1 through Key Stage 3, with the entitlement to study it at Key Stage 4, there is an excellent opportunity to ensure A-level Computer Science evolves into a qualification that becomes more appealing to students, universities and employers. We recommend that Computer Science A-level is reviewed with precisely this aim in mind. We also recommend that government works with employers and professional bodies to find ways to increase the supply of high quality IT apprenticeships, see Q9.

29. However, this positive perspective is predicated on the assumption that provision across KS1-KS4 will be fully available across all schools and provided at a high standard. There is a concern that some school management teams may be misunderstanding the new requirements, in particular they may not be realising there is an entitlement for all to study Computing at KS4, akin to the entitlement for all to study English and Maths. As a result some schools may fail to provide KS4 Computing to students who do not choose to take an examined optional course at that level (entitlement is not satisfied by options provision alone).

**Short- and medium-term support to the digital sector**

Q9 How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?
30. In the short term the government could ensure that chartered professionals are responsible for large public sector IT projects. This would be a highly visible signal to IT employers that they should ensure staff are continuously developing as professionals, which would mean there is eventually a greater capacity for providing work based training.

31. In the medium and longer term it is essential that Computer Science becomes firmly established in all primary and secondary schools as a foundational subject discipline, alongside mathematics and the natural sciences, if the UK is to remain at the forefront of technology innovation and be able to compete in a global market. For that to happen teachers of Computing need to be confident, enthusiastic, and increasingly well qualified. For that to happen there must be a nationally coordinated CPD programmes for teachers provided by partnerships with national organisations that are already developing that capacity, such as CAS and BCS working with employers and universities. Government should ensure such programmes have the resources necessary to support teachers throughout the country.

32. Higher education should help to develop communities of professional teaching practice for schools in their areas, as many are doing through the CAS Network of Excellence funded by DfE. University Computer Science departments should encourage their undergraduates to think about teaching as a profession, and encourage students to take up School Ambassador placements to help inspire the next generation.

33. Industry policy should encourage employers to provide far more level 3 and higher IT apprenticeships. Government policy should encourage far more undergraduates to take up industrial placements as part of a sandwich course, which are known to be highly effective at producing graduates with excellent workplace skills. Government industry policy should also encourage employers to work in partnership with universities and charities to provide professional development for school teachers.

Q12 What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

34. As far as schoolteachers are concerned one of the best CPD models is that of establishing and nurturing local communities of professional practice in partnership with professional bodies, universities and industry.

35. Our basic premise is that long term, mutually supportive, professional relationships between peers underlie the best and most effective teacher professional development. CAS enables teachers to connect in the spirit of learning, knowledge sharing and collaboration to further their own professional development and thus raise the standard of teaching in their schools. This is best delivered in a teacher's own community and involves local, face-to-face, peer-to-peer engagement with online support where necessary.

36. CAS currently has 14,000 members spread across the UK, where teachers make up more than 75% of the members. Membership is entirely free. Presently there are over 110 CAS Hubs around the country that act as local communities of professional practice. During term time each CAS Hub runs on average at least one event every month. CAS runs other national projects with financial aid from DfE and industry:
The CAS Network of Teaching Excellence (NoE) includes over 1260 schools as institutional members, of which over 400 are now CAS Lead Schools.

The Network also has the support of 78 universities in the UK, including most of the major universities such as Cambridge, Imperial, Manchester, Birmingham, Oxford, amongst others.

Through the NoE CAS has now recruited just over 300 teachers onto the CAS Master Teacher training programme, of which over 100 have now completed their training and are providing CPD in their local communities to provide help to 14,000 teachers in the first year.

The CAS Barefoot Computing project has over 1000 primary teachers registered and is producing exemplary computer science resources that also support learning in literacy, maths and science.

CAS also has support from many major employers, such as Microsoft, BT, IBM, HP, Google, Toshiba, Morgan Stanley, Goldman Sachs, GE, RBS and many others including British companies such as Ensoft and Metaswitch Networks.

CAS is a good example of how the ‘big society’ can be made to work highly effectively. LEPs and local government could be highly effective in helping to extend the capacity and reach of organisations such as CAS, by galvanising local employers to work with them and support their work.

An example of a local skills delivery model is the Digital Schoolhouse initiative in London that pulls together support from the Creative industries through UKIE to help develop inspirational resources to engage pupils in primary and secondary schools. Funded by the Mayor of London’s Schools Excellence Fund and managed by UKIE the Digital Schoolhouse has established 10 Digital Schoolhouses in secondary schools across London. Each Digital Schoolhouse will work with and support a growing network of primary schools. The creative industries are supporting the creation and delivery of new creative and engaging cross-curricular computing lessons for visiting primary school pupils.

**Industry**

**Q13** What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

40. One of the biggest barriers is finding sufficiently highly skilled people to employ. See our answer to Q4 for the types of professional employers need and in all cases struggle to employ. See the earlier questions for our answers on ensuring more people have the needed skills, of which the most important is the skill to learn new skills.

41. SMEs generally speaking have little capacity for providing CPD to their existing staff, which is another significant issue. Major employers could and indeed in some cases do help SME partners in their supply chain to provide staff with training. Government could also help facilitate more training opportunities, through funding more advanced and higher apprenticeships, which would support SME-s as well as large employers.

**Q14** How can businesses help equip the workforce with new skills in a rapidly changing environment?
42. Where possible we believe employers working in partnership with FE colleges and HEI-s to develop courses for work based learning is an excellent way to support professional development. Typically a college or HEI works with an employer to identify skills gaps and then tailors a bespoke work based course to provide these skills. Ideally such courses would allow the most talented employees to progress onto foundational degrees, or even honours degrees, which again should be provided as work based courses tailored to the particular employer. Employers that participate in such schemes usually prefer those that have accreditation from a professional body, since this is a guarantee of high standards and that skills are transferable beyond the immediate work based context they are delivered in.

43. Employers can also encourage workers to engage directly with professional bodies, who can help them structure their professional development to best effect, and can help them become active members of their professional community. As part of the wider professional community employees gain access to insights into best practice and ‘next practice’ from other professionals working in similar fields.

5 September 2014
TUESDAY 21 OCTOBER 2014

Members present
Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Lucas
Lord Macdonald of Tradeston
Baroness O'Cathain

Examination of Witnesses

**Dr Bill Mitchell**, BCS Director, Academy of Computing, BCS, The Chartered Institute for IT, **Professor Simon Peyton Jones**, Chair, Computing At Schools, **Charlie Taylor**, Chief Executive, National College for Teaching and Leadership, and **Sir Andrew Carter**, Head Teacher, South Farnham School

**Q143 The Chairman:** Thank you very much for joining us this morning and helping us with our deliberations. I will do a bit of housekeeping first. You have a list of interests that have been declared by the Committee members. These were declared orally by members at the previous sessions in July and can be found in the transcripts.

This is a formal evidence-taking session of the Committee and a full note will be taken. It will be put on the public record in printed form and on the parliamentary website. You will be
BCS, The Chartered Institute for IT, Computing At Schools, National College for Teaching and Leadership and South Farnham School – Oral Evidence (QQ 143-157)

sent a copy of the transcript, which you can revise for any minor errors. This session is on the record. It is being webcast live and will subsequently be accessible via the parliamentary website. You are welcome—indeed you are absolutely encouraged—to submit any useful supplementary evidence after this session. So, if we do not get through everything properly or there are things left hanging where you think you could send us some extra information, that would be great. I am asked to remind everybody to speak up clearly. The acoustics are not bad in here but it is good to keep your voices up. That is by way of an opening.

I will ask you to introduce yourselves one by one. If you wish to make any opening remarks, you are very welcome to do so, otherwise we will go straight into the questions. Obviously there are four of you on the panel, so we will not expect you all to answer all the questions. Some of them are more relevant to one or more of you, while some may be relevant to all of you. We will play it by ear slightly. Dr Mitchell.

Dr Bill Mitchell: My name is Bill Mitchell. I am director of education at BCS, the professional body for IT. We have about 75,000 members and a royal charter that says we exist to advance computing for the benefit of the public. We work in collaboration with the Computing At School group—which my colleague, Simon Peyton Jones chairs—and we do a whole range of things, working from primary school through to university level, where we accredit computer science degree courses in about 95 universities around the UK.

Professor Simon Peyton Jones: I am Simon Peyton Jones. I am a professional computer science researcher. I work at the Microsoft Research lab in Cambridge, but the reason I am here is because I am chair of the Computing At School group that Bill referred to, which is now part of BCS. This started around 2007 or 2008, with the single mission of reforming the ICT curriculum, as then was. We began to understand that what we wanted to do was to establish computer science as a foundational discipline that every child should study—just as they study maths, science or natural science—from primary school onwards. So it was a very big shift in perception.

Rather to our surprise, it was entirely successful and the new national curriculum embodies exactly this idea from primary school onwards. CAS’s new mission is now simply to support, encourage and equip our existing teachers and new teachers to be able to deliver that curriculum with confidence and enthusiasm. That is what we are trying to do.

The Chairman: That is very straightforward.

Professor Simon Peyton Jones: Totally one mission. Not all that easy to achieve.

The Chairman: Thank you very much. Mr Taylor.

Charlie Taylor: My name is Charlie Taylor. I am chief executive of the National College for Teaching and Leadership. We have responsibility for allocating teacher training places across the country and for national recruitment of teachers against the teacher supply model every year.

Sir Andrew Carter: Andrew Carter. I am a head teacher of a primary school in Surrey and am also conducting a review into an issue of teacher training at the moment. I am on the Teaching Schools Council board and a member of the regional commissioners’ board.

Baroness O’Cathain: I just wanted to refer to Professor Simon Peyton Jones’s statement about the curriculum. Last week, we had evidence to the effect that it was great in primary schools but then—to use an expression—they fall off a cliff, because as soon as they get to
the secondary school level, or a more senior level, they are left completely without any direction. I think it is very important that you tell us whether that is the case, because we gasped at that. It is completely contradictory to what you have said.

**Professor Simon Peyton Jones:** Were they referring to the past ICT curriculum as was, or the new one as introduced?

**The Chairman:** I think the point they were making—and in a sense we will probably cover it in more detail going forward—was that they felt there was an enthusiasm in the primary sector and that there was a chance of having a pretty universal delivery in the future in the primary sector, but that it was much more patchy, and a minority not a majority position, in the secondary sector.

**Professor Simon Peyton Jones:** No, I do not agree with that at all. The CAS working group started in secondary, if anything. By and large, secondary teachers are enthusiastic about the change. I perceive ICT teachers in the past as having been rather low-status or low in the pecking order of school teachers. The whole ethos of the new curriculum is to re-establish them as high-status, like science and maths teachers, and as doing a job where they could get a highly paid job in industry instead. Broadly, teachers are keen about the direction of travel. I do not have data on this but I have talked to a lot of teachers. But I think many of them feel underequipped to deliver that change in a short time. Essentially, we are asking them to do something that they have never been asked to do before, which is to teach an entirely new subject, both at primary and secondary level.

But teachers are good at learning. I have seen them stand up in a room and say, “We are teachers. We can learn”. If we provide them with enough support, enthusiasm and time to do the subject knowledge enhancement themselves, they will be just fine.

**Q144 The Chairman:** Let me pick up on that and move to the main questions. I will kick off with the first one. We know that an awful lot of teachers who are going to be teaching computing going forward do not have any formal qualifications to do that and have never taught computer science before. Can all of you—in different ways—help us understand how the current teaching workforce is preparing for the new curriculum? To what extent is it true that the new curriculum is not yet being delivered? How patchy is it and, therefore, what needs to change going forward in order to enable good teaching to happen across the country rather than with enthusiasts, in a sense? Perhaps I can start with Dr Mitchell.

**Dr Bill Mitchell:** We helped put together the new curriculum with the Computing At School group. We always took the view that 1 September is not the day that 20,000-odd schools are going to be good at teaching computing, but the day on which 20,000-odd schools are going to wake up and think, “Right, how do we become good at teaching computing?”. We have always felt that the most important thing is to make sure that teachers have the right support so that over the coming years—and it will be years—they will eventually get to the place where they are good at teaching computing.

We believe the most important thing is creating communities of professional practice, where teachers from different schools can get together and collaborate with each other to figure out what good and best practice looks like. In terms of whether they are prepared or not, for us the most important thing is whether or not they are taking part in those local networks where they talk to other teachers and start to learn about how to teach computing. It is particularly important as well that they can get in touch with their local universities because
now, with the new curriculum, just about every computer science department in the country is chomping at the bit to get in and help schools. In the past it was certainly the case that a lot of computer science departments at universities regarded ICT with disdain and were not terribly interested in it. Many of them had the view that they would rather it was not there at all. Whereas now, with the new computing curriculum, there is a huge amount of goodwill and support from those universities.

If we look at the Computing At School group, we surveyed about 2,000 of the teachers there in March and about three-quarters of them felt that if they were part of an active local community, they were doing fine. That was the key thing.

**The Chairman:** If they were?

**Dr Bill Mitchell:** If they were. Those that did not have that local community of support seemed to feel that they were a bit out on a limb.

**The Chairman:** Can you give us a picture at the moment of how many would be? That is the key. To give you a bit of context, we have heard lots of evidence of lots of enthusiasm and lots of good initiatives, whether it is Code Club or whatever, but our perception is that it is not sufficiently joined up in terms of the thing moving forward at the moment. I suppose one of the things we are interested in is how many teachers, roughly, and what proportion would now be involved in some sort of local group. What is the timescale over which that could happen and how will it happen?

**Dr Bill Mitchell:** The Computing At School group runs about 110 hubs or local groups around the country. That means that something like 90% of the teachers in CAS—which is about 15,000 or so—are within about half an hour’s drive from a hub. Half an hour’s drive is quite a long way, so ideally you might have 300 or so CAS hubs if you want to make sure that teachers are only 10 minutes away from the nearest hub.

On that sort of basis, I would say that perhaps one-third of teachers have easy access to a local community where they can talk to their other teachers and get help, which suggests that the other two-thirds do not have that easy access.

**The Chairman:** That gives us a picture at the moment. Lord Kirkwood wanted to come in quickly.

**Lord Kirkwood of Kirkhope:** Very briefly. As these regional differences emerge, are there things that we should be looking to deal with that? In particular, are there national differences? I am interested in knowing to what extent Scotland, Wales and Northern Ireland are embracing the work you have done. How much communication is there between you and your professional colleagues in other parts of the United Kingdom?

**Dr Bill Mitchell:** The Computing At School group goes right across the UK, so we do a lot of work in Scotland. In the same way that, in the UK, CAS is helping to train master teachers, there is a similar scheme in Scotland that is funded by the Scottish Government to develop what they call lead practitioners. There is a lot of similarity between the support that CAS is trying to provide to teachers in England and in Scotland.

In Wales, it is a very different situation because there is still a lot of debate about whether they need to change the ICT curriculum and, if they do, in what way. In Northern Ireland, there is a desperate shortage of teachers who can teach computing, so they have a huge problem there.
Professor Simon Peyton Jones: I think it is worth just putting a little context around this patchiness. In the olden days, when the DfE put in a new curriculum for something, as they did in ICT 15 years ago, they would have rolled out a big national training programme—indeed they did one called the National Strategy for ICT, which Charlie and I were talking about just before this. It was a big top-down training programme. The approach this time is entirely different and amounts to a bit of an experiment. The DfE and NCTL are consciously standing back from the process of training teachers and inviting the tech sector—the professional bodies and companies—and teachers themselves, particularly in teaching school alliances, to come forward and lead the process of training and equipping teachers to deliver the new curriculum.

That is innovative, diverse and creative; but it is also quite likely to be patchy. It is very difficult to guarantee the kind of uniformity of provision, regionally and across schools, that you might if you had big central provision. You may want to elaborate on that, Charlie, because this is more your bailiwick than mine.

Charlie Taylor: Simon is absolutely right. What we would have done in the past is the old style “sheep dip” of teachers and we would have said, “Right, here is the new curriculum. We will book hotels around the country and even perhaps give an extra day’s inset training, and we will deliver this training”. However, particularly with something like computer science, which is such a fast moving subject, to just have a point in time at which everybody is trained would not solve the problem because this is about ongoing training and support. We cannot even know yet what stuff people are going to be teaching in schools in a couple of years’ time, because some of it may not have even been invented.

So there is a process here of innovation and inventiveness rather than simply saying, “Here is the new curriculum, off you go and get on with it”. The new national curriculum is deliberately short—very short—so that there is lots of scope for doing it in different ways and to be innovative about the way that it is delivered.

Q145 The Chairman: I will ask you a supplementary on that. I understand that, but what about when you end up mapping the thing and you find that half the country is not covered and does not have teaching schools operating. What role will the national structure then have to move that on, at least to get everybody to the current acceptable level? I take your point about going forward.

Charlie Taylor: You are absolutely right. One of the things that is a crucial player in this—Andrew will say probably more about this—is the development of teaching school networks. One of the things that we are particularly focusing on in the National College is about encouraging more teaching schools to step up in areas of the country where there are not the levels of teaching schools that we need in order to get these networks of support to develop. In the last round of teaching schools, we designated 60, half of which came from places like Norfolk, Suffolk, parts of the east coast and Lincolnshire, where we do not have enough teaching schools. So there is a real push from us in terms of being able to do that.

We will continue to monitor and look at parts of the country and if we think there is an emerging problem, we will consider that and think again about what more we need to do in order to support them. But it is very much about what the Government can do to support teaching schools, or indeed the people like the BCS, to reach out and to support people. It is not just about us saying, “This is how you need to do it”.
Lord Haskel: Do you have any part to play in teacher training of current teachers?

Charlie Taylor: Is that for me?

Lord Haskel: Yes.

Charlie Taylor: Our role at the National College is to allocate teacher training places out, either to universities or to schools through the school direct programme. Our other role is to support nationally with recruitment. I hope you will have seen our new “Your future their future” recruitment campaign—I am trying to recruit here—to encourage more people to come into teaching. So we have an overview of initial teacher training but we are not involved in the specific delivery.

Sir Andrew Carter: We have to recognise that there is an enormous capacity in schools for change. In the last 20 years, we have been through many aspects of the national curriculum and we have been through strategies. Schools have become very adaptable and good at it and have changed structures in them. This is a worry, but I do not think we should worry too much about it.

We also need to look at some of the mechanisms by which change is brought about in schools. One is Ofsted. Anything that goes into an Ofsted schedule gets done quite quickly, clearly, because there are penalties that go with it and also honour that goes with it, I suppose. We need to make sure that Ofsted is trained in the new national curriculum, because the worst thing that could happen now is that a school falls over because of an Ofsted inspector who does not understand what is happening. I am not blaming people; it is just that there is a lot for them to learn as well.

Teaching school alliances are absolutely crucial to this. They are the biggest single mechanism in the country for getting something into schools. Even though the coverage is not there, already 99% of schools are in teaching school alliances. Those alliances are very active, with strong schools at the centre. If you want to get something into a school tomorrow, if you e-mail it to a teaching school today it will be in a school tomorrow and acted upon because there is a local need and local support there. Certainly in the schools I work in—I work in the primary sector—people are working very, very hard at this. I hate to mention the funding, but there is also an issue there. It is not that people need large amounts of money, but there are physical things that have to be bought that can, therefore, stop it going forward a little bit.

The Chairman: Just explain that a bit, because often it is not very much that makes a difference.

Sir Andrew Carter: No, it is not very much. Contrary to quite a lot of common belief, we are not after lots of money but this seed funding to make things happen. I was around in teaching when computers came in. The way it started was every school was given one BBC computer—just one. That was all that happened, and then the whole thing happened and we are where we are today, talking about this wonderful new world. So a small amount of money needs to go into every school but with the imperative to do it. The people clearly have the imperative because the national curriculum started in September and it will be inspected at your next inspection. It is very clear in schools; I do not know any school that is not working seriously towards this now.
Could I give you another suggestion? In the same way that we have a champion or a person who is totally responsible for special needs, it would be very useful if there was one person in every school responsible for IT.

The Chairman: On that point, one of the things that we will ask before you leave is, “Give us one idea”. That may be your one idea because we want to focus very clearly on a set of deliverables.

Q146 Lord Giddens: I will turn to a point that was raised briefly which I have been struggling with ever since we started this inquiry. How do you deal with education in a world of massively shifting skills? We do not have stable skills, or it is difficult to discern what they are. We are using iPads and iPads will probably not exist 10 years from now, I would guess. Skills are created but they are also destroyed, because computers can now do lots of things that human beings did before. I was in universities where you do not see what happens in schools, but how do you deal with that? You mentioned an obvious answer: teach creativity. But what the hell is creativity? How do you think teachers and children should best deal with such a mobile situation?

The Chairman: Professor Peyton Jones looks very keen to answer.

Professor Simon Peyton Jones: That is an excellent question, and I think there is a good answer to it. I think what happened in our ICT curriculum, as was, was that we had become very focused on skills in using technology. Your implication, in mentioning iPads and so forth, is that technology changes very rapidly and the skills in using technology rapidly become out of date. So what do we do in the rest of our educational provision? We do not teach children a lot about how to use particular bandsaws or particular sewing machines. We teach them subject disciplines, like maths or science or history or geography. These do not change fast. Newton’s laws of motion have not changed a lot in the last 400 years, relativity notwithstanding.

Subject disciplines are less immediately applicable than skills, but they are very long lasting. In this particular area that we are talking about today, what the new curriculum strives to do is to move the focus from technology to ideas, so that we can equip children with some knowledge of the underlying subject discipline—which happens to be called computer science—which will last them their whole lives and not just the life of the next iPad. That very same subject discipline, knowledge, methods, tools, techniques is then useful to them as they encounter successive waves of technology. They can make some kind of sense of it.

Lord Giddens: Can you give a concrete example? It might help.

Professor Simon Peyton Jones: Sure. Let me take the one that is closest to the surface of most people’s perception about the new curriculum, programming. Say I have written programs—perhaps in more than one language so that I know that it is not a magic incantation you utter in java—and I have the idea of what it means to write a program. So when I come across a new programming language or indeed a new computer, then instead of it being a completely magic entity that was built by somebody else and is not under my control at all, suddenly I think of it as something that someone built and someone like me could perhaps modify. That may be something as simple as writing the rules for your e-mail filtering—which is a tiny program—or writing an Excel spreadsheet, or perhaps becoming a software engineer. It is kind of like a sense of empowerment about the technology rather than it being supplied as a form of magic by somebody else.
Q147 Lord Macdonald of Tradeston: A very basic question, perhaps for Sir Andrew. I am not clear at all when you look for the basic tools and infrastructure, which you need more money for, whether the children are encouraged to bring their own technology into the schools. Do they bring in iPads and so on? If it is rapidly changing, is it for the pupils and their families to keep up with that while you provide a basic infrastructure that they plug in to?

Sir Andrew Carter: The challenge around that is that you get this social divide then, and that is always difficult. So, no, they do not bring them yet. I am absolutely convinced they will in the future. In the same way we all took in a protractor years ago, they will be taking those in as well. However, what we do want to make sure is that when they come into school, there are iPads. There need to be iPads for every child. But to do that would be a huge investment. I guess that we have to come to a position in society about whether we make that a mandatory thing and whether, therefore, we give that extra support for children on the pupil premium. It is quite difficult. At this moment now, what we need to have is at least a set of iPads in every primary school. That would change the world.

The Chairman: You could do one class. They could use them class by class in the same way you used to have computers.

Sir Andrew Carter: Yes. That would be a tremendous start. We are realistic; we are not going to give one iPad to every child in the country. Many schools do, but of course it is at the expense of something else.

The Chairman: It is not super-efficient. Mr Taylor, you want to come in.

Charlie Taylor: I was just going to say on that what is very interesting about children bringing technology in is the sort of argument over mobile phones. You have some schools who say, “We must never see mobile phones. These are a terrible threat to discipline within the school”. Other schools use mobile phones a lot. I was in a technology class the other day and the teacher said, “Right, end of the lesson, everybody take a picture of their work please, stick it up on their Myspace and I will have a look at it later on this evening”. So it was absolutely just dyed in the wool that it was absolutely part of the way that that school did business.

So there is a big sort of spectrum in terms of the way that schools have the confidence to interact with technology. It also depends on the type of school and the type of pupils and whether they have the self-discipline, or the school has engendered the self-discipline, to be able to use technology in a sensible and useful way.

The Chairman: Can I just ask you what sort of school that was? To what extent is there a danger—

Charlie Taylor: It was a school that required improvement in Kettering, so this was no leafy sort of—

The Chairman: Right, because obviously one of the things we keep hearing—as you have just alluded to—is the danger of a larger social divide.

Charlie Taylor: Indeed, but a phone with a camera is pretty ubiquitous now.

The Chairman: Yes, it is everywhere.

Charlie Taylor: It is quite hard to buy one without one.

The Chairman: Thank you. Let us move on. Lady Garden, over to you.
Q148 Baroness Garden of Frognal: You have touched on this but can I focus you on the initial teacher training package. Are newly recruited teachers being trained effectively? Who ultimately has the responsibility for training the trainers when you get, effectively, a new curriculum subject like this?

Charlie Taylor: Shall I take that? When the new computer curriculum was on the horizon we convened expert groups in order to get together and disseminate resources, because obviously this was a shift for the ITT computing departments of universities. Expert groups got together in order to disseminate materials to say, “Look, here are the sorts of things that we think are going to be useful in terms of delivering the new curriculum”. So that was the work that we did in training the trainers within the universities and the school-centred initial teacher training.

Baroness Garden of Frognal: That would apply to new recruits as well as to existing teachers, would it? Is there some overlap between the two?

Charlie Taylor: That was the trainers, so the people who were going to be delivering the training. That was the first stage in terms of preparing them to be able to train trainees for the new curriculum.

The Chairman: To what extent is this being picked up across the piece? One of the other things that various people have suggested to us is that, rather than it just being the case for specialists working in this area, the whole aspect of computer skills in general, not just in teaching but across the piece, needs to be everywhere and needs to be much more universal. Yes, it needs specialisms but also to be much more universal. To what extent is it coming into general teacher training for everybody as well as obviously the specialist people that Professor Peyton Jones is talking about?

Charlie Taylor: When one is thinking about teacher training, we need to move on from just thinking about it as something that goes on for a year. There is a limit to the amount that people can absorb, as well as having to teach the new computing curriculum, particularly in primary. They have to teach maths, science and all the other aspects. I do not see this as just about initial teacher training; I see this as teacher training across the board, from when they start to when they retire much further on. Therefore, it needs to be an iterative process that goes on through people’s career rather than just saying, “If we frontload everything in, in the first year of teacher training, that will be enough”. It simply will not be enough, particularly in a fast moving subject like computing.

The Chairman: I take that point. But you said in your introductions, “This needs to be seen alongside English, maths and science”. They are taught in the initial teacher training so should this not be, at least at some level, across the piece in the initial teacher training?

Charlie Taylor: Part of the process of teacher training is you have to meet the qualified teacher standards. Part of the qualified teacher standards is having sufficient subject knowledge to be able to teach those subjects.

Sir Andrew Carter: I am conducting a review of initial teacher training for the Government at the moment so I am steeped in what is going on. The answer is that there is not enough subject knowledge in this at the moment. However, there is an awareness that there should be. What is happening is that schools are in advance now of teacher training because they have to do it because it is live in their school. We are certainly going to make some recommendations around this subject knowledge area.
The way that can be best done is if teachers are taught in a school-based route but using HEIs, higher education institutes, to support a lot of that subject knowledge; not just computing, although that is what we are referring to today because it does have to be there. A lot of people believe they know about computing but of course, as we know, they know about how to use them rather than what we are talking about now. I do not think it is going to be too complicated to get to the level of understanding that people will need, certainly at the primary level, but more technical later on perhaps.

**Professor Simon Peyton Jones:** There are two separate conversations going on here. One is about training teachers to teach the new national curriculum subject, called computing. Another is about training teachers in the pedagogy of using digital technology to support teaching and learning across every subject, so you become a better history teacher or geography teacher. They are not unrelated, but they are absolutely not the same. We are still learning how to use, say, ubiquitous tablet technology in schools to improve teaching and learning across the whole piece. We do not have answers to that yet. The school where I am chair of governors has introduced one-to-one tablets recently and there is a lot of innovation going on there, which should eventually migrate into teacher training itself. But that is separate from how we make sure there is an adequate supply of computing teachers. Let us not forget that computing teachers are not just about teaching the computer science bit; the computing curriculum covers existing ICT provision, which is still very important.

**Baroness O’Cathain:** Surely that means that there is a third tier on top of the two that you said, which is making sure that there is a cadre of people who are always at the leading edge of computer science. They in turn will be taking your part and directing what people will do. You train teachers to teach but you also need people who can do their own research on issues like that and get close to the scientists—some of them would even be scientists from university. Otherwise they are going to be stuck in a groove of teaching the same sort of thing.

**Professor Simon Peyton Jones:** That is true of every subject, is it not?

**Baroness O’Cathain:** Yes.

**Professor Simon Peyton Jones:** We need constant refreshing of the content and the way of delivering it.

**Q149 Lord Holmes of Richmond:** Good morning. I would like to turn to the question of incentives. Do you think more incentives are required to increase teacher applicants to these subject areas, perhaps increased salaries and things of that nature?

**Charlie Taylor:** There are three things there. The first thing that we introduced is bursary payments to teachers in order to encourage them to come into the profession, and computer science is one of our absolute priority areas. We know we need to get more people coming into computer science, and there is a very competitive market out there: good-quality graduates are in short supply and high demand. Therefore, this year we have increased the bursaries that we are paying out for computer science. If you have a First or a PhD, you can get a tax-free bursary of £25,000 in order to support you through your training year. That is the first thing.

The second thing is the scholarship scheme that we have introduced with BCS, which has been an innovative way of both increasing the supply of people coming in but also increasing the status of computing and of the teaching of computing, working with an eminent group
like BCS but also other groups, such as Google and Microsoft, which are supporting the programme. That has meant we have been able to encourage and raise the status of it.

Finally, there are subject knowledge enhancement courses. They are run by universities, or within schools, but we provide the funding for them—I think £350,000 last year. These are for people who perhaps do not have a degree in computer science but, for example, have many of the skills that would be required. What the subject knowledge enhancement course does—we do it for physics and maths as well—is to help them to move to a place where they are confident enough to be able to start teacher training and then to deliver the new subject. I think those are probably the three ways. Bill may want to say more about the scholarships.

The Chairman: Could you just tell us—I do not know whether it is you, Mr Taylor, or Dr Bill Mitchell—how many people get those bursaries? Are they for secondary and primary or just secondary?

Charlie Taylor: These are for specialist computing teachers, so secondary teachers. There is a different bursary scheme for payments to primary. We know that 70% of people who came in to computer science last year got at least a 2.1, and even for a 2.2 we provide a bursary of £15,000. There will be very few people who would not have received a bursary for computer science, and we have increased it this year.

The Chairman: How many people take the bursary up?

Charlie Taylor: Everybody who goes on the teacher training course gets the bursary as part of the process.

The Chairman: Yes, but how many is that? What I am asking is: how many new teachers are coming in to the profession to help deliver this curriculum?

Charlie Taylor: Last year 360 came into the profession, which was only 57% of our target; so last year was very concerning. The final numbers are not out yet but there is at least a 50% increase and we think we will be around about 90%, or probably just below 90%, of our target this year. So it is not as good as it should be but we think there is a big change.

The other encouraging thing is the number of people who register an interest on our website in becoming a teacher. We have seen registrations double in the last year for people wanting to do computer science. Particularly with the work of people, like Bill and Simon, this is a subject that has been invigorated and made more interesting and more exciting. I think there is a momentum beginning to build around it, although it is a challenging recruitment environment and we are in no way complacent. That is why we have increased the bursaries.

The Chairman: Dr Mitchell, do you want to add to that?

Dr Bill Mitchell: The number of scholarships that were awarded this year, 2013-14, was 121. There were about 400 applicants, and the vast majority of those had at least a 2.1 or First Class honours degree. It is very encouraging. What is also encouraging of course is that all of those people who had a 2.1 or a First Class honours degree would automatically be offered a bursary, and the vast majority of those did go on to a teacher training course.

What is nice about having something like the scholarship scheme is it gives an extra kudos and cachet to people applying to train as computer science teachers, because it is backed by companies such as Microsoft, Google, Facebook, BT, IBM, HP—all of those huge companies.
So teachers that go through that scholarship scheme feel as if they are actually being endorsed by these large companies. It gives a huge boost to their confidence.

**The Chairman:** What about the primary sector?

**Sir Andrew Carter:** As I mentioned, I think that we ought to try to create a teaching and learning responsibility in every primary school for ITT which would attract finance. But there is a bigger incentive in teaching: teachers are often driven by some very different motives, and it is about status. In a school, leading this new initiative stands as a very high-status job within the profession. There should be strong links, but I do not think the commercial world is as good at this as it should be—it should be linking with every school, so that when you become involved in computing in a primary school you are linked with someone who is in the commercial world. I know it would be difficult to do that but we could do much more of it. The commercial sector does not get involved in the primary world, because they go nearer to where the people will be entering the workforce.

**Dr Bill Mitchell:** One of the things we are finding—it is not hard data, it is qualitative data—is that where primary schools are taking an interest in introducing innovative and exciting computing, they have found that a lot of their children are improving their literacy and their numeracy skills. If that message is indeed true—it would be great to have some solid research done on that—and if that message then got to head teachers in primary schools, that would hugely increase their interest in wanting to teach computing.

**Q150 Lord Janvrin:** I will take you back to an area that we have touched on. Mr Taylor, you mentioned the iterative process through a teaching career, and the whole question of continuing professional development and how we deliver that. Is it through these local professional networks? What role does higher education have in that process? In particular, there is this point that we have just touched on: where does industry get involved? How can it get involved in changing the culture of lifelong learning within the teaching profession? There is the wider world, too, but we are focusing on the teaching profession.

**Sir Andrew Carter:** As I have been looking at initial teacher training, one of the things we have been very clear on is that it is initial teacher training and, therefore, we must understand that teachers will need to go on training—we could say for ever, but certainly for up to five years, we would expect there to be a systematic approach to that. The higher education institutions get involved through having a lot of expertise, and they ought to be working in partnerships with schools. The error is that they should not be leading it; the lead should come from the schools. But absolutely, we should use the HEIs and their expertise, because it is schools where the hard action is taking place and where the real issues lie. With industry, it is very difficult. I mentioned earlier that they do not tend to get involved with younger people. There is a lot of evidence to show that the bank your parents bank with is the one you tend to bank with yourself. Let us get a message the other way, so that the commercial world understands that those early links are often the ones that stay with children right through into later life when they might want a job too.

The thing about CPD is that CPD is funded by schools. There is no additional funding for CPD—again, I am not making a plea for money because I understand the world as it is—but if a teacher goes out on a course and it costs £150 for the course, the reality is it costs the school another £200 to pay for a supply teacher, and the supply teacher will not necessarily be as good for that class, because you cannot find teachers. So there has to be a bit of an
incentive package around that. That is where working with alliances and groups of schools together can be enormously cost effective and enormously helpful. Again, Microsoft cannot go everywhere, but there are companies that could support schools enormously and could reach out. There ought even to be somebody from a technological firm on the governing body of every school.

Q151 The Chairman: That is quite optimistic. The Committee has been struggling with how you move from ad hoc good practice. There is certainly lots of ad hoc good practice, including industry links. We have had Microsoft and Google in front of us, as you can imagine, and they are doing some great stuff, but it is pretty localised, I have to say. It is rather the same favoured regions or sub-regions getting all the attention, and any insights you can give us on how it can spread from pockets would be very helpful or any recommendations, because we are not getting good advice on that. Do you want to come back on it?

Lord Janvrin: Who creates these local networks? The local schools?

Sir Andrew Carter: Teaching schools. Teaching schools are the ideal vehicle for that because they are there, they are established and they have taken on that role.

Lord Janvrin: Is it up to them as to whether they are creating this?

Sir Andrew Carter: Let me give you an example. With the rollout of the new national curriculum, teaching schools were asked to bid for £10,000—not for them but for their alliance of schools—and they then produced large parts of the training that went round it. As Charlie said, the old national strategies were fine but it was very difficult to find a national strategy because it tended to be a little bit too prescriptive. Local people could find their local solutions. The other thing is that, even if they find out the solution that everybody else has found, it is much more meaningful because they have worked it out for themselves.

Lord Giddens: I just want to ask briefly about something that also preoccupies me. How far are these technologies going to change the actual nature of teaching itself? Because in many areas they imply a participatory model, not a straightforward didactic model, and we all have experience of learning from our children about using digital technologies. Do you think the structure of teaching is going to become more open and more participatory?

The Chairman: Mr Taylor has a mantra, I think, on this.

Charlie Taylor: It is going to be one of the most fascinating things that will develop in the next few years.

Lord Giddens: It is going to be a true revolution.

Charlie Taylor: I agree. However, the most important thing here is that we continue to look at the evidence for what works. It is important that we do not just plunge in with the latest bright idea until we have looked at—it is a financial commitment—what evidence there is showing that this way of teaching is an effective one? One of the things that has been interesting, again, about the work of teaching schools that have remit for research and also for things like researchED or for the Education Endowment Foundation, and also for universities, is looking at what things really work in terms of ICT. I do not see ICT as the solution to all problems but I do think that improved computing skills, improved ICT, will help us to solve some problems. But we need the research to back that up.
**Sir Andrew Carter:** I think it is going to make a change. We have a problem across recruitment, and I believe what will happen—many schools are already doing this—is larger classes. This is not a way of doing it more cheaply but having one trained teacher with a number of para-professionals—teaching assistants and people with different levels of skills—and technology can be hugely beneficial.

For instance, if you look now no child can ever leave their homework at home any longer because, of course, they go home and there it is sitting on the net waiting, and it can be sent. The way we look at this is changing. The use of whiteboards in classrooms is not a blackboard by another name. There are other things, but it takes time for that to happen, although it is happening quite dramatically. I just come back to Ofsted because Ofsted needs to also reflect that change as well.

**The Chairman:** Can I just ask just one additional question on this? Is the national curriculum being delivered in all schools whether they are academies or not?

**Sir Andrew Carter:** Yes.

**The Chairman:** So they are ignoring the fact they do not have to, they are doing it?

**Sir Andrew Carter:** You do not have to but you are Ofsteded in the same way, so you do have to.

**Q152 Lord Aberdare:** Can I pick up the question of the involvement of industry? From both sides, how can teachers gain more experience of the reality of working life and how can industry be brought on board? I also have one little supplementary. We have heard absolutely nothing good about the current state of careers advice. Is there a role for industry in that? We have heard nothing good but what we have not heard is what solutions are being come up with. I am not sure who I am addressing that to.

**Charlie Taylor:** Shall I take careers advice and you take industry advice? Nicky Morgan, the new Secretary of State, is very keen to look at what we can do in order to improve the quality of careers advice within schools. It is work in progress and something she is very keen to push, so we can expect more in the next few months.

**Professor Simon Peyton Jones:** There are quite a lot of opportunities for people in companies to become involved these days. One of the quite liberating strengths of this new rather bottom-up, decentralised training programme is that it leaves the field open for companies to become involved. CAS certainly has been very active in trying to talk to companies to say, “You should not just stand on the sidelines and say nice things but get involved”. When it comes to “getting involved”, you know of Code Club, for example.

**The Chairman:** We have had them here, yes.

**Professor Simon Peyton Jones:** So there are quite a lot of volunteers from companies who are involved in that.

**The Chairman:** I have to say that is one of the things that has concerned us when they were here. They were brilliant, but they were very small.

**Professor Simon Peyton Jones:** There are perhaps a couple of thousand of them.

**The Chairman:** Yes, only in primaries.

**Professor Simon Peyton Jones:** Yes, Code Club is focused on primary.
The Chairman: But struggling to get industry.

Professor Simon Peyton Jones: Yes—

The Chairman: I suppose that has fed our concern about how we make this happen in a joined-up way, not just in the good areas where they already have contacts. Sorry to have interrupted you.

Professor Simon Peyton Jones: I think it is because it went from zero to 1,500 after-school clubs in about two years, which is quite a remarkable change. Those are actual volunteers. About half of them are run by teachers but half of them are run by volunteers from industry. It is an example of something that did work. Speculatively, I would love to see people from companies partnering a bit more actively with school teachers, if not in the classroom then at least after class; not just running ancillary clubs, but part of the curriculum. But I do not think we have any good models for doing that at the moment. It is not something CAS has done particularly well thus far.

One innovative idea that the DfE ran recently was to offer matched funding for work to support the computing curriculum. They said, “If you put a pound on the table we will match it with a pound”, which unlocked £500,000 of investment from companies, mainly, and other donors to directly support the computer curriculum. I would love to see that repeated because it is not only that it is cost effective—a pound the Government is going to get matched—but because nobody gives you £100,000 without becoming involved in a visceral way. So it is a good model. I would like to see it happen again please.

Q153 Lord Macdonald of Tradeston: You will get 2,000 out of 20,000, perhaps 10%. We were told the target was 50% by 2018, which is much too slow. Should we not be old fashioned and go back to a central command economy that says, “There is going to be money for Code Clubs, and every primary school should have one within the next year or two. You go out and find it in the community, and we will match it”? Should there perhaps not be that top-down, centralised instruction?

Dr Bill Mitchell: With trying to get industry to help with after-school clubs, the bigger question is getting the volunteers rather than the funding, because for the schools the cost is almost zero. The volunteers are very enthusiastic about it if they do it—you want a volunteer who is very enthusiastic—so simply providing money for it certainly would probably help, but it would not necessarily provide the volunteers.

One of the things I wanted to mention a moment ago is there is a scheme called the master teacher training programme, which is funded by the Department for Education. The idea of a master teacher is that a practising teacher who is, according to Ofsted, outstanding is paired with a local university and provides CPD for their local schools. That person, that master teacher, could be an ideal person to help with careers advice, in my opinion. There will be around 400 of them by the end of March next year, more or less, and it is perfectly possible for industry to be able to provide those 400 master teachers with the support so that they can do an effective job of providing careers advice. Whereas what you could not do is expect industry to support the goodness knows how many teachers there are in schools on a one-to-one basis. My own recommendation would be to see if there are ways of using that master teacher network to support careers advice through schools. Last year they helped more than 15,000 teachers so they are quite effective.

The Chairman: Mr Taylor, do you want to come in on Lord Macdonald’s point?
Charlie Taylor: I take your point about the idea of a top-down approach. The risk is around quality. We have to make sure that we have the right people going into schools, and the risk of saying, “Right, here is the money, let us get people in” is that people who come in from industry have to be people who can engage with children, build relationships and do the job. Therefore, building it gradually over time and encouraging more people to become part of what is a burgeoning movement is less risky than simply saying this has to happen. The danger, or potential risk, is that you get people paying lip service and thinking that we have to get someone in, but that it does not matter who it is, in order to tick the box and get the funding. That is the counter-risk against the more top-down way of doing it.

The Chairman: Do you think there is an in-between role, where there is a need for a more strategic overview at least of how things are going and better mapping of how things are going? When Code Club gave evidence and we asked, “How are you going to spread your impact? How are you going to roll out?”, they said, “We do not know”. They were great, and they were enthusiastic, but in all frankness we did not get any view that they were part of a strategy about becoming national.

Professor Simon Peyton Jones: That is the thing about these bottom-up volunteer groups. CAS is mainly a grass-roots volunteer movement and is straining every nerve to do whatever possible to support the new curriculum. It is a bit like walking into a room of starving people with a basket of bread; it is very rapidly used up and it is difficult to make sure it is distributed in a completely fair way. But I do think there is perhaps a role for NCTL and the DfE to stand back a bit and say, “Given all this patchy volunteer provision, where are the gaps?”. I am not sure we have a good story on doing that at the moment.

The Chairman: That is what we are collectively asking.

Professor Simon Peyton Jones: I do not think we have a mechanism for doing that, do we? Perhaps we do.

Charlie Taylor: One thing, for example, is one might look at something like an Ofsted thematic inspection of computing within primary schools. That would be the sort of thing that could happen in a year or two’s time: to say, “Okay, how well do we think this is bedded down?”. Also there is the Ofsted framework as well, in which schools are held to account for the quality of teaching, which is going on in there as well. There is an assurance mechanism there too.

The Chairman: Except they do not look at individual subjects, do they? Let us be honest.

Charlie Taylor: Yes, but they look at the quality of teaching every year.

Lord Kirkwood of Kirkhope: This is very important for us because sitting on this side of the table you will understand that it is much safer for politicians to say, “We will deliver standards, across the country. No one will be left behind”. That is the press release, and the dogs bark and the caravans move on. There must be a middle way somewhere. I would like you to go away and maybe send us a page of A4 about it, because I think the idea of letting a thousand flowers bloom is very attractive, and your argument is nearly persuading me, but as a practising politician it is very hard to say let the best thrive and let the devil take the hindmost. If this Committee is to come up with a recommendation, it would be very brave of us to say, “Just let it all hang out”. Could somebody give us a note about what a middle course, as suggested by the chair, might look like because that is where I would like to come out on this?
The Chairman: Sir Andrew, when is your report?

Sir Andrew Carter: The only place where this all happens is in a school, every day. At the moment, while we are discussing it, teachers are doing it. That is where the action should be. Here is a very practical thing and I am not saying this is any clever way. This time last year we had not decided about free school meals for children under seven. It was decided, and today everybody is eating them. That happened and it was without a lot of fuss, to be absolutely honest. If you go to schools, they will deliver, if it is a requirement. Now, if it is a reasonable requirement, give £100 to every school for a computing curriculum—it could be £200 or £500, but let us be realistic and say £100. That looks to be about £70 million, I think—I do not know. But you give £100 and then put some very strict rules on what has to be delivered at the end of that. It may not be this particular Code Club, because Code Club may not be able to do it, but something like that. If you have very clear parameters and it is in the national curriculum, I am absolutely convinced schools will deliver it.

Charlie Taylor: Just very briefly on that. To some extent we have a middle way, which is around teaching schools. We have 500 at the moment; we are looking to expand to 600. These are funded by central government and have a remit about the things they should do.

Lord Kirkwood of Kirkhope: Across the UK?


The Chairman: I think we need a map of where they are and where they are not, because it does slightly go to our point of patchiness at the moment.

Charlie Taylor: We are up to nearly 500 teaching school alliances. The aim is that by the end of this Parliament there will be up to 600 across the country, and our aim is to focus on those areas that are less well represented. But Ministers are currently considering a bid from BCS about extending the current CPD programmes that are being run by CAS and BCS. It is not the case that we are stepping back. We are still taking an active interest in what is going on in terms of this and other parts of the new national curriculum.

Professor Simon Peyton Jones: With anything of the nature of giving every school £100 per pupil, you should not be too prescriptive; so do not say “Start a programming club”. Just say “This is to support your excellent provision of this”. Every school will be different. I am quite worried about being over-prescriptive about these things. I do think the suggestion of an Ofsted aspect survey would be good. Ofsted’s business—is to improve the quality of teaching. If Ofsted, after a year or so, could go around and say, “Look, we have found excellent examples. We would like to celebrate the excellent ones and showcase them for other people to learn from”, that would be very helpful and might help address the patchiness question as well, because they could say, “Well, this area or perhaps this kind of school—it is not necessarily geographical patchiness—might not be so well served”. Ofsted is the perfect body to do that.

Lord Kirkwood of Kirkhope: I accept that, yes.

Q155 Lord Aberdare: Just two quick things: first, I am not entirely convinced that knowing that the Secretary of State is enthusiastic is the solution to the careers advice problem. Secondly, I think it was Sir Andrew who suggested that every board of governors should have an industry representative. Is there something we could recommend or that the Government could do that might promote that?
Sir Andrew Carter: Promoting it would be the thing. It is very difficult to find governors in schools, and often we are scratching around and finding people who just sit on the board, come to the meeting and read the papers the moment they are there. But what is industry? The commercial world, the people that create the wealth in a direct sense, have to take their responsibilities towards education seriously, and many do. On every governing body now, you have to have a governor responsible for special needs, a governor responsible for the curriculum and a governor responsible for RE. They may not even be technologically based, but why not have a governor who is responsible for technology? Hopefully you can match that to a skill.

Baroness O’Cathain: Generally speaking, the governors know the children who are in the schools; a lot of them are parents. Plus here is a great opportunity to get somebody on board who has real life, hands-on experience of computing in the day job and then give them the power to be responsible for that. Also, if you are going to give them money, you need somebody to account for that money, so that could be part of the responsibility of Mr and Mrs X, who have kids at the school, and where he runs a computing facility.

Sir Andrew Carter: We give schools between £4,000 and £8,000 a year per child anyway, which is accounted in the system.

Baroness O’Cathain: I see.

Sir Andrew Carter: But this £100 is on top of that. You could be absolutely right: that could be one of that governor’s responsibilities, because you have a curriculum that they have to deliver. It would help and absolutely show the Government’s intention that they believe this is important. It is a tangible sign of that.

The Chairman: Lord Giddens. I am conscious we need to get on. Sorry.

Professor Simon Peyton Jones: It is not the Government who are responsible for technology. I am working to avoid getting fixated on technology, per se, unless it is technology to support teaching and learning across the curriculum, that is one slice.

The Chairman: The computer curriculum.

Professor Simon Peyton Jones: But we are focused on subject disciplines. The technology word often sneaks in and then it means one thing in the mouth of the person who speaks it and something else to the person who hears it. So you need to be very nuanced in what you are writing about this.

The Chairman: Yes, we do not want a governor responsible for buying computers, necessarily.

Professor Simon Peyton Jones: Exactly, yes.

Q156 Lord Giddens: We are running out of time, but digital technologies are associated quite strongly with inequalities. What can the schools do to mute those? Maybe you would like to talk about gender inequality particularly, since that has emerged as a big thing.

Professor Simon Peyton Jones: I am rather hopeful—you will have all seen the pictures of the hourglass economy with a hollowed out middle—that this new approach to teaching computing as a subject discipline will help more of our citizens, whether or not they become software developers. I want them all, including the ones who are going to become lawyers and hairdressers, to end up in the upper part of that hourglass. I am hopeful that it may, in
some ways, help more people to end up in the top part. That does not directly reduce inequality but it can provide a route for children. Provided they have access to the basics of the technology, computer science can be quite an exciting way for some children who find other subjects difficult. Suddenly they thrive in it, so perhaps again it is a staircase for some; we have seen examples of that. I am hopeful.

**The Chairman:** Sir Andrew, what is your experience?

**Sir Andrew Carter:** You have to be very careful with inequalities. In my judgment, the greatest inequality in school, particularly in this, is in the financial divide that is in our society. Every school has a responsibility already to make sure that there are no inequalities, and you will have that governor as well. But what we have to watch here—this is where you come back to the technology—is that it is the hardware of this that is important. We can assume that children have these things at home and they do not. So schools should be making them available. We run Saturday clubs now for children so they can come in and use things and make it work in that way.

But we also have the pupil premium. The problem with the pupil premium is that it is being asked to do quite a lot at the moment, and if you put some computing into it as well that would be difficult. But, again, Ofsted is the key to making schools change. If anybody hears me say that, I shall probably get into a lot of trouble, but it is. There were no gates around schools until they introduced safeguarding and suddenly everybody had gates overnight. Ofsted could survey schools to look at that particular thing; not only whether computing is going well but how well we are addressing the inequalities around gender and of course finance.

**The Chairman:** Thank you. Lord Macdonald has the final question.

**Q157 Lord Macdonald of Tradeston:** From each of you, is there perhaps one key suggestion for change in respect of digital skills that we could recommend to the Government that is both viable and affordable?

**Dr Bill Mitchell:** It is extremely important that teachers can get access to some local CPD. We are suggesting to the Department for Education that they should be funding 1,000 master teachers. At the moment they are funding about 400. That is a very doable thing and is not at all expensive compared to the budget for the whole of education. It is a few million, so I would suggest that. The other thing that I would say is extremely important is to do some real research at primary school to see whether the good teaching of computing genuinely does support literacy in maths, because if that is true—and demonstrably so—it will transform what happens in primary schools.

**Professor Simon Peyton Jones:** The one thing that I suggest is just that we follow through on the path to which we have set our feet. That is, we make a big change in this particular area of the national curriculum. My fear is that the political spotlight will move on and it will become business as usual but—to change the metaphor again—the tender plant will wither and die just because it is not given enough water. We need to continue to water. It will be 12 years before my daughter, who has just started reception, does her GCSEs. Only then will the entire span of these two pages [of the new Programme of Study] have been worked out in practice. It is not going to happen overnight. We need to pay sustained attention, which does mean some sustained money, but relatively small kinds of money will do a lot. I think that £5 million or £10 million applied for central things like CAS—but not only CAS—to
support the continued development of the subject and its pedagogy, particularly, which is still developing, would be extremely helpful. If we fail to do that, there may be a shrivelling up. Then that would lead to disappointment and disillusionment and people asking, “Why did we do all this and was it any good?”.

**Charlie Taylor:** I absolutely agree in terms of keeping up the momentum. The quite remarkable that is going on in schools is the level of networks that they are now building. Whatever solutions are proposed by the Committee, we should think in terms of how the networks that already exist can be part of the delivery of this. For example, I visit teaching schools all around the country and I am just astonished by the sorts of things that they are achieving. Do not ignore the networks that are already there, which are already doing some amazing stuff around this. That would be my advice.

**The Chairman:** It would be very useful, collectively, if you could give us a map, both in terms of figures but also the geography of where things are happening. In a sense what we are pushing you on is the scaling up. It is not the change; it is the scaling up of what exists. It is quite hard to pinpoint how many master teachers there are and where are they. What is the overall geographical picture at the moment of how this is being delivered? Sir Andrew.

**Sir Andrew Carter:** I would agree. Focus on teaching schools and focus on the school-led system. I have mentioned the governor in every school. A compulsory lead teacher for computing in every school. Seed funding for pupils and more training at initial teacher training. But that will come out of our report as well.

**The Chairman:** Thank you very much indeed, all of you. That has been helpful, thank you.
At the Committee evidence session on October 21st, the Chair requested data showing the geographic distribution of CAS Master Teachers. DfE are funding the recruitment and training of 400 CAS Master Teachers in England by April 2015. Currently a total of 344 teachers have been recruited onto the training programme. Figure 1 shows their distribution. Figure 2 shows the distribution of the current 15,500 members of CAS across the whole of the UK and Ireland.

BCS and CAS are currently requesting further funding from DfE to expand the CAS Master Teacher programme to provide a total of 1000 Master Teachers by 2021. That would mean one Master Teacher per 20 schools in England. Our model assumes each CAS Master Teacher can provide CPD support to around 60 teachers over a year, which means a network of 1000 CAS Master Teachers could offer support to 3 teachers in each school in England over a twelve month period.

24 October 2014
The Chairman: I think some of you were here and therefore know the areas we are pushing on. Can I just run through a few things that I need to do before we start? You have a list of interests that have been declared by Committee Members in front of you. They were declared orally by Members at the previous sessions in July and they can be found in the transcripts as well. This is a formal evidence-taking session of the Committee and a full shorthand note will be taken to be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you will be able to revise it in terms of any minor errors. The session is on the record. It is being webcast live and will
Miles Berry, George Spencer Academy, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172)

subsequently be accessible via the parliamentary website. You are very welcome to submit supplementary evidence and indeed, as you heard before, we may well ask for some specific stuff where we have questions that we want to delve into rather more. Make sure you speak up clearly. We will also try to do so. The acoustics are not bad but not brilliant. So that is by way of introduction. What would be great is if you introduce yourselves and if you wish to make any opening remarks please do so, otherwise we will go straight into questions. As you heard from the previous session, some of the questions will be applicable to all of you, some not. So we will play it by ear. Thank you very much.

Miles Berry: I am Miles Berry. My job is as Principal Lecturer in Computing Education at the University of Roehampton. I have been there for five and a bit years now. Before that I spent my teaching career pretty much in the primary phase, a lot of the time working around the computing curriculum or ICT curriculum as it then was, as well as looking at how ICT can be best used to support the curriculum across school. I am part of the Computing At Schools Board of Management and a member of Naace’s Board of Management, as well as the UK Forum for Computing Education. I was part of the drafting panel that put together the new computing programmes of study and have been quite heavily involved in the implementation phase of the new curriculum, particularly in regard to primary schools.

The way things are in initial teaching training—at least as far as university-based teaching training is concerned—is a lot more positive than you might have been led to believe in the previous session. Certainly my informal professional network suggests that those who are doing roles like my own are pretty much up to speed with the new curriculum and are doing a lot of very good work in preparing the next generation of teachers to teach this confidently, competently and with a degree of expertise.

In terms of broad principles, it important to bear in mind that breadth and balance is there as a statutory entitlement in terms of curriculum provision as well as computing provision. There is much more to the new curriculum than just coding, despite what the media might have led us to believe, that it is the foundation of the applications and the implications of this as a subject discipline.

The focus has shifted though from one that was about skills in using technology to one that is about establishing children’s, young people’s, understanding and knowledge of the principles that underpin that technology. It is also important to bear in mind that the national curriculum is about entitlement and it is a curriculum for all and we need to do all that we can to make sure that every child has access to a stimulating, enjoyable, academically rigorous computing curriculum.

Much of the detail is left to implementation. As you have seen, it is just three sides of A4. So the important aspects of this—like creativity, like pupil’s autonomy when it comes to using digital technology; like opportunities for collaborative working and opportunities for creative expression—is going to be down to the way this is delivered in school rather than what you see in the document that we produced.

Paul Hynes: I am Paul Hynes. I am Vice Principal at George Spencer Academy, which is a teaching school, which have been mentioned before. I teach computing. I taught it yesterday, I will be teaching it tomorrow and I will be talking about it at a parents evening this evening. I came into the school off the back of nine years doing national advisory work with Specialist Schools and Academies Trust, so going round talking about use of curriculum,
technology, as well as the embryo of what has become a computing curriculum through the maths and computing colleges as was. I am also part of the ICT expert panel.

The two things I want to talk about would be the use of student digital leaders, which I found an absolutely brilliant initiative. So getting the students involved and embracing their energy and enthusiasm and the skills that they have as a way of ironing out this inequality, and also the link to vendor qualifications. So the qualifications that are currently provided by the likes of Microsoft and Adobe and Cisco are very difficult to get into schools because often they are not available to be shown in the school league tables. They do not necessarily attract the funding and yet they are probably the best thing we can do to provide a skillset for a group of students who are going to move on into a career in that area.

The Chairman: That is very interesting; we will come back to that.

Jack Evans: I am Jack Evans. I am a primary school teacher in Hackney, the computing lead. I have been working in the same school for four years. I have been helping my team in our school specific curriculum in terms of computing for this year across the school, which I did with our partner school as well with Louise Kwa at Gayhurst, again in Hackney. I have also been responsible for implementing Code Club in the primary schools, as well as trying to co-ordinate that with our second school as well. Yes, I suppose that will do.

Mark Chambers: Mark Chambers, CEO of Naace. Naace is a membership organisation. It has about 2,500 members. It has been around for 30 years so it sometimes has some millstones around its neck in terms of its reputation for exclusiveness, and what I have been doing in the last 18 months to two years is making sure that it is an inclusive association. We have 51% membership from schools and school teachers now and about 49% of the old LA teams, advisers, independent consultants and the rest. The thing that unites us—because it is quite a diverse and intentionally inclusive community—is that we are passionate about the subject computing. We are equally passionate about technology and its learning, and something I have been calling recently “technology for school improvement” because, if the focus is not on school improvement, we tend not to get through to these guys in schools. That is the most important mantra for them.

We look for and recognise quality provision. As a fellowship, we have created from within the community on a voluntary basis something called “Third Millennium Learning” and the Third Millennium Learning Award, which recognises schools, which take radical approaches to technology and a matching radical approach to pedagogy. We have responsibility for the ICT mark when we created it and gave it to Becta, and Becta returned it to us at the end of their period. There are still 2,500 schools registered to that programme and the other thing we developed, which is tools. So the self-review framework tool that helps them to establish where they are in their use of technology for school improvement.

We also develop other tools, such as a professional development programme. Our most recent initiatives are around a national performance collection and open badges, which recognise pupils’ competence or readiness and preparedness to deliver the computing curriculum. Fundamentally we believe that effective use of technology has the potential to change behaviour, change systems and empower the individual and, as such, all three aspects of the computing curriculum—computer science, ICT, digital skills—must develop as an essential part of the school curriculum, so that our learners who will be leaders understand it and are then able to solve problems, design tools, experience fresh global
Miles Berry, George Spencer Academy, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172)

thinking. The most important thing from our perspective is to apply these things to the real world: authentic learning.

Q159 The Chairman: Thank you very much indeed. Let us kick off with the first question, which is about the new curriculum. To what extent do you think teachers are ready to deliver the new curriculum? Can you give us some insights into how widespread it is at the moment and how can that be done in a more comprehensive way than perhaps it is at the moment? Any concrete suggestions would be very welcome.

Miles Berry: Our key priority has been developing teachers’ subject knowledge in terms of computer science. The part of the new curriculum—

The Chairman: That is specialist teachers, yes?

Miles Berry: No, pretty much every teacher in primary school is teaching their class for computing lessons. There are exceptions.

The Chairman: That is what we were trying to get from the last panel.

Miles Berry: Some schools have gone down alternative provision but my impression is that they are very much the exception rather than the rule. Yes, we are expecting with the new curriculum for teachers to teach something that they themselves have never been taught. This does not mean to say it is beyond them and many teachers have gone out of their way to acquire this subject knowledge, and a lot of the initiatives that have been in place have been about equipping them with that core subject knowledge to teach new subjects. Examples such as the joint CAS/Naace guidance documents, Code Club Pro, the Barefoot scheme from the British Computer Society and joint CAS/Naace conferences for primary teachers, have all gone a long way to helping with that, although we are not there yet and there is plenty more work to be done in that area.

In terms of making it innovative and engaging, certainly as far as the primary phase is concerned, this draws on good old fashioned best practice in primary education. This is about collaborative working, allowing scope for pupils’ own creativity to flourish and allowing scope for independent, autonomous projects—the sort of thing that has been good practice in ICT education for a long time now, which Ofsted remarked on when they last reported on ICT education. That said, it would be interesting to have the aspects survey as to how schools are coping with the demands of the new curriculum. Yes, we do have some feel of what good practice is through the networks, through computing at schools and other places, but having somebody like Ofsted come in and do a proper survey of that and report on that would be tremendously useful.

The technology can help in terms of making computing education both innovative and creative. We see lots of good examples of children getting excited about blogging in primary education, children working collaboratively using online tools, and the role of open or digital badges is a way of accrediting learning within the computing curriculum. All of that is using technology to good effect in teaching a subject, which is in part at least concerned about the use of technology.

Other things that would help: more time. What we have done is have funding from the department to develop resources, to provide courses, to provide content to get teachers up to speed but the best way to learn to code—I know there is more to it than coding—is to spend some time writing some code. Very few primary school teachers have time to engage
Miles Berry, George Spencer Academy, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172)

with the subject content at that level of depth. I am not sure what the solution is to that but it would be nice.

The Chairman: I must stop you there otherwise we will run out of time. Mr Evans, tell us what—because you are primary, are you not?—your background is and how you have come to be doing this. That would be useful. What is your impression of other schools?

Jack Evans: My background is I came from, to be honest, a rather wishy-washy degree called Communication, but it touched on a lot of aspects of digital technology, which helped me in my role going into the primary school. I would say that largely there are a lot of gaps in teachers' knowledge at primary school. We are very lucky. We are a single form entry. I deliver a lot of our training when it comes to being aware of the new technologies and things like this. When you are going in two, three form entries it is a lot more difficult. We were helped greatly by Code Club Pro delivering a pilot exercise where we had a number of CPD sessions in our staff meetings, extended sessions where we were introduced to new aspects of the curriculum. That was immensely helpful for our staff because they found a lot of the new ideas difficult. To be honest, just looking at a very real example, yesterday I was teaching to my year 6s the coding that I did in my second year at university. I feel very comfortable with it. I can run through it pretty quickly and pick it up again, whereas there are a lot of teachers who would find that impossible without having extra CPD. I would say that is important. It is something we want to look at and it needs to be made more aware of and there is definitely a lot out there, particularly in Hackney. I feel that Hackney has done very well at making that available to teachers but probably on a wider scale; it does need to happen on a greater scale.

Q160 The Chairman: On to secondary, where presumably, in a sense, there are more specialist teachers so it is a different picture than primary.

Paul Hynes: Yes, certainly. I look after our teaching school alliance and I would be confident that they are quite good at delivering that. We are blessed at my school. We have three very highly quality specialist computing teachers. That is a rarity. They have been able to deliver quality professional development to those primaries in the alliance, talking about the innovation, talking about teaching computing without having any computers so all the physical things you can do in the playground around some of the theory and the concepts. So I would say they are very confident at that.

We found a slightly bigger challenge helping secondary schools because we have a legacy of staff. For one member of staff from the last year I spoke to, her original training was as a typing teacher. That was her qualification. She has had to re-skill into becoming a business studies teacher. Then she had to become an ICT teacher and at this moment suddenly she has had to become a computer programmer—she thought retirement sounded quite nice at this moment—and her 60 words per minute are now used elsewhere. So that has been a big challenge for those staff that have just happened to have found themselves in a department—

The Chairman: But labelled with something different.

Paul Hynes: Yes, absolutely. I think it is a place that when you go into those departments and you ask around, including myself—my degree is in chemistry—I found my way into that area, as a lot of the staff have. Until the quality candidates start coming through and populating those departments, we have a legacy of staff that we need to take with us on this journey.
The Chairman: That is very interesting, thank you very much.

Q161 Baroness Garden of Frognal: You have already mentioned the fact that ICT needs to be taught as a core subject embedded across the curriculum. What does good practice teaching look like in computing and across other subjects, and how do we address the gaps in teachers' skills, and perhaps you have some thoughts about the key learning technologies for this new development in the curriculum?

Miles Berry: I am by no means convinced that IT should be taught across the curriculum. IT certainly should be used across the curriculum, and partly that is so as to help children, young people, develop and apply their core skills in digital literacy and information technology. But I think there is much gained through teaching computing as a holistic subject where the connections between computer science, information technology and digital literacy are exploited. We can think of examples if you would like of that.

That said, in terms of use of technology across the curriculum, it is about meeting young people where they are and taking them on to some place where they would not have got otherwise. Green and Hannon writing for DEMOS back in 2007 said young people on the whole are pretty good at being everyday communicators, they are good at staying in touch with their friends, they are good at gathering information, but they saw far less evidence of young people as creative producers or digital pioneers. Providing the opportunity within and beyond the computing curriculum to move on to those higher uses of technology, those deeper skills, I think would be something I would very much like to see across the curriculum.

Mark Chambers: Just referring back to the first question, I am slightly less optimistic than Miles in terms of our ability to demonstrate that we are going to make a difference across the whole education system to the computing curriculum. I think there is evidence that in the primary schools—as in the case of Jack here—even in larger schools, teaching has been left to single individuals, who are those that are being exposed to the national training programmes that have been funded in the various methodologies. We are creating a gatekeeper for knowledge in the primary sector in particular, where things are getting trumped up and not reaching out to the individual classroom teachers, which brings me to your question. I am feeling that, because there has been almost an obsession with coding and with computer science, to the exclusion of the rest of the computing curriculum and to the exclusion of the use of technology for school improvement, right now we have a lot of teachers who are not confident about their use and who are questioning the value of things that they have learned have been useful over the last three or four years. I think we are at a moment where one of the powerful things that we could do is remind everybody that the use of technology in the classroom is important because it can impact on outcomes for young people. Most importantly, it is about providing them and sharing with them relevant experiences, which will reflect their experiences of the real world. I think that is key.

We are at a point where if we continue this almost lemming-like obsession with one aspect of the computing curriculum by national funding, by emphasis, formed by publication, we will lose the opportunity to draw forward the multitude of skills that are needed in the digital economy beyond just programming.

Paul Hynes: Two points: on the computing curriculum we have put a heavy emphasis on the digital literacy aspect. We divided our computing curriculum into three equal parts, so we
have the computer science aspect. We introduced one called “creative media” that we did not feel was well represented in the curriculum. Then we also have the digital literacy. When we went out to our employers and said, “What do you want out of this strand?” nobody came back and said, “We want programmers”. Now that might be the west side of Nottingham’s group of employers. It is not a hot bed—it is not the UK Silicon Valley or anything—but what they did say was, “We want them to be good users of the Office applications”. So almost a backward step to what had been almost thrown out, so we have made a move to do the Microsoft Office qualifications with the children, so they leave with a certificate that says they can use Outlook, Tasks, Calendar and Contacts and all of those things—Word and Excel spreadsheet work—and that is of more value than any other course we can offer, when you look at it from the employer’s point of view.

To pick up on the issue of the learning technologies, at secondary we are blessed in that the students bring in, a device that has high-definition video, we connect it to an open wireless network in our schools so we have no technical issues, and we open up the world of knowledge to them. That aids the teachers in terms of offering differentiation and extension. We can link them, through a QR code or similar, to absolutely anything. I think that has been a blessing to us. Jack will probably say it is a little more difficult at primary certainly.

**The Chairman:** What about children who do not have that technology?

**Paul Hynes:** I think that is a bit of a myth. Whenever we do our surveys and talk to the children, if we are talking about a digital device in terms of poorer students, our poorer students have the better technology. It is almost as if our richer parents stay rich by not spending it on the latest device. I would say we have very few but again a school has the power through Pupil Premium. We can easily fund a device for them—sub £200—that will make a difference. We are also in the luxurious position that we can push out our wireless network to the local community and so we can say, “Here is a device that will connect when you are at home” so the fact that you are on a black list with BT so cannot get a landline because of county court judgments and previous history you can have internet in your house and there will be no charge for that.

**The Chairman:** Because from your school your area is very tight?

**Paul Hynes:** So their use comes at a time when we are not using our bandwidth because it is holidays and weekends and evenings, and that is not just us educating the child but offering opportunities and bringing a digital citizenship to the community and that group of parents particularly who would find it difficult to get that connectivity.

**Lord Kirkwood of Kirkhope:** Is that used a lot by other schools? I have not heard that.

**Paul Hynes:** It is quite rare. There are examples of it and the technology is there. You can provide a wireless in pretty much whatever radius you like. It is an extension of what you would get in a normal café or something similar.

**Mark Chambers:** I absolutely endorse what Paul is saying. We see it as members report to us what is happening in schools. We see it in schools that are embracing the technology as a key strategic part of their tools. But it is not common. Again, if the Committee wants to think about things that would make a practical difference, in terms of equality of access, requiring that schools create structures that facilitate young people’s access to learning through their personal devices would be very good.
Miles Berry, George Spencer Academy, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172)

Paul Hynes: As well, the other aspect is, when they connect they connect through our network so they are covered by all our web filtering and all of that protection.

The Chairman: Yes, it is safe.

Paul Hynes: They are immediately immersed in our learning resources that we would provide them.

The Chairman: That would only work where you have a very tight catchment area though, would it not?

Paul Hynes: It can be half a mile radius of the school. It is possible certainly.

Miles Berry: It also provides some interesting creative solution in areas where rural broadband access is very limited; if there is cable to the school but not to the village.

Jack Evans: I would say that perhaps there is a bit more of a divide between our children’s access to technology than what you suggest. Perhaps it is smaller on the whole, perhaps it is a bit of a myth, but definitely, on just my personal understanding, in our school we have a significant number of pupils who do not have access to those technologies. We are lucky we have great community links and they are aware of to be able to use them outside, libraries, through our clubs and things like that, but it is difficult for them to do those extra aspects we would like them to do.

Referring to your question about what is good practice, I would say in primary school particularly my personal opinion is a big deal for a primary school is to make children enjoy learning, so to see them using technology and to enjoy it. It is all well and good saying, “Oh we are going to use the cameras today just because you are doing a cross-curricular lesson” but unless they are enjoying it and using the technology and having fun through that, I do not see a great deal of value. We have to ignite their excitement in what they are doing. Although we are a very creative school, I would also say the idea of them cracking codes, changing their behaviour and rewriting things and then solving the problem is huge for them. When they go back and they say, “Nothing has happened”, they have gone back and rewritten it and then it has fixed it. That is probably the biggest deal, the biggest change that I have seen since we started doing the new curriculum. It is something that goes across wider education about: do not give up on the first problem; you can try something else. I would say that would be important.

Q162 Lord Macdonald of Tradeston: In a Hackney school, Jack, I would anticipate you have quite a few children for whom English is not their first language. Do you find that the access to digital technology helps them with reading and literacy in the way that we heard in the previous session?

Jack Evans: It is very interesting because there is a very distinct divide between what types of languages are spoken at home and how that is dealt with. To give an example, for a lot of our Asian communities it is definitely improving their literacy. They access the kind of programmes that we ask them to. Whereas perhaps a lot of Turkish families they will use those technologies but it will be in Turkish at home, and so they much rather decide to use those rather than some of the programmes that we might suggest. There are still a lot of problems when it comes to the parents of our Turkish families, teaching users, compared to perhaps some other ethnic communities. So I would say it is quite varied. I do not know if that is a particularly clear for you.
Q163  Lord Aberdare: I want to ask how you tackle the issues of making students aware of the security issues, the privacy issues and some of the risks involved in technology? Does the new curriculum cover that in a helpful way and how do you deal with it?

Jack Evans: At the moment it does certainly. There are different points throughout the topic. We break it down into the topics, so throughout a number of the topics there will be a very specific focus on internet safety. When we are doing research for other areas of the curriculum as well, we have this ethos throughout the school and the understanding is anybody can be writing these websites. We know the rigour of research is very important, and that touches on the idea of internet safety. Also Internet Safety Day, every year there is a very huge focus. I know that is not good enough in terms of just one day a year but that is a very big deal and it comes into anti-bullying week as well, which is important with cyber-bullying going on or being aware of it. So there are a few different examples.

The Chairman: Mr Hynes, is that your experience too?

Paul Hynes: Yes. What I would say is our solution and the solution of many schools is to involve student digital leaders. So take a group of students who have this level of skill, use them as the forefront of the assembly where you are talking to the masses about e-safety, what the issues are, because to be honest the students will listen to each other rather than to somebody like me standing at the front telling them to be safe, because they have had that.

If they are doing the assemblies, they are running twilight sessions for parents on how to set up their own blocking and things at home—it does not always make these digital leaders popular with their peers when the parent goes home and blocks their internet and things—but those are exactly the people that should be designing the posters when Facebook change their privacy settings or whatever the latest tool is that replaces Snapchat or whatever the new one is, what your privacy settings should be. In my book, that should be a student deciding that and it should be a student producing the posters, communicating that to the students, whether it is through a school Twitter account or similar. But they are the lead; they keep up to date better than the staff.

The Chairman: I am going to move us on to make sure we get through, because otherwise we are not going to get through the questions.

Miles Berry: Schools have long had a duty to keep children safe. The new curriculum provides them with a responsibility to teach children how to keep themselves safe, and that is a significant difference. Yes, we have from key stage one up that children should be taught to keep their personal information private. In the modern world of the internet, that has wide implications so at key stage four there are new ways to keep your personal information private—there is a bullet point. That can include virtual private networks and onion routing for browsing. At key stage three we have a reference to security, which allows us to bring in issues of cyber security and encryption and password security there as well. Brief enough?

The Chairman: Thank you very much. That is fine, thank you.

Q164  Lord Giddens: If there is a high technological change, talking mainly of secondary schools and colleges, how do we prepare today’s prospective labour force for the jobs of tomorrow since they are likely to be very different from the jobs of today? How do we do
that in terms of preparation? What kind of vocational qualities should be taught and what kind of links with industry should there be?

Paul Hynes: The companies that run the vendor qualifications—such as Microsoft Professional and those sorts of courses—have a vested interest in keeping that up to date. So those courses are out there. The difficulty I see is schools are not picking them up. They do not attract those league table points and they do not attract the funding, and so schools have to do quite a complex mapping process. If I go back 10 years—

The Chairman: Who monitors those courses? They are not covered by Ofqual?

Paul Hynes: No, they just exist. But in terms of a globally recognised accreditation, something where we can push out the best of our candidates from this country and go out and lead the world, in a sense, I do not think there is anything better because they do have that instant validity wherever you go; they have a currency. If I go back 10 years, we used to use the advance GNVQ qualification and mapping those professional qualifications to it. We had to do that because that was the course that was funded. That is the course that would attract some element that would help in the performance tables, and yet we delivered the vendor qualifications through that mechanism. I would like to see more schools doing those sorts of things. That would certainly be one aspect.

Lord Giddens: How do you know the qualifications of today are going to be relevant to what is happening tomorrow, for example, given that someone could have an apprenticeship and then that complete trade is just knocked out? That has happened to compositors in the printing industry, for example.

Paul Hynes: It is generic skills. It is the computational thinking. We have this with our code club—which is not connected to “the” Code Club—where students can come along and programme in whatever language they want. That causes no end of headaches for the volunteer staff leading it. Suddenly they are trying to flick from one mode to another, in a language they are not comfortable with and with a student who has a hare-brained idea of what they want this programme to do. But those transferable skills we are teaching them there should allow them to take up any course. Again when I talk to schools there is such a variety of programming languages being used out there, often led by whatever the member of staff happens to have some knowledge in. So, I would say go for the generic skills.

Lord Giddens: Would you care to specify what those skills are or give the Committee a sense of them?

Paul Hynes: Yes. It is the bug-fixing; it is the process of coming up with a structure, flowcharting, those sorts of things, looking at where a programme has particularly broken down and going back and looking at where the errors would be and feeding back. I think that is a generic skill every person should have to be a citizen, and you can probably apply it to most jobs through their life. That is not necessarily teaching them to programme in Python or a particular language.

Miles Berry: I concur with that. It is the skills of learning to use one particular application or even one particular programming language, which are going to be quite time-limited. Skills and approaches, such as computational thinking, that I would use as an umbrella term for things like logical reasoning and algorithms, decomposition, abstraction and generalisation of patterns. Something that applies to coding programming projects, but also has wide applications across the rest of the computing curriculum and to other fields, like project
management. Many roles are going to draw on that sort of body of understanding or those sorts of concepts.

Alongside the computational thinking, though, I would add things like working creatively across a range of digital media. That will include code but need not be limited to code: being able to put together a four minute video essay—something we ask our trainees to do as part of the course at Roehampton—as well as things like being able to work collaboratively. That is something certainly a lot of the industry reports I read seem to be crying out for from schools, but something most of our exam boards seem to discourage in examinations, as well as the deeper criticality of stepping back and asking the “why” questions and “What is this? What are the assumptions embedded in this software or this digital media?”

The qualifications get you so far but for many of the creative industries it is, “Show us your portfolio. Tell us about the projects you have worked on”. Getting a job in the games industry is not about having an A level in computer science or a degree in games programming. It is about having made a game, and the opportunity for that in school, as I am sure your pupils have, is going to matter.

The Chairman: Just to be clear, when you describe what you are doing with your students at Roehampton, they are primary, are they?

Miles Berry: The people I work with for the most part are training to become primary school teachers as primary generalists.

The Chairman: In a sense, you are teaching this set of skills to primary teachers whose lead subject may be all sorts of different things. Is that right?

Miles Berry: Yes.

Mark Chambers: Just to share with you again some of the issues for people who are on the chalk face, so to speak, in schools there can be an almost—I am sorry, I am using “obsessive” quite a lot today—a strong emphasis on literacy and numeracy, because that is what will make a difference to young people. You can lose sight of the opportunity that technology brings as a multiplier to improve attainment in those subjects. Where we are with vocational skills at the moment is that we need to encourage industry to get involved with schools, at a direct level, to bring real world problems to the attention of teachers and students that they can collaborate together on solving those problems. If we do that in the context of literacy and numeracy, using technology, we will be getting very close to reflecting what they are going to do in the world of work rather than in an isolated sense studying literacy or in an isolated sense developing their IT skills. I think that is a much better reflection.

Lord Giddens: Do such collaborations—

Mark Chambers: I certainly think they do in good practice. The third millennium schools that I have referred to that Naace has been working with. They do in schools that are emphasising entrepreneurship as a key element of the curriculum, either secondary or primary, and those that are emphasising social entrepreneurship where young people are using technology and using their learning to create solutions to local problems that make a difference in people’s lives.

Lord Giddens: It sounds quite important to me. It could be generalised, could it not?
**Mark Chambers**: I think it could with a key message. It does not even take money. It takes messages; it takes important people prioritising this to communities and to the nation.

**The Chairman**: If you can send us anything hard on that it would be helpful. Any examples, and also anything about the impact that the use of technology has in terms of delivery of higher attainment, because people always need the proof before they will move to it.

**Mark Chambers**: One of the things I could recommend, and I know you are all extremely busy, as are MPs, is selecting to visit some of these schools that are demonstrating this practice. We could help and empower you with that, and that gives them an encouragement. Some of these schools here are SD marked schools or third millennium schools. Knowing that and we could empower you by giving you that information and then going to explicitly look at that kind of experience would give a great deal of encouragement at the local level.

**Lord Giddens**: I think the more we can get businesses to understand this the better, because you have to break the old model where schools just prepare people and the state pays and business just takes this for granted. Business has to have a much more proactive role in developing these skills in the future.

**Q165 Lord Janvrin**: I would love to continue that but I want to step back into best practice, sharing best practice among teachers and how in your experience this is most effectively achieved. We have heard a lot about hubs and local networks, and so on, but what I do not understand is who is leading the charge in setting up local networks so that teachers can share best practice and learn from each other. What is your experience about who is enabling that, whether it is CAS or some other organisation that is pushing this? I would be very interested in your own personal experience of this.

**Paul Hynes**: For me there are two major areas. We are a lead school on the CAS centre of excellence and we are very tightly linked to a very good university, Nottingham Trent University that leads our local region. We are very happy with that network. But we have a more local need and that is where our teaching school alliance comes in, a group of schools that share their expertise on all sorts of areas whether it is behaviour management, use of school data, all those sorts of things. Using that network that is already in place and that mechanism of the meetings and the sharing and the keenness of people who are part of that is how we share those messages. We find that a little bit more inclusive in a way. Computing At Schools is a fantastic thing. It is quite a tricky network for the group of people who will most benefit.

**The Chairman**: Explain that a bit.

**Paul Hynes**: The people who are not interested in programming. This is what I found, if you go back 18 months, I will generalise it. A very nervous primary school teacher who has no vocabulary suddenly goes into this environment. Computing At Schools is not new. For the last eight or ten years or whatever it was populated by high ability, geeky programmers. There is a sort of mismatch there and it is those primary, under-confident people that most benefit from that experience but they do find it a threatening environment. I think we have the Computing At School hub that addresses one need and attracts a certain person who is willing to give up 4.00pm to 7.00pm every six weeks or whatever to come to a meeting and share practice. But for the other group that do not fall into that then the teaching school alliance meets most of their needs.
Lord Janvrin: One supplementary if I may; do you get any industry involvement in any of that or is it simply the profession at the various levels?

Paul Hynes: I would say very little in terms of industry involvement. We have done work with the employers, normally through the school governors, as to what their needs would be.

Lord Janvrin: It is more on the governance.

Paul Hynes: Yes. But we are limited again. We would love to send them to some fantastic work experience placements. Previously we have sent students down to London all the way from Nottingham to find a good work experience placement for that because they are not easy to find in our area. We do have companies that do high end virtual reality, but they are so secretive you cannot get a student to wander round there for a week doing some photocopying or experiencing what is going on. That is one particular local issue for us but we would love to give them more opportunities.

Mark Chambers: The Chair came up with a good idea when suggesting we need to map some of this provision. In response to your question, there are a whole range of providers from school to school; providers who are supporting each other with development in the computer curriculum to LA teams, which still exist because schools are valuing their contribution. I am thinking of one local authority where they still employ 10 people, not on any kind of top-slicing but simply because schools are purchasing those services because they value what those people are bringing in terms of an innovative use of technology to the classroom. If Naace can help with that idea I think this is certainly something we would like to do.

Jack Evans: I can echo Mr Chambers’ suggestion about LA authorities helping out. Particularly the Hackney Learning Trust is great at making those ideas available to teaching computing leads, which is obviously very highly dependent on the enthusiasm and commitment of those individuals throughout the school. But it is very easily available and Jeremy Harris, who I am thinking of specifically, makes me aware of a lot of ideas that are happening throughout the borough and then bringing teachers together.

On a much smaller scale with our partnership school we have a lot of collaboration frequently where we share best practice. She has now left but Louise Kwa—who I wrote our particular school’s computing curriculum with—was equally passionate. We managed to combine our skills to write the curriculum for both those schools, but, of course, that is very small scale. It is quite difficult to copy.

The Chairman: In terms of Hackney, you say the Hackney Learning Trust provides some level of coordination, is that right?

Jack Evans: Yes.

The Chairman: When you write your curriculum with one other primary school in Hackney what happens to that? Beyond your schools does anything happen to that?

Jack Evans: With ours at the moment, no, but we do have ideas in place that perhaps if it is particularly successful we can roll it out to others. We have also used in the past a Hertfordshire school curriculum that is again sharing knowledge, which we found incredibly helpful. It was based on the previous curriculum but did have an open mind to the new
Miles Berry, George Spencer Academy, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172)

aspects so it was helpful but obviously now has to be changed quite a bit. Yes, there are possibilities, definitely.

Q166  Lord Holmes of Richmond: I want to turn to extra-curricular programmes. What role do you think extra-curricular programmes such as Code Club have and what impact do such programmes have on the students’ learning?

Mark Chambers: Just to start off, we might introduce another name: CoderDoJo is another alternative to Code Club. Naace and CoderDoJo are currently talking to a major bank about getting involved with us directly, in terms of an initiative in the North West providing out of school learning opportunities for those who are interested in coding specifically. I am giving you a little illustration there of an alternative to Code Club. We feel this is important because it gives those who want to specialise the opportunity to deepen their learning. The fact that it happens outside the school day recognises there is a broad range of other things that others will be interested in and I think we would advocate some balance in terms of that provision.

Miles Berry: I want to return very briefly to a couple of things in relation to the previous question about ways practice is shared. There is more to CAS than the CAS hubs. The online community is a particularly vibrant place, where people are posting you questions and getting responses and there is a lot of industry representation there. You would have some very senior people working for Google and Microsoft responding very quickly to teachers’ questions and that is fabulous, it really is. We are seeing a sharing of practice. I think at some point we are going to need to step back and question what best practice is in here. There are 1,000 flowers blooming at the moment.

The community is becoming more skilful in evaluating what makes for good practice here but I think at some point there will be a stepping back and saying. “Yes, that does work”. This comes back to the question of measuring impact of initiatives such as Code Club. Nobody gets to Carnegie Hall through just going to class recorder lessons. The entitlement for everybody of course matters, but those who are destined for careers in the industry or as academic computer scientists will have to put in the 10,000 hours. Peter Northing talks about taking 10 years to learn to code and it is going to be an experience like that.

Code Club will pivot from an extra-curricular club for those who are interested in learning coding because it is not happening on the curriculum to the extension and the enrichment activities for those who do want to take it further, just as you have a school orchestra or a school choir for those who are particularly interested or gifted in those dimensions. But that alone will not be enough either because you need to put in the hours of practice and start writing some code essentially.

Q167  The Chairman: How does that happen because they do not even operate in secondary schools?

Miles Berry: No, but last week I think Claire Sutcliffe hinted this was something on their agenda and many secondary schools like Mr Hynes’ are offering extra-curricular provision for those who are enthusiastic and have done so for a while now.

In terms of evaluating the impact, we announced yesterday that I and a couple of colleagues at Roehampton are going to be evaluating the impact of Code Club’s work and our model should be robust enough to look at other initiatives as well. We are interested in does this
promote this sense of wanting to be a digital maker, wanting to work creatively in the digital domain among those children who do turn up to Code Club and take part in that? Does it help develop children’s computational thinking, the cluster we were talking about earlier? Does it help them with those softer skills, the creativity, and the collaboration? I hope so, and ultimately does it make a difference to their maths science? It would be nice if we found evidence that it did.

**The Chairman**: People would buy into it quicker, that is for sure.

**Miles Berry**: Yes. This is an open question and I do not want anybody thinking there is a foregone conclusion there.

**Paul Hynes**: Certainly I think we get a different clientele to each one of our extra-curricular activities. Code Club is one group of particularly focused programmers. ICT Club has a different clientele and our Robotics Club is a very different group altogether. Often the younger students who just want that little in to the real world of programming, through using the Lego apparatus and things like that they can do that. We have noticed the progression of those students that attend the Code Club is off the scale. It goes so much quicker, and part of that is them explaining to other students or jointly problem solving an issue with one of their pieces of code. It reinforces their own knowledge but at the same time gives them a level of challenge.

If I am being polite, some of those students are not necessarily the best communicators as well, as a lot of programmers you meet aren’t, so that opportunity for them to be into a vibrant community environment where they are sharing code and talking about each other’s code helps them in a softer social skill as well as their programming aspect.

**The Chairman**: This is slightly darting to another question, but what is your proportion of girls and boys in your upper school set?

**Paul Hynes**: Again in those sorts of things the gender split is across the different groups. We are quite lucky in that we are starting to put female role models in there through the teaching staff, and I think is a massive step forward for us. We are dying to have our first female computer scientist that can go all the way through to A level but we are lucky in that we get these in at Year 7 and 8 when the girls can see; hold on, here is a female role model here who knows their programming and they can follow that through. As long as we do not alienate them in any way through those extra-curricular and they are adopted into there I cannot see any issues.

**The Chairman**: We will move on or otherwise we will not get through our questions. Lord Aberdare.

**Q168 Lord Aberdare**: I wondered how you see the role of online learning and whether that is going to in any way change the role of the teacher, whether you are already using any of these famous MOOCs that we hear about but what your perception is of the potential of online learning, particularly from the two who have experience.

**Jack Evans**: I can start just by introducing some of the things we do in terms of online learning. Mathletics is a large part of what we include, so it is an online experience where children log in and they can be set certain tasks by the teachers and they can also challenge other children around the world. They can have their particular maths challenges and you can work out which sum is the fastest. From my personal point of view I would say it is more
individualised aspects like that. Perhaps you could broaden that to other subjects, of course, but just from our school’s point of view at a primary level I would say it would be more individual aspects of learning rather than a broader understanding of it.

**Paul Hynes:** I think for us the focus has been on the blend. We are not ready to get rid of teachers just yet but we cannot obviously ignore the power of the online learning, its 24/7 availability and the diverse nature in terms of differentiation. You can find all sorts of videos on YouTube and Khan Academy and things that will help students. From our staff is introducing concepts like flipped learning that takes that model of what used to be the homework becomes the classroom experience and what used to be the classroom experience becomes the homework status. The students do their learning outside the school through a flipped model and then they come in ready to maybe do the exam technique aspects around that as well.

Again, I think the computer staff are leaders in this. They have to become facilitators. That is what they are really. We still use the phrase “teachers” for them but they are facilitators because they cannot be experts in all those programming languages and solve all people’s problems. But they facilitate the support and the challenge and the extension of the students and post them in the directions of where they will their next piece of work or where they will find support if they are struggling. Computing is probably our lead area in the school for that transition over to a facilitation role as opposed to a genuine stand at the front, on the stage sort of role.

**The Chairman:** Mr Berry, is this something you train your new teachers in?

**Miles Berry:** We spend some time asking them to evaluate online resources, particularly focused on systematic synthetic phonics and we get some very interesting results. One of the interesting observations from trainees has been how different some of these resources would be if the software developers had teachers or educationalists involved in their development. Often what is labelled a phonics resource seems to be a reading resource and is not developing that graph in phonics correspondence.

The online resources we see particularly targeted at primary school are very good at drill and practice for reinforcing factual knowledge, and it is of course part of learning and rightly so. But they seem less effective at a more social model of learning. They seem less good at developing a deeper understanding of things or at exploring the creative application of knowledge. It is very easy to get a computer to mark a page of maths questions. It is much harder for a computer to give meaningful feedback on a piece of poetry or a piece of art, and you see this with things that are focused on the computing curriculum too.

But the flip learning point is a well-made one. Of particular interest is the key stage 4 computer science curriculum. It says on the National Curriculum all pupils should have the opportunity to study computer science or information technology at a higher level and in a school where there is not an expert teacher who can teach to GCSE computer science, MOOC may well have a place there. Something like EdX’s CS50, what a brilliant opportunity to study that for a child who is sufficiently motivated and connected to be able to pursue a qualification on a course like that.

**The Chairman:** Lord Lucas, you wanted to come in.

**Lord Lucas:** It is on a different subject if someone wants to continue this.

**The Chairman:** We are tight so you can come in.
Q169 **Lord Lucas:** To come back to what you said about industry qualifications, it has always seemed extraordinary to me that universities that can evaluate qualifications from 190 countries round the world are so restrictive on the UCAS form. Would it make a difference if you were allowed to list things like these qualifications on the UCAS form or would they have to assign points to them for you to be motivated to do them?

**Paul Hynes:** It would be idyllic if there were points attached. Some of them overlap so much that they are not welcomed by universities. We had a student with a Cisco Networking qualification who applied to university. They accepted them and said, “Basically you do not need to turn up for year 1 so come and see us in a year’s time because you have covered everything. Go away and do something exciting for a year and then come and join us in year 2 because your Cisco Networking qualification covers our year 1 curriculum”. It is not quite engaged, because it is not a recognised route that they are used to, they are used to the traditional A level route, they have to be treated as special cases.

**Miles Berry:** I do not take responsibility for Roehampton’s admissions policy.

**The Chairman:** You are part of the national, are you not? You cannot separate.

**Miles Berry:** But the potential trainee for our undergraduate course who says, “I have completed EdX CS50” or another high value online open course as part of their personal statement is somebody I would very much like to talk to at interview about that experience. That evidence of independent study and self-motivation counts for a lot in terms of a recommendation for a course, possibly more than quite a few UCAS points, to be fair.

**Mark Chambers:** We are wrestling with the area that you are talking about as a community at the moment, particularly at aged 16 where we have a computing science GCSE that is part of EBacc and we do not have any point at the moment, formal stage of recognising another qualification that might involve the rest of the computing curriculum, so there is no computing GCSE for 2017 onwards. There is a lot of debate internally in our community at the moment as to the appropriateness of that qualification, of the overlap between the two. In terms of the vocational qualifications that might be of equal value with the GCSEs, again there is a lot of debate at the moment because between the practical elements of computer science and the practical elements of a computing vocational qualification is incredible overlap because you cannot produce course work of comparable quality unless you have the theoretical underpinnings that would help you to support the delivery of that course work.

But that is overlap, so you might be disqualified from a points’ equivalent system that we have operating in England at the moment.

**The Chairman:** It needs some joining up.

**Mark Chambers:** It is more telling you about the complexity of the issue at the minute than suggesting we have solutions as a community, I am afraid.

**The Chairman:** Thank you. We need to move on very quickly. Lord Haskel.

Q170 **Lord Haskel:** This is a question about inclusion. We have been told that a lack of awareness of the benefits of digital and how to use new technologies will contribute towards a rise in inequality. How can we make sure that all students and all pupils are inspired and equipped to work in and maintain their future in a digital-based environment and what are the skills they will need to do this, to avoid this inequality?
Miles Berry, George Spencer Academy, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172)

The Chairman: We have covered some of this earlier so it is anything in addition you want to bring to the table on this.

Mark Chambers: If I could just emphasise that one of the biggest barriers to equality is not necessarily personal ownership but the effectiveness of the infrastructure when they attend school or in their local community. I think this Committee might well have some strong opinions on how to support primary schools particularly with effective infrastructure. I could go on on that, so that is fine.

The Chairman: No, we have had that before and that makes sense.

Miles Berry: I would add to that the importance of home access and I am not alone in regretting the demise of Vector’s home access scheme of providing children who were coming from particularly challenging backgrounds a computer and access to the internet. The access to the web is such a transformative thing in terms of so much of what we have been talking about here and I would love to see some evidence of schools spending Pupil Premium money on providing those children who do not have that access, by no means every child on free school meals, of course, with a laptop of their own, with a connection to the internet.

Q171 The Chairman: This has been raised with us before and we have asked various other people to send us a very short note on what is the cheapest basic package that somebody needs to be in a sense connected at home. If you could do that, whether it is a tablet or a laptop, what the basic cost of joining it all would be because we want to get that from arrange of people. It would be helpful.

Miles Berry: I will do that for you. The other thing worth saying is firstly on the gender issue, I think putting computer science onto the curriculum from primary school will help with that. Emma Mulqueeny speaks about Year 8 being too late and I think she is absolutely right. If they are interested in computer science and programming from primary school there is more chance of coping with possibly adverse per pressure when it comes into secondary school. That said, 14 to 18 becomes an issue. I worry, and it is hard to track down the evidence on this. Maybe your Lordships can help with this. The proportion of schools that are offering computer science as a qualification at GCSE and at A level, my suspicion is that they may be skewed towards more affluent areas an there is not a fair entitlement there. Having there as an entitlement, yes, you should, whichever school you happen to be at, whatever home background you come from, be able to study GCSE computer science and A level computer science as well as qualifications in IT, of course.

Paul Hynes: What I would say, Lord Haskel, if I put four students round a table and gave them a task the immediate response would be to all get their devices out and make a decision. They do not do it in the way that you or I or the parents are worried that somebody will say, “Your phone is rubbish. It is really old”. They do not do any of that. They look at what is available on the table for their team and what the task is and they choose the most appropriate tool for the job. One child’s device might take HD quality so we will use that for producing the resource. Somebody else’s might have a bigger screen. That would be easier for browsing the internet to do our research. Sometimes it is just sitting there and seeing whose screen is not broken or cracked or whatever. That is how the students would approach that. In our heads and often in the parents’ heads they think there will be some
sort of bullying because of not having the latest device but I never see it in practice. That is how they would sit down and they would work on it as a group in that way.

**Jack Evans:** I think quite a big aspect of addressing this inequality is maybe going into the idea of our extra-curricular club. For example, I choose, because our club is oversubscribed, a selection of children, not only the ones who I think are going to do well, which is obviously incredibly important, but also to the ones who I know do not have access to those types of things. To make the availability and the idea that they could pursue this if they wanted, whatever they have at home, regardless of that, so they know they can be part of this world very easily is I think incredibly important.

**Lord Haskel:** You think social skills are as important as the technical skills.

**Jack Evans:** I think the mentality behind it very much so is as much important as technical logical skills, yes.

**Q172 The Chairman:** A final question, and we are asking this of everybody who comes in front of us. Can you give us one key suggestion that you think we should recommend to the Government to move this whole area on? It is always hard to focus on one but if you can try and focus on one thing that you think is worth us recommending.

**Miles Berry:** I would come back to the point I just made, ensuring that all secondary schools offer GCSEs in computer science and IT for any student who wants to study these along with developing a similar robust academic, rigorous qualification in creativity in digital media. I am not sure how we label that but a qualification like that would be really nice to see.

**The Chairman:** Thank you very much. Mr Hynes?

**Paul Hynes:** I would like to see some qualification that recognised the work of student digital leaders reflected in performance tables that takes it on a step. Things like the nice idea of open badges takes it to one step but I would love to see a more robust certification that would be recognised by employers for that, reflected in league tables as well.

**The Chairman:** Thank you very much. Mr Evans?

**Jack Evans:** I would suggest highlighting the idea of training primary school teachers, looking at just for my background, in computing skills. I did not qualify too long ago, five years ago, and the computing that we did we had to pass a test for it but that was so tiny. You might be able to help me out slightly, Mr Berry, about what you do now but I would say focusing on the fact that it is a huge part of what we teach in primary schools now and making that training very rigorous.

**The Chairman:** Thank you. Mr Chambers?

**Mark Chambers:** Computing science specifically, since the redevelopment and re-launch of the computing curriculum has received significant national investment. If there were to be a similar or even a 50% or any other number you care to choose, prioritisation of the rest of the computing curriculum I believe that not only would we see a return on investment in terms of performance in computing, we would see a return on investment in terms of computing across the rest of the curriculum, sorry, competences across the rest of the curriculum where computing has such a multiplying effect.

If I can add one little bit, you as individuals could take an interest in those schools in your communities that have achieved a quality mark of some kind. We write to you, we write to
Miles Berry, George Spencer Academy, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172)

MPs and if you could respond to those and encourage those schools that would be extremely practically useful.

The Chairman: I am not sure you do write to Members of the House of Lords, do you?

Mark Chambers: We definitely do to MPs. I need to go back to the office to ask about the Lords.

The Chairman: I think you need to go back and make sure that you write to Members of the House of Lords as well, and that is a very fair recommendation. That is our recommendation to you then. Thank you very much indeed. It has been very interesting. Clearly the computing community is not quite as cohesive as we had been led to believe so that has been very interesting. Thank you very much.
MONDAY 1 SEPTEMBER 2014

Members present
Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Baroness Garden of Frognal
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Lucas
Lord Macdonald of Tradeston
Baroness O’Cathain

Examination of Witnesses

Sean Williams, Group Director Strategy, Policy and Portfolio, BT, Dominic Field, Partner & Managing Director, Boston Consulting Group, and Daniel Butler, Head of Public Affairs, Virgin Media

The Chairman: Good afternoon. Thank you very much for joining us and helping us in our deliberations. I will just outline a few points to start with. You have a list of interests that have been declared by the Committee. These were declared orally at previous sessions in July. They are in the transcripts. This is a formal evidence-taking session of the Committee. A full note will be taken. It will be on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you can revise any minor errors. The session is on the record. It is webcast live and will subsequently be accessible through the parliamentary website. You are really very welcome to give a bit more information on any issues—in fact, we would encourage that. We are very pleased to receive supplementary evidence after the session if you wish to submit some. Make sure
that you speak up reasonably clearly. It is not bad in here for acoustics, but it is not great. If you can speak up, that will be helpful. I will start by asking you to introduce yourselves. If you want to make any opening remarks do so, but you do not have to. As we go through the questions it may be that all of you want to answer on each question or not. We will see how it goes. Let us start with Mr Williams.

Sean Williams: Thank you very much. I am very delighted to help you with your inquiry. I am Sean Williams from BT Group.

Dominic Field: Hello everybody. I am Dominic Field from the Boston Consulting Group. I am very happy to be here and helping you with the inquiry.

Daniel Butler: Good afternoon. My name is Daniel Butler. I am head of public affairs at Virgin Media. I just want to start by saying that it is really welcome that this Committee has been formed with this particular focus. We have seen a strong focus on supply-side interventions in digital policy, which is shaping this particular phase in digital policy. What has received less attention to date has been a focus on how to stimulate and sustain demand to secure long-term investment in infrastructure. We see that as the central challenge for government policy in future. There have been some notable, successful attempts to look at ways of stimulating demand. They will provide a good evidence base in future, but we would like to see a more coherent approach to demand-stimulation policy as the next phase of digital policy takes shape.

Q76 The Chairman: Thank you very much. I will kick off with quite a general question to all of you. Can you just outline for us what you see as the main technological advancements that most affect the UK’s infrastructure? How do you see that change coming forward? What are the challenges and opportunities for the country?

Sean Williams: The central thing that is happening is a proliferation of connected computing devices, whether they are smartphones, tablets, PCs or even televisions these days. They are all essentially connected computing devices. They are all driving an enormous amount of data traffic on two networks. In the past eight years we have seen a thirteenfold increase in peak data usage on our network. That enormous growth in demand, which is driven by incredibly capable devices, is changing the way people work and live, and is driving demand for the investment in networks as well. As a consequence of that, all networks are essentially investing to increase speed and capacity to respond to that level of demand. For BT in particular, this is driving our broadband and fibre broadband agenda. We are responding with capital expenditure investment in our fibre broadband network of about £3 billion over a number of years. We already have the UK at about 78% coverage of fibre-optic or superfast broadband, which is ahead of the major countries in Europe. We have a goal to get well beyond that—to get over 90%—and support the Government in doing that. It is driving a lot of investment in demand. We see those as the central changes currently going on.

Dominic Field: To add to what Sean was saying, in addition to the step change in consumer demand for data services, we would also highlight a couple of things we came across in dealing with our corporate clients. Those would be, number one, a proliferation in business activity online and by mobile. Although the internet is over 20 years old, we have seen waves of digitisation through different industries: first the music industry, then retail. We are increasingly seeing other industries finding that the infrastructure and the demand is now at a point where it makes sense for them to shift their modes of operation, interaction with
consumers and interaction with other businesses online. That is a continuing wave of advancement that is affecting the UK’s infrastructure.

As a second-order consequence of those shifts, we see significant growth in the amount of data that are generated by consumers and businesses, which in turn allows the development of extra intelligence and further opportunities for growth and new business. The UK, as some of our reports have shown, is a leader in what we would define as eGDP—an attempt, which has been verified by the OECD, to quantify the impact of the internet on the economy. The UK leads, with roughly 9% of its GDP generated as eGDP on an equivalent basis. That is a disproportionate outcome relative to other countries around the world. We see a significant opportunity for the UK to continue with that position.

**Daniel Butler:** I would just add that clearly, at consumer level, there is exploding demand and traffic consumption, driven primarily by HD video consumption. In the business market, we see increasing demand for dedicated broadband services—often point-to-point services, often fibre-rich services.

I would just step back from the question for a second and make a slightly optimistic point. UK networks’ strength is in responding very well to the explosion in the demand that we are seeing. Some interesting analysis was done by the Broadband Stakeholder Group and the Communications Chambers earlier this year, which painted a more dispassionate view of how infrastructure is keeping up with increasing demand on those networks. The UK is actually in quite a strong position. We have two competing fibre-rich networks, which are demonstrating that they are able to reach not just existing capacity but conceivable increases in the level of demand that are placed on those networks. From Virgin Media’s standpoint, we currently provide 152 megabits as our top-line speed to residential consumers. To business consumers we can offer a range of connectivity solutions, all the way up to 100 gigabits. Our most popular broadband service is 1 gigabit—what we call a Big Red service. There is a multitude of offers in the market that are pitched at levels of existing demand. What was interesting about that Broadband Stakeholder Group work was that the impact of current levels of traffic on network capacity is extremely low. The existing use of network capacity quantifies about 0.8% of the total capacity of UK networks, so clearly we have a long way to go before we exhaust existing capacity.

**Q77 Lord Kirkwood of Kirkhope:** This might seem like a blindingly obvious and naive question, but what does infrastructure consist of? I am not a specialist. I understand infrastructure in terms of railways and roads. Can someone send us a piece of paper—I guess I am looking at BT for that—that fleshes out what we are talking about when we refer to infrastructure? We are now talking about soft infrastructure and data networks. I am certain that the Committee will want to do a serious piece of work in terms of recommendations in this area. I would like to make sure that I was confident that I knew I was covering all the sections of the infrastructure. Does such a piece of paper exist?

**Sean Williams:** I am not sure that there is one readily available, but it is a very important question. To answer the full question you need to think about infrastructure quite broadly. I would articulate five different levels to this.

**The Chairman:** It is never easy, is it?

**Sean Williams:** No, that is maybe too many levels.

**Lord Kirkwood of Kirkhope:** I can only do three at a time.
**Sean Williams:** I know; the rule of three should apply. One level is simply about the cables in the ground, whether they are copper, fibre or coaxial cables. There is one level on top of that that I think is important, which is innovation. We should not forget that it is not just a static technology; it is about driving innovation in this environment. The UK has a strong track record in innovation in this space. We hold the world record for broadband speeds at 2.2 terabits per second, for example.

There is a third level, which is essentially people skills. For us, as a major participant in this space, it is about recruitment and training of capabilities in ICT services. That human capital element is also very important, but I think it goes beyond that. One has to think about the capabilities of the customer base as well. On the one hand, our engagement with our customers ranges from the largest corporations in the world and trying to devise technology solutions for their business problems. It goes all the way through the SME base, where they may, for example, be moving their technology infrastructure from something that happens in their premises into The Cloud. It may be that it is just the mass market of residential consumers who are learning how to use the internet, how to communicate and connect, and are often very reliant on support in that from their service providers. The fifth level is, in a sense, the public policy establishment around this. Think of it in terms of the curriculum in schools, the developments in science, technology, engineering and management, the real soft elements of this. You have to think at all five levels to take this whole agenda forward.

**Lord Kirkwood of Kirkhope:** That is very useful answer. Thank you very much.

**The Chairman:** That pretty well summarises the judgment of the Committee, actually. That is very helpful.

**Dominic Field:** Could I offer a double-click on the hard infrastructure piece?

**The Chairman:** We do want to get into the nitty-gritty.

**Dominic Field:** Absolutely. On the hard infrastructure piece, we asked ourselves the same question: what is it and where do we stand relative to other economies around the world? We published a report in January 2014, which I am happy to send to the Committee, in which we quantified the relative position of 65 global economies on the infrastructure metric. The criteria that we used for that were: access—how widely available it is, and there is a set of sub-dimensions there; speed—if I am fixed or mobile, how quickly can I interact?; the price, which is important in terms of availability and affordability; a traffic dimension—how much is flowing across the infrastructure; and finally, the architecture, which may sound slightly IT-oriented, but the underlying structure of the internet and how it is organised can also speed up or slow down our ability to access it, and it varies on a global basis. So we quantified those five dimensions for the hard piece. I would add soft elements such as skills, tech talent and so on.

**Daniel Butler:** I would just add that there can be a tendency in public policy debates about network architecture to reach immediately for technological solutions based on a series of assumptions. Often when we talk about the broadband infrastructure, the immediate leap is to fibre-to-the-premise connectivity and an assumption that a certain network composition is required to meet the trajectory of demand that we are seeing. Actually, there are a variety of technological solutions that can meet a particular level of demand. As I said in my previous answer, current network composition is doing that very effectively even where that does not constitute fibre-to-the-premise. It is a fibre-rich network, fibre-to-the-cabinet, with
varying degrees of different materials running from the cabinet to the home. It can lead to very expensive and actually perverse impacts on the private investor to leap straight to a particular network composition as being the solution. Actually, the long-term policy challenge is how you stimulate investment in different technologies in order to create the right conditions to keep up with demand wherever it may go and with the ability of networks to get better at managing that demand, which is an important element. If you look at where traffic is going, one might assume that speed has to increase at the same rate as traffic. Actually, there is some really useful analysis that shows how networks are getting better and smarter, through things such as video compression, at managing that traffic and its impact on consumers more successfully. They are not necessarily as closely correlated as you might think.

Q78 Lord Aberdare: My question, which you have already addressed to some extent, was: does the UK have a competitive infrastructure to support a knowledge-based economy, and how does the UK compare to other countries? You answered that in a fairly positive and encouraging way. I now have two questions. First, who is responsible for making sure that that is the case? Is there a role for the Government or somebody? BT, Virgin and others are doing their thing. Who is going to make sure that we have, in the round, everything we need? Secondly, how confident can we be? I am very conscious that when we first started downloading videos and everything, the speeds that we thought were going to be tremendous suddenly became nowhere near good enough. Is there any danger of being complacent about where we are at the moment?

The Chairman: Lady O’Cathain has a supplementary to that and then you can answer all of it.

Baroness O’Cathain: Yes. We have been hearing this marvellous expression of how it is great science and terrific and everything in the garden is lovely, but I am sure that every single person around this Committee table, unless they are a major scientist, has experienced utter frustration about the reliability factor. Even this morning I had problems with my electricity company. They said, “We won’t be able to do your direct debit for another 24 hours because our system is down”. Then you go to the airport, as I did on Saturday, coming from a country that shall remain nameless. I waited in a queue for two hours because they could not get the aircraft off the ground because the computer system was down. How many times do you ask for theatre tickets but are told, “Sorry, we’ve had a glitch in the computer.”? If you looked at my annotated bill from BT, you would see that the main people I speak to are our own computer assistants here at weekends because the system has gone down or something has gone wrong with it. Reliability has not improved at all and the customer is so frustrated.

Lord Aberdare: I will not even mention the saga I have been having for the past couple of weeks trying to move my phone number from BT to Virgin.

The Chairman: We will pause at this point because otherwise we will be here for another two hours. Who would like to start covering both those questions?

Sean Williams: I am happy to. I think it is a shared responsibility between the Government, the regulator, the industry and our customers. I think it is quite well recognised in the UK that there is a commercial case to take investment to about two-thirds of the country, and beyond that the commercial case for investing in new networks is uneconomic. We have had support from the Government under the BBUK scheme. As a result, we will get superfast broadband networks into more than 90% of the country. With the extension programme, we
will get it considerably beyond that as well, in partnership. The regulator has responsibility as well to ensure that it is possible to make reasonable returns on investments, not just over a three-year market review cycle but to commit to a policy and a strategy towards investment that promotes investment over the long term. Clearly, that involves the Government, the regulator and commercial organisations. At the same time it is ultimately driven by our customers and whether they have a demand for these things. That is where the complacency comes in.

We should not be at all complacent. The world is moving on very rapidly. We watch very carefully and consider all the time when the next level and phase of investment is coming in. In my view, we will be investing in new technologies every year for the next five to 10 years as we develop new ways of answering as yet undetermined and unidentified customer issues. We take some comfort from the Broadband Stakeholder Group report that was published earlier in the year, done by Communications Chambers, which says that the kinds of technologies in the market today—the cable network and the BT network—are likely to be sufficient for 90% of users for the next 10 or so years. Again, that depends on the kinds of compression that Daniel has spoken about, and the emergence of 4K or 8K television and how popular that becomes. There are lots of indeterminate drivers. We just have to be very watchful.

I completely agree with Baroness O’Cathain that it is not about just speed and coverage; reliability and consistency—resilience, as we would call it—are also very important. We look at this all the time in our strategic reviews of our fibre deployment—how can we ensure that this network is designed to be as resilient as possible? As more and more people and businesses rely on connectivity to connect their systems and their devices, it becomes more and more critical that they are always available. That is not being glossed over in our work at all. I assure the Committee that it has very high prominence among the three most important things that our network will have to deliver over the five to 10 years to come.

Daniel Butler: In terms of the regulatory architecture that governs competition in the UK broadband market, we benefit from having quite a robust set of regulatory powers. Ofcom has not been afraid to act to address competition issues where they have been posed by the exercise, or rather the existence, of significant market power in both the residential and business markets. We have a robust regulatory framework to ensure good competition. What you have seen in the UK market as a result is infrastructure-based competition. It is critical to draw a distinction between infrastructure-based and service-level competition, where you are talking about infrastructures keeping pace with technological innovations and investments being made in the quality of the network. It is vital that there is that infrastructure-based competition so that where Virgin Media is investing in fibre-rich networks, that then puts pressure on the incumbent to do something similar. If you look globally at the impact of infrastructure-based competition, particularly on penetration, it is very high. Where there are two competing infrastructures, you typically see 20% higher penetration. You also see more revenues being reinvested in the quality of networks by the incumbent—around an 8% increase in the amount of revenue that is invested. So there are definite benefits to having competition at the infrastructure level. If you will allow me a second of corporate lobbying, we at Virgin Media are keen to extend that infrastructure-based competition as far into the market as is financially viable. We are currently present in fewer than 50% of homes, and there are some regulatory barriers that prevent us from being able to build an economic case to go further. This is some material planning regulation
and red tape that constitutes about 85% of our build-out costs—restrictions on how we dig up the roads, the permissions that we need to do so and the behaviour of local authorities in assessing the quality of the reinstatement of those roads. That takes significant money off our balance sheet that we cannot then invest in generating more competition at infrastructure level, and we think there are really actionable things that the Government could do today to reduce the burden on infrastructure investors to generate further competition.

Q79 Earl of Courtown: Mr Williams, I think you mentioned that one-third of the country would be difficult to upgrade broadband in. Is that what you said?

Sean Williams: Yes, the case for superfast broadband fibre-optic penetration goes to two-thirds.

Earl of Courtown: What population does that affect?

Sean Williams: About 10 million households. As a result, the Government have—

Earl of Courtown: I know that there are various areas, and I live in one of them. The problem that you have, of course, is that most of us around this table rely on BT to supply their broadband, and as someone who lives just outside the M4 corridor my BT broadband connectivity is absolutely appalling. This is not right up in the Cairngorms, Snowdon or the Pennines. I was just wondering how on earth you are going to improve this for quite a large number of households.

The Chairman: Can I ask an additional question to that? We have been concerned about speed in general everywhere. I am not saying that you are being complacent.

Sean Williams: I am not.

The Chairman: However, we have had very clear evidence from people working in London—the obvious hubs, if you like—that their speed is now inadequate for uploading rather than downloading. We are seeking to get underneath the glossy headlines, if you like. How do we get rather more reassurance, or more openness, about what the challenges are and any ideas on how they are going to be met?

Sean Williams: I do not want to paint a glossier picture than the reality. However, we start from a pretty good place, although there is a lot more to do. We have superfast broadband coverage of 78% of premises, which is a good score relative to our major competitors, and 99.3% ordinary copper broadband in the UK, which again is higher than in most other countries. But that does not change the fact that some people are getting speeds and indeed resilience that are inadequate for them. All I would point to is that over the next few years there will be a very large investment in superfast broadband for the final third to get to over 90%. Once that is deployed, our estimate is that households that will get less than two-megabit broadband, which is pretty basic broadband but is at least functional for downloading, will be fewer than 1% of premises. To get the uploading part going well at the same time you really need in the order of 10-megabit broadband, and we will probably have fewer than 5% of premises getting less than 10-megabit broadband after all that deployment. At least, it will be available to them; obviously I cannot guarantee that we are going to get to take-up at that level. So there is an enormous amount of investment going on over the next few years out to 2018. We will be in much better position as a result of that. There will still be some holes. It is right that we as a country consider what we are going to
do about all those white spaces that are left where people cannot get enough. There should be a continuing agenda to drive coverage. I also endorse the point that Diana made at the beginning: this is also about driving the demand side. How can we ensure that everyone gets the benefit of it?

The Chairman: Mr Field, do you want to come in on this?

Dominic Field: Yes. I just wanted to say that those figures that were just laid out there, which I concur with, place us in a strong position relative to the other big five EU countries. When you look at the question of who is better, the names that typically come out are the likes of South Korea, the Nordics and Japan, but we are up there. In the infrastructure scored that I talked about earlier, we place the UK at number 13 out of 65 countries around the world. The area that held us back was not fixed broadband, which we have talked about so far, but mobile. Mobile broadband access is actually the primary mode of access for many people in the country and is increasingly becoming so. That is an area where we have lagged behind both in access and in price. That was the factor that weighed us down and took us to number 13. I will not hypothesise as to where we would be if we had taken a fixed-only view, but it would have been higher than 13.

The Chairman: Lord Haskel, we have covered some of your questions. Is there anything else that you want to pick up on?

Lord Haskel: First, I want to say that I am a fibre-optic customer of Virgin, and obviously the system is overloaded.

The Chairman: Basically you are running a case work seminar.

Q80 Lord Haskel: Getting back to the question of infrastructure, in March 2012 the Government actually created an e-Infrastructure Leadership Council to make recommendations to government on all aspects of e-infrastructure. It defined e-infrastructure as “a complex interaction of software, computer hardware, networks, data services, cyber security and the skills of the people who make the e-infrastructure work”. Mr Williams has mentioned some of those things. I just wondered, with this proliferation of what infrastructure is—hard and soft infrastructure—how we are going to get all this infrastructure to come together. Obviously one aspect of it without all the others could let us down, so it is not just a matter of whether we have the wires and the fibre in the streets, so to speak, but somehow we have to get it all together in balance.

The Chairman: I sense we have done hard infrastructure so let us put a tick against that. In particular, help us to work out how the development of the soft infrastructure works with that in an overall strategy.

Lord Haskel: And mobile.

The Chairman: Who would like to kick off?

Dominic Field: It is easy to quote figures on hard infrastructure. With soft infrastructure, it is harder to come by the data. We recently did a small study in which we talked to the CEOs of 30 technology companies, large and small, based on what makes a great tech city. We looked at London as the case study, evaluating its position relative to San Francisco and other tech hubs around the world. The conclusions from that study were, first, that our hard infrastructure was in relatively good shape and, secondly, on the key areas where the country could do more—in this case it was the city but you could extrapolate—at number
one was talent. When those CEOs talked about talent, it broke down into a couple of buckets. First, there was securing the supply of people with advanced degrees in science, technology, engineering and mathematics, the so-called STEM topics, who could help to drive technology-oriented companies. That was the top one. The second thing was ensuring that there was the right visa and immigration agenda to allow those people to either enter the country to work in this sector or stay on after university. I am aware that there are already initiatives in place around these areas. However, there was a sense that this was an area where we were on a good path but we could do more to drive availability. That would be an area for your skills question because that starts to bridge into that category. That was the number one piece that came across in terms of how you bring it all together: who are the people that will actually do this?

**Daniel Butler:** I agree that one of the central soft challenges is how you build digital confidence and digital skills—the capability challenge, if you like. Underpinning that are two elements. One is a marketing challenge, effectively. We need to be able to sell the benefits of superfast broadband to the 16 million citizens and 20% of businesses that have not yet embraced it and live their lives offline. Clearly, in terms of economic value and significance to economic policy, targeting that 20% of businesses is hugely significant. There are various studies out there about the economic impact. The most widely quoted figure is that there is an £18.8 billion annual revenue opportunity for more digitalised businesses. There is also an efficiency benefit to small businesses getting online. Digitalisation improves efficiency by about 20% on average. At Virgin Media we undertook a digital training project in Birmingham in 2012 with 25 local “hard-to-reach” businesses—microbusinesses that had developed their businesses strictly offline. I think it is fair to say they had not embraced the potential of digital technology for their businesses. There was an anecdote from the first of three weeks’ of training sessions that we did with the training provider Free:Formers. There was a guy called Marvin, a plumber from Solihull. Six months’ prior to the training session, Marvin had no digital footprint whatever. Then he paid for a website, and paid an IT consultant to build him a Facebook “like”—one of the thumbs. He paid £2,000 for this guy to do a week’s work, doing what is very simple coding to put the Facebook thumb on to his website. Within the first 15 minutes of the training session, all 25 people in the room had been taught the code to do that. I just offer that as anecdotal evidence that at the moment SMEs and microbusinesses in particular do not know what they do not know. Without wanting to take aim at the “have you tried turning it on and off” brigade, a lot of IT consultants do extremely well at the moment out of uninformed small businesses. That is a major challenge to be addressed. If you look at how digital policy has attempted to address that challenge, in this policy cycle there have been some welcome efforts. Web Fuelled Business is an interesting programme with a huge amount of central government sponsorship.

As an observer, I would not say that it is the most accessible programme or best targeted at hard-to-reach audiences. Our experience of the Birmingham project was that, because these businesses were not convinced about digital technology, you really had to spoon-feed them a little bit. You had to sit down in a very structured environment and take them through the material step by step. Web Fuelled Business is a great marketing tool but I am not sure that it lands that particular approach. Our observations of Tech City—I think Marcus from the Chamber of Commerce put it well in his evidence—was that its success was built on demand aggregation around existing, strong pipeline of both soft and hard infrastructure. On
connectivity in east London, there is recent press contesting this argument, but we have some of the best connectivity in the world. In east London, Virgin Media tested a 1.5 gigabyte residential connection at the heart of Tech City back in 2011. Tech City benefitted from having strong infrastructure and a pipeline of talent. Crucially, its success also depended on attracting major anchor tenants such as Google at a very early stage in the process. That was in large part to do with the work of UKTI and particular individuals in central government such as Lord Young selling the potential of Tech City. For cities outside London, if we are looking to build a blueprint for a tech city, I would say, first, locate your incubators where there is existing very good connectivity and softer infrastructure. Secondly, how do we allow other cities to benefit from these kinds of political endorsement and marketing benefits that attracted major companies to locate in those centres?

Q81 Lord Macdonald of Tradeston: We hope in the course of this inquiry to find evidence that digital input will drive competitiveness and indeed economic growth in Britain. So far, that is proving a bit elusive. On the other hand, on the skills side we have tended to look at that as a way of getting people into jobs. As you heard from some Committee members this morning, there is probably a larger issue here of how fast this technology is developing and the risks we run because of it, whether that is the crime figures that came out last week for online fraud or the risks to our essential community services and the networks we depend upon. That resilience seems to be lacking even at the very basic levels that we heard about earlier. Yes, we need skills to put people into jobs, but surely there must be a huge skills shortage in terms of the kind of people that can try to ensure that society is not at risk because of the way this technology is rocketing forward, without a great deal of control partly because the private sector can find an answer to that. It is regulated to an extent in some areas, but it is a bit alarming to many. Do you feel the anxiety about the skills gap of those people who will make this stuff more resilient?

Sean Williams: There are two parts to the question. I certainly take the view that it is important that all organisations invest in developing the skills fit for this environment. From our perspective, some of that is within the business and some of it is about how we look after our customers. On the first of those, we recruit around 300 graduates and more than 700 apprentices into technology roles, as well as 1,600 servicemen coming out of the forces into our network business. We are recruiting thousands of people a year into the technology world and training up thousands of people a year who will obviously have careers and go on to other places. It is part of building the soft infrastructure.

On the piece that is outside BT, it goes back to my fifth level—the whole public policy environment for this. Some of it is about developing skills and some of it is about protection. On the skills front, we very much support the introduction of computing into the school curriculum and we are working in partnership with an organisation called Barefoot Computing, which is helping primary school teachers to train up so that they can actually deliver the new curriculum, as well as helping the National IT Partnership to develop apprenticeships in these areas. We are going beyond that to help to encourage people into STEM subjects. We have nearly 500 STEM ambassadors, as we call them—people in our business who go out and use their skills in local events in communities to get people engaged with this whole agenda.

There is also the protection side of it. This is very powerful technology and we need to ensure that people are properly safeguarded. We are doing a lot in that regard both
commercially with the introduction of parental controls and out in the community. We are working in partnership with UNICEF UK on an initiative called The Right Click: Internet Safety Matters. We are out in schools training children and teachers in internet safety. We hope to reach a total of tens of thousands of parents and children through our one-hour online safety training. Lots can be done within the business in developing curricula in schools and more vocational avenues. Thirdly, there is more we can do to support our customers in using this great capability in a safe and protected way.

**Lord Macdonald of Tradeston:** Is there a step change that you would look to government to introduce? If it is a technology of such profound influence and very real dangers, should the Government be taking it more seriously? Should there be a step change in the recruitment and training that is necessary? The thousands at BT are very welcome but that is out of a workforce of 29 million working on a technology that is about to transform industry, as we hear every week.

**The Chairman:** How can we join up the bits? In every session we have had, we hear lots of good bits. You have just said you are working with primary teachers—great—but I bet it is not that many in the grand scheme of things. In every session, we as a Committee are trying to think, “How the heck do we take all these bits and turn it into a proper UK plc strategy?”

**Daniel Butler:** It is central to our commercial objectives to get network resilience right. Particularly in the business-to-business market, the resilience of connectivity is even more important than the quality of the service or the speed. If you survey businesses, they will tell you that resilience comes first, security second and speed third. It is important that we ensure that our network is secure at a critical infrastructure level. From a residential broadband perspective, clearly engagement with broadband depends first and foremost on consumers trusting the service and trusting that their security will be looked after. What you see across the market is that we give away antivirus software to our customers on the basis that we know how fundamental it is to them that they are able to protect themselves from malware. Each network operator will take action to protect its own critical assets. I do not see it as a challenge for central government; I see it as a fundamental necessity for us at a commercial level. It is important not to underestimate the amount of activity that already goes on to ensure the resilience of our services and our network.

**Q82 Lord Janvrin:** I have a very quick question on BT and your recruitment programmes. I think you said 300 graduates, 700 apprentices, 1,600 servicemen. Where are you having the greatest problem? At what level?

**Sean Williams:** I do not think we are facing a problem; we can recruit people. The problem is that we do a lot of the training. We would benefit from having recruits who are better prepared for their technology roles in life if they have come out of school with more depth in those areas. We do not have a problem with attracting talent and capability and training them up in the specifics of our business and getting them out into the field and into the business in a useful way. Where the Committee could really help is in devising a coherent framework that could slot helpfully into a clearer overall picture.

**Dominic Field:** We should not be complacent, but it is fantastic that in terms of economic positioning—the eGDP, as we would call it, which is the economic impact of the internet—the UK ranks number one among the G20 economies. Just to put some numbers against
that, in 2010 we quantified it as 8.3% of GDP, which compares with 4.1% for the G20 countries on average. We are actually doing quite well.

We have heard a lot about the infrastructure, which is actually in pretty good shape on the hard side—there are obviously some folks who are not feeling it yet but it is coming—but there is an area in which a co-ordinated national policy could help. In the same way Daniel said that Tech City has managed to help this in London, I would raise two questions. One would be: how can we have several tech cities across the UK? Where are the next tech cities coming from? Where do we have the degree of co-ordination and focus? Ultimately, a lot of the growth that we are talking about will come from companies that do not exist today. That is the power of the internet—the ability to transform businesses. It is a revolution, an industrial revolution of sorts. That would be the first question: how can we develop industrial policy to create that? The second thing, to feed those future companies, would be the ICT skills. To put one piece of data out there, I talked earlier about the UK being 13th overall on our global index. It is 29th overall in ICT skills. As a contributing factor that powers the growth, it will be important to continue to push that area.

**The Chairman:** Thank you. It would be very helpful if you could send us the document on this. Lord Holmes has a different question.

**Q83 Lord Holmes of Richmond:** Picking up what was said a few minutes ago about the potential market for superfast broadband, what about delivering on the promise to all those people who have been convinced to go on to superfast broadband? If you chat to most people about service and supply, it is seldom super, rarely fast and often when you get dropouts, on a Sunday night especially, it is not even broadband. What is going to be done to improve networks in places such as London—we are not talking about rural areas—where people have been sold superfast broadband and it is not?

**The Chairman:** Do you have anything to add to what was said before?

**Sean Williams:** I will have a stab at that. The data that Ofcom produces actually suggest that the superfast broadband network is delivering what we define as superfast broadband speeds. You can define those in the way the BBUK process did, as over 24MB, or in the way that the European Commission targets work, at over 30MB. On average, the SFBB network is delivering 47MB. I point to the data that suggest that actually it is delivering good speeds. Not all the provision arrangements are perfect and it is not always faultless, but it is improving all the time. It is also important to register, as we have in passing in this conversation, that for businesses it is very often not about superfast broadband but real ethernet fibre connectivity. In addition to all the superfast broadband, a lot of companies rely on ethernet connectivity, which is very reliable once it is installed and is able to deliver multiple GB of symmetric speeds, which businesses require.

It takes continuing investment in what is a new technology in superfast broadband. We had not started deploying this until about five years ago. It is going very rapidly and it will improve all the time. It is not perfect, but it is delivering superfast broadband speeds.

**Lord Holmes of Richmond:** Do you think it is acceptable for customers to have interrupted supply on a regular basis? If you were a power supplier the current service, for many people in areas such as London, would make the blackout of the 1970s look like the blink of an eye.

**Sean Williams:** This goes back to Baroness O’Cathain’s point earlier about resilience. It is very important that the resilience of these networks is enhanced all the time. When you
make the comparisons of fault rates on various different technologies, you can see how, as the fibre technology has matured, the fault rates have come down enormously and will continue to do so.

**Daniel Butler:** I would just plug our own network performance. Virgin Media has topped Ofcom’s speed reliability charts for six years running. The extent to which we have fibre built into our network and the coaxial cable that runs from the cabinet to the home helps to guarantee that there is no dramatic degradation in speed for the end consumer. As Sean says, Ofcom’s statistics point to a very robust performance of speed. It speaks to why speed, in and of itself, is not the best indicator to build policy around, because one of the challenges that any network operator faces is not so much the speed of application but the stuff that is being used. HD video requires about 10 megabits; 4K TV is estimated to require about 20 megabits of bandwidth. The challenge for network operators is how many people are using how much across a single network at the same time. That is very different from the headline speed. A fixation on headline speed will not address that as a policy outcome. Performance against headline speed is improving. On Virgin Media’s network it has always been very robust because of the quality of investment we have made in network.

**The Chairman:** But that is not enough as a measure.

**Daniel Butler:** The bigger challenge is how network operators deal with a connected home. Again, just to plug the BSG’s—

**The Chairman:** I am going to stop you, otherwise we are not going to get our last questions. I want to do that. I know Mr Field wanted to come in.

**Dominic Field:** I suspect, although I have no evidence to back this up, that many people who believe they have a problem with their superfast broadband have a problem with their old fashioned dial-up or DSL. That is much less robust than the superfast broadband. As we talked about before, there are also many people who are not taking advantage of the fact they could have a much better service.

**Lord Holmes of Richmond:** On that, I suspect it is an oversold service and there are too many—

**The Chairman:** I am going to stop this, because otherwise we will say, “A week last Monday X happened”. We will not go there.

**Q84 Lord Lucas:** If I am running Eastbourne or Hatfield or some community like that with a university and a decent set of tech people around there and I want to create a hub, what can the infrastructure community do to help? Do I need to stump up a lot of money? Do I need a greenfield site? What makes one happen?

**Dominic Field:** The questions I would ask are whether those universities are offering the right kinds of degrees: the basic conditions of science, technology, engineering and maths. Number two, I would look for opportunities to locate and anchor tenants of technology companies near to campus, in and around the area. Thirdly, I would make sure they are well plugged in. Those would be the three things I would look for.

**Lord Lucas:** Is being well plugged in something that you can do starting from nothing, or do you require an initial investment by a local authority or someone to get you off the ground so that you can provide that sort of quality of service?
**Daniel Butler:** Virgin Media does not take public subsidy to invest in our infrastructure. We never have, because we operate a closed network. My challenge to the aspiring incubator would be first to look at sites that already benefit from strong connectivity. That is clearly not always possible. In those types of scenarios with those types of capacity requirements, one would expect that business-grade connectivity was what was required to serve the particular needs of that incubator hub. Virgin Media itself has the ability to provide point-to-point fibre connectivity to 85% of business premises up and down the UK, so there is a strong possibility that in any hypothetical scenario there is an opportunity to provide services. This speaks to the willingness to pay, frankly. I was having a conversation with Tech City last week; with some of the tech start-up incubator hubs that are emerging in east London we still have a marketing challenge to get over. Those communities might not think that they need point-to-point ethernet or business-grade connectivity, but the things that they are going to use that connectivity for, particularly the upload demands that they will place on networks, probably speak to the requirement that they do need that level of connectivity. For small businesses there is a challenge in marketing the availability of products and the benefits that they can get from those products better so that we can address that willingness to pay issue.

**Sean Williams:** I endorse the general sentiment that if there were a hypothetical greenfield business park for a tech cluster, I would expect that we would be deploying fibre, whether business-grade ethernet or superfast broadband connectivity. We would not particularly be looking for contributions from people developing such a place. We are in the business of serving greenfield sites and working with developers all the time to find fibre solutions to provide to new premises.

**Q85 Lord Janvrin:** A final question, which we are asking all panellists who come before us: if you had to pick out one suggestion or recommendation that you would like this Committee to make to the Government in the area of infrastructure that we have been covering, what would that recommendation be and have you any thoughts about the cost of it? If you picked out just one priority.

**Daniel Butler:** I would actually suggest that you do not focus on infrastructure. The unique contribution that this Committee can make, given that it is the Digital Skills Committee, is to consider what the next phase of digital upgrade looks like. As I opened by saying, I think that is more a demand-stimulation and marketing challenge, a challenge about how you get those who are currently digitally excluded, particularly small businesses, to embrace the possibilities of technology, over reaching for a particular speed conclusion or a particular network infrastructure conclusion. The one bit of infrastructure policy that we think needs working on is looking at what the right conditions are for private sector investors in network, because supply-side infrastructure policy in this Parliament has focused on government-funded schemes, and rightly so because it was addressing a particular market failure. If you are stimulating demand, the next phase of digital policy should also look at the right conditions for private investors in network to continue to invest in meeting that demand. We think that there is a bunch of useless red tape that could fall by the wayside.

**The Chairman:** I think that was two, actually, but there we are.

**Dominic Field:** As Daniel has said, from a hard infrastructure perspective the UK is in pretty decent shape. It is about the soft piece and a focus on developing a stronger talent pipeline.
to produce more engineers, data scientists and people who can help to grow the businesses that will employ the UK population going forward.

Sean Williams: I support both those recommendations from Dominic and Daniel. I would add on the hard infrastructure side that there are still some white spots—that is, non-fibre areas—particularly in cities, because network economics for cable operators and BT do not work. My ask of the Government would be to go forward to seek approval from the European Commission for a city fibre subsidy scheme to deal with the non-fibre areas in cities. The reason for saying that is that to achieve the universal coverage goal, we have to deal with the problem in cities. It would be really rather ironic if at the end of this we had 95% coverage across the whole of Cornwall and Northern Ireland but only 85% coverage across the whole of the city of London.

The Chairman: Can the EU do that?

Sean Williams: Yes. The issue is that the European state aid guidance and guidelines lay out some quite restrictive provisions around the terms on which such aid would be approved. The Government should go into battle with the European Commission and come out with approval for a scheme that would be viable for the UK.

The Chairman: It would be very helpful if you sent us a bit more information on that. That answers some of the points that we have been trying to raise today.

Daniel Butler: More public subsidy for BT would be a brave recommendation for the Committee to make.

Sean Williams: I said nothing about a subsidy for BT. That is a very cheap shot.

Lord Kirkwood of Kirkhope: Is there any chance at all of a combined industry-wide approach to government before the next election covering the next five-year period? We know that there is an election in May. Is there any chance that there could be an industry-wide body that could come together and make exactly the kind of points that you have just been making about infrastructure?

The Chairman: They are not all here today.

Sean Williams: There are industry fora. The Broadband Stakeholder Group is probably the leading forum in this area.

Lord Kirkwood of Kirkhope: So that would be the one that would be—

Sean Williams: Maybe you could invite it to come to speak to you on that subject.

Q86 Lord Macdonald of Tradeston: I have a question for Virgin. It has been my impression that after the various amalgamations that created Virgin Media, you stopped at 50% of the country covered and seemed to find it very difficult to go beyond that. Is that correct? Is there a stasis at Virgin Media that means that you can serve only half the country? That speaks to BT’s point about the other half.

Daniel Butler: That is an accurate description of where Virgin Media was up until this time last year when, speaking frankly, we were at a stage in our history where we had invested heavily and consolidated the cable markets down to a single operator. The market economics were particularly challenging as an independent company regarding how we built out further. As I think you know, Lord Macdonald, we were taken over by Liberty Global just over a year ago, and the scale of that potentially opens up routes to investing and expanding
our network considerably. Already this year we have announced an expansion of 100,000 homes in east London, and we have acquired a small cable operator in Scotland that serves around 50,000 homes. There is huge appetite within the business to expand the network. That speaks to the funding and market-condition challenges that I mentioned earlier—the impact of red tape. Red tape constitutes 85% of our build-out costs, so anything that we can do to deploy the network cheaper means that we can provide more competition to BT in more postcodes up and down the country. I accept that there are white spots in cities that need addressing. Our view is that you should start by seeing how far the market can get you, without all this red tape, before immediately looking to the taxpayer to subsidise that expansion.

Lord Lucas: Can you let us have some details about which regulations and how much?

Daniel Butler: It is hard to shut me up about it at the moment, Lord Lucas.

Sean Williams: We endorse that general agenda of reducing red tape and have already submitted quite advanced proposals to the Government on that. Some action has been taken but there is more to be done.

The Chairman: Thank you all very much indeed. That was very useful.
Professor Nick Bostrom, The Hartree Centre and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)

Evidence Session No. 3
Heard in Public
Questions 26-39

TUESDAY 22 JULY 2014

Members present
Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Lucas
Lord Macdonald of Tradeston
Baroness O’Cathain

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Examination of Witnesses

Professor Nick Bostrom, Director, Programme on the Impacts of Future Technology, University of Oxford, Michael Gleaves, Head of Business Development, The Hartree Centre, Science and Technology Facilities Council, and Kevin Baughan, Director, Technology and Innovation, Innovate UK (formerly known as the Technology Strategy Board)

The Chairman: Good morning. Thank you very much indeed for joining us this morning. You have a list of interests that have been declared by Committee members that should be there in front of you. These were declared orally by members at the previous session on Tuesday 8 July and can be found in the transcript. A couple of members who did not declare interests at that stage because they were not present will do so today. This is a formal evidence-taking session of the Committee and a full note will be taken. This will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you will be able to revise any minor errors. The session is on the record. It is

160
Professor Nick Bostrom, The Hartree Centre and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)

being webcast live and will be subsequently accessible via the parliamentary website. You are also, by the way, welcome to submit supplementary evidence after the session; we would really welcome that. I remind us all—witnesses and members—to speak up so that we can all hear each other.

I will come to each of you to introduce yourselves. If you would like to make any brief opening remarks, you are very welcome to do so, but do not feel that you have to. First of all, Mr Baughan.

Kevin Baughan: I am Kevin Baughan. I am the director of technology and innovation at the Technology Strategy Board and I am happy just to move to the questions.

Michael Gleaves: I am Michael Gleaves. I am head of business development for the Hartree Centre, which is a supercomputing centre based in the north-west of England. We look at supercomputing, big data analytics and visualisation, and try to apply that to industrially relevant problems.

Professor Bostrom: I am Nick Bostrom. I am the director of the Programme on the Impacts of Future Technology and of the Future of Humanity Institute at Oxford University.

Q26 The Chairman: Thank you very much indeed. Let us kick straight off into the questions and first of all a broad one for all of you.

Can you help describe for us the pace and change of the future digital landscape over the next five, 10, 15 years and in broad terms outline how you think that is going to affect our society, our workforce, our economy? So no challenge there, but if you can just help us paint that picture to start off, it would be really helpful.

Kevin Baughan: With pleasure. In my group we have huge involvement across multiple sectors in the UK economy. As a consequence we can see digital penetrating each one of those sectors. One of the key characteristics that is changing is really the fact that digital is embedding itself into almost every sector we work with. Whether it is agriculture, transport or manufacturing, all of those now have a digital dimension. So we structure our own activities very much with a digital team that works alongside each of the sectors as well as on digital-specific areas. I think that is probably one of the biggest changes. That means that we see a world now that is moving beyond fascination with accessing the digital world and connectivity to one that goes right inside it to understand how data can transform entire industries—how the analytics of that are becoming increasingly important, how really it is involved in design, in simulation, in testing—because if you can move into a digital dimension the costs of an industry are completely different; you can experiment, you can change, you can understand and therefore the world is one where you can be much more productive. So it penetrates all those different aspects.

Then if we look a little bit further out we can also see the fact that the digital world is changing the form of production as it moves into 3D production and even into robotics and autonomous systems; the virtual world is becoming more physical again. Those kinds of technologies are allowing the equipment to perceive, to reason, to change their purpose and therefore we see a further transformation. So that digital world is infusing itself in almost every aspect of each sector.
Michael Gleaves: I commend what Kevin says, but I think that one of the drivers is Moore’s law. Are you familiar with the law that every 18 months your computer gets twice as fast? That means that the fastest supercomputer in the world 20 years ago is now the same computational power as an iPad today. Put another way, a room full of computing is now an iPad that you can carry around with you. It is just a revolutionary process. If I take that forward again, if I run it on my fastest supercomputer in my computer hall a calculation for 10 minutes, that same calculation would take 16 years to calculate on that same iPad. So basically half a lifetime’s research can be done in 10 minutes on the fastest systems in the UK today. That Moore’s law generates the availability of computing but also the cost. So the cost of computing per core hour is plummeting over time down to couples of pence per core hour right now. That is driven right now by the rise of parallelism. Everybody remembers that they had a single core and their computer got faster every time they bought a new one. Then Intel produced Core Duo and nothing got faster but you could run two applications simultaneously. Now you can run four, eight applications but the code is not getting faster, unless you write it, to be able to use that parallel system. Computers are also becoming more heterogeneous, so there are accelerators in those systems, whether they are graphical-processor units or other accelerators, and they are even more complicated to code and use. So the problem of how to use the computers that are available has been moved from hardware company to the software developer, and that is where we need to invest the skills to use these technologies that are ably being created by the hardware manufacturers of the globe.

The other thing is data: the rise of data right now is huge. From 2006 you can see huge uptakes in the amount of stored data and particularly data that are IP accessible, so they are in a form that you can connect to over the internet and you can analyse them in real time to give insight and actions that can make significant differences to business’s operational costs but also innovation.

Professor Bostrom: I want to fill in a little, more briefly perhaps. One might disentangle two kinds of trends. On the one hand we have a continuation of the types of developments that we have seen in the previous five, 10 years—specific new innovations but of the same kind and the same magnitude where the internet remains an extremely exciting frontier of entrepreneurship—and new applications in governance and business: in all sectors really. Education is another thing that is up for being revolutionised. That, it seems, is fairly predictable, not in the specifics but there will be more.

The Chairman: It is a general direction.

Professor Bostrom: With the other thing I think there is a lot more certainty, and this is the rate at which we will see advances in machine intelligence. At some point, partly due to the increased computing power available but also through progress in algorithms and in cognitive science perhaps, computers will become more and more capable not just to crunch numbers but to detect patterns, to do more abstract reasoning and eventually to begin to substitute for human intelligence in a wider range of domains through having general learning algorithms. There is a great deal of uncertainty as to how quickly that will move, but that, I think, will have important implications in the shorter term for how many different jobs can be automated; driverless cars are one application, but there are a lot of different occupations in principle where you can see this too. In the longer term there are even more profound issues: one is considering scenarios where computers eventually match humans in general intelligence.
The Chairman: Can I ask a supplementary? To what extent do you think policymakers understand the big change that is happening now and is going to happen? Are there any lessons from previous periods of fast technological change that they ought to be looking at and applying?

Professor Bostrom: To a very small extent, I think. If one is thinking about several decades out, the most aware just recognise some possibilities to have some thinking. The policymakers’ attention by necessity is focused more on the short term, and there is an awareness in the sense that, yes, we recognise for example that information technology is important—presumably that is why you are all here—but you probably know more about the degree to which policymakers at large know the specifics.

The Chairman: We are fairly depressed about it at the moment.

Michael Gleaves: I do think that industrial pull is one of the most important: being able to demonstrate the state of the art in an industrial setting that creates the need but then creates the requirements for the universities to produce the staff. The future generations with those skillsets that are being pulled into industry is pretty important. Policymakers can build centres of excellence that can be focus points for these types of technologies and can be demonstrators that help to make the business case internally for those businesses to make those investments. Some of these investments are large investments on an industrial scale.

Kevin Baughan: We see a good relationship-building across multiple government departments in this kind of area. We obviously work a lot with BIS and other government departments, and we find them very supportive of the Technology Strategy Board in our work. If you look at our delivery plan, in each of the areas you will see sectors that are being transformed and encouraged to take on new technologies, and there is quite often a very strong digital element in particular in that. If you went to the construction industry you would find discussion around building-information management systems. None of the sectors is changed and we find a really good resonance there, but the scale and pace of change is always one to underestimate. You asked if there were lessons to be learnt. I think one is not to be scared of these changes, to embrace them, to get on top of them. I have lived long enough to see a few scare stories about what technology can do, but if you can embrace them and use them successfully they become very powerful forces not just for the economy but for people’s lives and for the quality of the experience.

The Chairman: Thank you.

Q27 Baroness O’Cathain: This is amazing stuff, but thinking about the business sector, who is going to be the champion of this great progress? Looking at board structures, you have a director of finance, a director of personnel, a director of something else. Where is digital going to sit? Do you think there is a case now to make sure that the FTSE 100 companies in particular realise the impact that there is likely to be and that they ought to have a digital champion on the board as a director of digital? What happened in this country just about 20 years ago was that engineering directors went off boards and engineering became plumbing. This is too important, not just to the UK but looking at where the competition is coming from. You say that the Government are taking this on board. What about major manufacturing, retail, education, all sorts of companies? Do they have a digital champion—
Professor Nick Bostrom, The Hartree Centre and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)

somebody who really is the one to direct the digital programme in that company—on the board? Otherwise it is not going to run.

**Kevin Baughan:** The point you raise is extremely important. I think that the people who lead the products, not just the technology departments, are going to be at the centre of this, because they need to understand that their entire product portfolio and their whole approach are changing. So I do not think it is going to become something that will be put in one corner. I really hope that it is not. I hope it becomes absolutely central to the lead member on the board for the product as well as for the technology. Clearly the finance departments are involved in all those discussions. In fact, if you look at industry, the one that I get most nervous about is the small to medium-sized enterprise industries. I think the big corporates are powered to change because of the competitive worlds they live in. The smaller micro-industries tend to change dynamically because they need the benefits of digital for their businesses. The small and medium-sized enterprises—the ones that are busy just meeting the payroll and doing their activities—are the hardest ones to change, the ones that I think probably need the most help.

**Baroness O’Cathain:** They think they can buy it off the shelf but they cannot.

**Kevin Baughan:** Yes.

**Michael Gleaves:** There are some great examples. I do quite a lot of work with Unilever and they have a senior vice-president for R&D who is very into digital and simulation. They have set up focus groups, internal groups, to look at these technologies, which is quite productive, but that is probably a highlight.

**The Chairman:** Anything to add or we will move on?

**Professor Bostrom:** Outside the business sector there are big opportunities in governance and education that you should also bear in mind.

**Q28 Lord Haskel:** Thank you for that tour d’horizon. Very interesting. But I wonder whether we could come down to the more particular. Could you tell us which technology trends will have the highest impact for us here in the UK and how these technological developments are going to be different from the ones in the past?

**Michael Gleaves:** We have just embarked on some work on energy-efficient computing, and one of the routes forward on that is the ARM processor, which is obviously a Cambridge company. They have their 64-bit extremely energy efficient computing, high computing power technology systems. One of the real opportunities for the UK is to combine technology and design. The really successful organisations within the UK—the Dysons, Bentleys and Jaguar Land Rovers of this world—are not just technically brilliant or engineeringly brilliant; there is also a high level of design and design ethics in the product, which makes them better because they are British to some extent. There is also R&D and the likes of the really R&D-intensive industries such as the aeronautical industry and the pharmaceutical industry; and the application of data analytics, computing simulation, and using data analytics to get to the right market segments can be a very powerful way of organising your business.

**Professor Bostrom:** I do not know whether you would count it as a specific technology, but there is a particular type of application for it in general transparency or surveillance, depending on how you look at it. More and more data are becoming available off what
people are doing—their behaviour—and what things are doing; more and more things will have embedded chips that can communicate with other chips. I think we are moving into a social domain where there will just be a lot more data available that can be processed and mind patterns extracted. It can be used to target advertising and police populations, to customise experiences to the individual user’s preferences, and for other things that we have not dreamt of yet that can be built on top of this mountain of data. There will certainly be business opportunities in that direction, but there will also be challenges in how you trade off privacy concerns while giving people opportunities to put different datasets together to find these new opportunities.

The Chairman: Mr Baughan, do you want to come in?

Kevin Baughan: Just briefly. I think I will frustrate you a little because I do think it is very, very pervasive. At the end of the day we live in an innovation economy, so we succeed by innovating, and in the Technology Strategy Board we are very focused on that as a means of accelerating growth. But whether it is the creative industries that now have 80% of their films in a virtual world instead of a physical world, whether it is transportation and bringing together streams of information for more intelligent mobility, I struggle to find any one of them [that is not involved in this]. Some are more established, particularly high-value manufacturing and leading companies in that space, be it Airbus, be it Jaguar Land Rover. Those are very far advanced in this, but I think it will pervade everything, and that is the challenge that sits before us.

Lord Haskel: While all this is going on—we hear what you say—the economists tell us that productivity has not moved in the last 10 years. There are more people at work but we are still not producing more. What is happening with all this? Are we missing out by people not learning the skills? Is that what we are missing? That is what this Committee is about.

Kevin Baughan: Perhaps we could move into the skills area. Obviously we approach it from the direction of business and what is happening in business. The first bit of good news for me is that the United Kingdom is a nation that has embraced going online. We have very high penetrations of that. If you look at the technology trends, they are moving towards much lower costs and making it much easier to use, so at the end of the day I am less concerned about people becoming familiar with technology as users because all the trends are in the right direction in the sense that we already embrace it. The cost of accessing it is coming down, the ease of using it is going up, and that is an encouraging environment.

Where I think the real work lies is in making sure that we can fuse worlds together so that there is a digital dimension to the way you study subjects as you progress through your education and you can enjoy the benefits of that, be enriched by that and get inspired by that and want to participate. It does not take away the need for expertise; it just needs to be combined with tools and knowledge as to how to play with your expertise in a digital domain before you do something in the physical world.

Professor Bostrom: With regard to productivity, I think there is also an issue of econometrics there in that some of the benefits created by the new digital world are not included in GDP; a lot of services online are free. I use Google search engines and all kinds of products that enhance my life a great deal, but I do not pay for them so they are not included in the accounting. So to some extent it is an open question as to how much productivity would have grown if we had fully accounted for these kinds of benefits.
Q29  Lord Lucas: I will first declare my interests. I am in the process of founding a social enterprise in the career space, which will be very heavily reliant on a lot of digital technologies.

Professor, if I can pick you up on something you said about the use of our personal data, do you think that we as politicians should be thinking about developing a personal information right so that individuals get back some control on the way that companies and Governments are using information about them?

Professor Bostrom: I am not sure what the correct solution is either way. I have not made up my mind. I think that some choice will have to be made. My guess is that it will de facto go towards transparency and data becoming available, because there is something that is known as the promiscuity of data, which is basically that a given set of data, even though it looks like it is only about a certain thing, once you combine it with other datasets, turns out to have implications for all kinds of things that were not explicitly included in either. So it is quite difficult to lay down barriers between datasets that will really last. You can try to anonymise data, for example, but often if you are a clever person you can find ways to de-anonymise the data; if you put enough pieces together you can identify whose data they were.

So in the long run my guess is that we will move towards this more transparent route where certainly the Government and security agencies can see everything that everybody is doing. But one question is whether it will also be possible for corporations to see what everybody is doing and for networks of citizens to create their own surveillance structures and so have access to the same data; whether it is a one-way transparency or a two-way transparency. So I do not have any opinion one way or the other on this specific initiative. Maybe it is a good idea, maybe it is not. It is hard to imagine politicians making this choice once and for all. I think it will be an evolving social dialogue with adjustments along the path.

Q30  Lord Janvrin: We have begun to touch on this. I would like to hear from each of you what you think the main challenges are likely to be as the UK attempts the transition to this kind of knowledge-based economy. We have had a bit about the opportunities, particularly on the business side. Are the challenges skills-based, educational or regional policy? All of the above, no doubt, and many more, but I would be very interested in what you see as the major challenges that we are now facing.

Kevin Baughan: Probably they come in two big groups, one of which is encouraging people to have the confidence to invest. In the UK we are not that good at investing from both the private and the public sector, and if you are facing large transformations you really need people to be comfortable about investing and confident in doing so. We could talk further about that.

The other aspect is the skills dimension. I look at it as a challenge of fusion—fusing things together—because at the end of the day if digital just becomes the next phase of ICT programme, it stays in an engineering domain and stays thought of as the preserve of people who like engineering. It is not. At the end of the day I would really like to see it be the fusion of creativity, expertise and commerce. With creativity, it does not really matter whether it is art or design. With expertise, it does not really matter if it is construction or sciences. with
the commercial bit, it does not really matter if it is psychology and understanding people or business studies and understanding finances. It is that fusion of subjects and encouraging people to really bring them together that I think is the most exciting piece going forward. If we can find ways to encourage people to do that, I would be much more confident.

**Michael Gleaves:** Yes, I would say that STEM graduates are really important in this process, but they must be taught how to think in a simulated or data-analytical way as well as the chemistry-domain knowledge that they have. It is only when you get both those components together that you get the real insights. There is a book by Jim Gray called *The Fourth Paradigm*, which talks about the four different paradigms, starting with analysis, experimental theory and simulation. I notice that Dominic Tildesley is now the chair of the Royal Society, and he is a modeller and simulator, so that is now establishment, so the only one left is really the data-driven science that he was pushing on. That is the level that domain skills and expertise need to be embedded in the chemists, physicists, engineers, marketeers and business-development managers of the future.

**The Chairman:** Would you say that is not the case at the moment?

**Michael Gleaves:** Not at all. We run summer schools to try to teach graduates and postgraduates, typically from the PhD levels up. So this year we are running whole-week summer schools in high-performance computing, visualisation and big-data analytics for cohorts of 50. But it is only 50. It needs to be pervasive.

**Lord Janvrin:** You could do a summer school for Peers.

**The Chairman:** We would take longer, I think. We would need a couple of years.

**Michael Gleaves:** We will take up that challenge if you wish.

**Professor Bostrom:** One challenge is the comfort level that different people have with digital technology. I think there is a generational gap there. Generally speaking, younger people who have grown up with it take a lot more things for granted and are happier to access government services, banking and financial services and other things through the internet.

From an economy point of view, creating the culture of entrepreneurship like one sees in the Bay area, where it is normal to start up a company and have it fail and then maybe start again or join somebody else’s, is a very different outlook from the traditional model where you joined a corporation when you were 20 and then maybe expected to stay there for the rest of your life. If you then lost that job, it is a big failure, whereas in the modern economy it is important to expect that you might change jobs frequently. I think the impact of unemployment is not just about losing money or a livelihood; it is also feeling like a failure. If there is an expectation that you are supposed to hold on to a job for ever and you then do not, it is a much bigger psychological blow, so creating that kind of expectation that one will need to be flexible to thrive in the new economy is important.

The Bay area also suggests another challenge, which is that it is above anything else a geographic cluster, and we see it in other sectors as well. There are biotech clusters of excellence where you have a critical mass of components coming together: cutting-edge researchers, people with money, people with experience running start-up companies, designers, other kinds of support services. That suggests that in the UK there might be one or two clusters that will be hot beds of innovation but other parts of the county are left behind.
Professor Nick Bostrom, The Hartree Centre and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)

It is not obvious how best to respond to that, because these clusters form because they create network effects, so by trying to spread everything out you might put out the fires, and perhaps counterintuitively one should try to encourage this kind of concentration to reach critical mass where you could get something that is meaningful at a global level.

Lord Janvrin: Can I just come back to Kevin Baughan and your very first point on the confidence to invest? You said that more could be said about this. Could you say a bit more about that against the background of what we were talking about—top senior people in business are not as digitally aware as they should be—and against a background of well documented failures, particularly in government projects, which is an inhibitor to thinking creatively about investment? Could you say something on that very good point you made?

Kevin Baughan: Yes, certainly. I think we can approach it from a couple of angles. Obviously one of the Technology Strategy Board’s roles is to encourage innovation and accelerate economic growth by looking at the barriers to various aspects, so at the end of the day when we look at sectors we work with the industry to understand the barriers that are preventing them from going forward. Sometimes they could be regulatory barriers, other times they could be ones that are based on the perception of the level of risk that they have to undertake. Therefore we can get involved to look at finding ways to go through those barriers and see when it makes sense to use public money to do it and at the same time encourage them to develop skills so that they can tackle those things themselves with private investment. Some of the more interesting aspects of the work that we do is where we have projects and programmes such as the catalysts, which then stimulate activity in a sector but measure their success by looking at the ongoing private investment that follows the public investment that was made to trigger the change in the industry. Whether that is in agri-tech or in biomedical areas, it is a way of helping the industry gain confidence and direction.

But that is only part of the challenge. The other half is having UK industry prepared to invest at a higher level than it is at the moment, which I know the Tera Allas report and others from BIS have looked at in detail. There is a role that we can play in public funding to trigger people, give them confidence and build a consensus, and some of that is as simple as stretching out the road map—the strategy for the sector—with them so that they can understand the direction they are going in. Then if there are specific barriers, we can try to overcome them or stimulate the opportunity. But I think the country as a whole has to get better at managing and feeling more comfortable with risk, because that is what we are in when we are investing in transformation.

Q31 Lord Macdonald of Tradeston: I declare an interest in digital skills and competition as an adviser to Macquarie Infrastructure and Real Assets and as a non-executive director of Scottish Power.

We heard previously about the large adjustment shock that there might be as workers are laid off and that the wages of unskilled people might fall below socially acceptable minimums, which, combined with new technologies, robots and so on, might make the distribution of income even more unequal. This really goes back to the question of the challenges that we face if we are to remain a leading innovator in this area but also have to adapt to cope with the social consequences.

There is an election next year. What would you suggest people put in their manifestos?
Professor Nick Bostrom, The Hartree Centre and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)

**The Chairman:** Excellent.

**Kevin Baughan:** I will leave each party to decide what they put in their manifesto, but the thing that interests me is not to be scared to use the power of digital to tackle some of those problems. At the end of the day it is a great leveller. It creates opportunities to perform at a global level from a very small base. Those opportunities do not necessarily suit everybody; I fully accept that. But there are some enormous opportunities that stem from the technology itself as well as some change in the way people live their lives and the way they work. Clearly we have to be focused on addressing those who are excluded for whatever reason and finding ways to support them through that, but the younger generations are embracing this at pace, so it is really trying to take that enthusiasm, understand how it might lead to more entrepreneurial activity, and understand how it might lead to more opportunity inside industries. For me, we can scale up tremendously here in the UK. We have a lot of leading-edge technologies, and I do not think we need to be nervous at all about the outcome if we embrace it. I have a lot of confidence that it will create a lot of opportunities as we come out of it if we embrace it. The difficulty is that if we hold back, others will seize the opportunities and take economic activity away from us.

**The Chairman:** I am going to give you a warning that at the end of our session I am going to ask you for one specific policy recommendation that you would give to us as a Committee. We are going to try to nail you down a bit more, Mr Baughan, than you have just done: to move from the generic to give us one thing. What would be your top choice? I will come to you right at the end, but first Mr Gleaves on this question.

**Michael Gleaves:** This is a very fast-moving area and there is an element of continued professional development. It is learning for life, and it needs to be embedded within the culture of our nation that people need continually to re-educate themselves and build new skills. Big data were not even heard of five years ago and now they are being used effectively with lots of businesses. There is a requirement for the people within those businesses with all those domain skills to go back out, re-educate themselves and then reapply that, and that may drive some of the efficiencies within our Government.

**Professor Bostrom:** On the inequality thing, I do not have a panacea, but I would just note that if there are increasing effects from one type of development, there are these traditional methods of progressive taxation or whatever where you can tune a parameter up or down to combat inequality. So if one is concerned about inequality, an inefficient way to deal with that might be by trying to reduce the pace of digital innovation and it might just be better to make the taxation system more progressive.

An answer that will often be given is that education is the key; everybody has to have a good education. I think there is truth to that, but it is also not necessarily easy just extending the period of education; it might be that we are at the point of diminishing returns where we have a sort of certification arms race. It is not so much that you need to have the MA to be able to do the job; it is just being able to get the job. You have many applicants. One has the MA and one does not. The MA guy will be hired but it might not add so much value to the economy as a whole. So improving the quality of education perhaps rather than the quantity would be another suggestion.

**The Chairman:** Lady Garden, do you want to come in, because your question carries on

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169
Q32 Baroness Garden of Frognal: Yes. You have all already spoken about skills, but I wonder if I could ask you specifically what hard and soft skills need to be developed within the talent pipeline to ensure that our future workforce is adequately equipped and are these skills transferable across occupations and industries. I think, Mr Baughan, that you have already suggested that they are embedded across industries and occupations, but how do we ensure that the people who are coming into the workforce have the right sort of soft skills as well as hard skills?

Kevin Baughan: The challenge is that everything moves so quickly in this digital space. If you try to design courses and roll them out, by the time you have finished them the world has moved on. So some of the more important aspects of learning going forward are really self-learning and peer learning. That is another aspect where clusters are so important: people learn from each other; they pick up on each other. Again the technology direction is such that people do not write user manuals any more in the expectation that they will be read; it has to be intuitive. People have to learn to pick things up. So I think the kind of areas that are important are the ability to learn yourself, the ability to learn from your peers, and the ability to keep that going informally as well as formally. There is still a very important need for formal education. All this depends on good science, good engineering and good art, whatever the foundation. That does not disappear. But the ability to apply it has to be done at speed, and there are different skills in that.

Just to pick up on Professor Bostrom’s point as well, people on the softer side need to be more imaginative, more innovative and more entrepreneurial if they are also going to flourish in a fast-moving world, because they have to be on the front line of that. On the softer side it is those innovation skills and leadership skills for change, whether at the board level or further down, that are important. I have those two things in my mind, which are, I think, very transferable at the end of the day, because they are really life skills in a fast-moving world.

Michael Gleaves: There are a couple of points there. First, the managers and directors within institutions need to be able to communicate with data analytics people and computing people in a way that sets a question they can answer. So there is an upskilling of the management layers of businesses in how to communicate to these groups and how to get the best out of the activities that they do. I have mentioned this a number of times: it is down to domain skills. These skills need to be embedded in the scientists, the engineers, the physicists and the astronomers, and it is when you get that embedding that you really get the upskill and the uplift in people’s ability to give you an answer, an insight and an action, and it is the action that is important, not the insight.

The Chairman: Thank you.

Professor Bostrom: One can point to specific technical skillsets that would be useful. The data scientist role seems to be one where there is increasing need for somebody who has the technical chops to dig through big datasets and do statistics on them but also the business acumen to try to figure out something useful for the business that would affect the bottom line and the ability to communicate that. It is a hybrid of the traditional nerd type but also somebody who can spot opportunities in the economy. In a wider sense, of course, the future economy will need a very wide range of skills. Most people will not be doing technical work with computers. A big chunk of the economy will be taking care of other
people in some fashion—in the healthcare system, with the elderly, in tourism and in service industries—so very different kinds of qualifications will be needed.

Perhaps the most important thing, though, is to inculcate the mindset that skills are not something that are foisted upon you in school, you are a passive recipient and then you continue on for the rest of your life with the skills you were given, but rather that if there is some skill that you need and that you have the confidence to try to learn, either just by browsing the right website—there is so much beautiful material now: instruction videos, online courses, infinite opportunities really for somebody who has the time and inclination to learn themselves—or by joining some continuing education course and having that sense that you can and that it is up to you, is probably more important than any particular skill.

The Chairman: That is really interesting. Thank you.

Baroness Garden of Frognal: Is there a call for some changes in teaching methodologies in schools, which obviously are adapting all the time anyway? You are talking a lot about self-learning and not following manuals but learning from peers, and there are lessons there, are there not, for our school education system presumably, too?

Michael Gleaves: I have a seven year-old, so I bought a Raspberry Pi and I tried to get her to do a bit of hacking—it takes a while—but that is not what they are teaching them in the primary schools, unfortunately.

The Chairman: No. We have already had evidence from somebody who said that the best thing that we could do would be to make sure that every child had a Raspberry Pi, and that would move them on.

Michael Gleaves: They are great little devices.

The Chairman: Thank you very much.

Q33 Lord Giddens: I wonder whether I could ask Professor Bostrom to quickly say a bit about his book *Superintelligence*, because I think it might interest the Committee. It seems to me we are at the outer edge of this amazing global surge of change, and we just do not know what the reality is going to be. You probably do not want to talk about the simulation argument.

Professor Bostrom: If one is taking a wider perspective and looking at that longer term, at the moment, and for all of human history, the human brain has been where it has been at regarding information processing. It is the only general intelligence system that we have had, which is why humans have created these complex civilisations and why it is us rather than the gorillas who are running the show. It is because our brains are slightly different from those of our ape ancestors. At some point, I believe that machines will surpass us in general intelligence and then, for precisely the same reasons that we are now powerful compared with other animals, machines will be very powerful at a later time.

Lord Giddens: You think the point of singularity might be quite a long way off from the one like Ray Kurzweil’s?

Professor Bostrom: Nobody knows with any precision how far off these kinds of developments are. Therefore, rather than picking an arbitrary date or dismissing it, one should think in terms of probability distribution smeared out over a wide range of possible arrival dates. It seems that there is a fair probability that it can happen by mid-century or at
Professor Nick Bostrom, The Hartree Centre and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)

least before the end of this century, but it could happen much sooner or later. The consequences would be momentous. It would be the most important thing that has ever happened in human history, with enormous dangers, and it would be key to try to set up the initial conditions so as to make such an intelligence explosion survivable. But for more details on that I would urge everybody to buy a copy.

The Chairman: Summer reading, yes.

Lord Giddens: We are not going to buy it, we are going to get it free online, are we not?

Baroness O’Cathain: We are now building up a booklist.

The Chairman: We are. We are going to have a summer reading list.

Baroness O’Cathain: Can we make a note? The Fourth Paradigm and then this book by you, so please note.

Q34 Lord Giddens: There is also this famous computer simulation argument that we might all be in a computer game and you can demonstrate this mathematically. Anyway, I do not want to waste the Committee’s time.

I feel that all these general issues are very relevant to the immediate on-the-ground ones—the reason why I asked it—but I would like to push you a bit on what you would say about the impact of supercomputers and robotics on the labour force and the processes of deskillings as well as upskilling, because Dr Frey and our Committee have written extensively about these and it seems to me that it is another wave of change and it is hard to grasp what the significances and consequences will be. Will supercomputers knock out a whole range of jobs in the labour force?

Professor Bostrom: Yes, there will certainly continue to be turn in the economy, new jobs created and old jobs disappearing, perhaps faster than the usual rate. To me the main reason why this big picture thinking is relevant for present day concerns is that it is not always obvious otherwise what the right direction is that we should be headed in. If one is concerned about the very long-term outcomes for humanity, it is not at all clear to me that we would want faster progress in computing technology, for example. I think that hastens the day when we will have superintelligence and maybe we would be better off with more time to prepare for that, but that is a bigger discussion.

But if one is just looking at the local benefits to people right now and for the next decades, it seems faster progress is good because it boosts the economy in the short term.

The Chairman: Thank you. Does anybody else want to come in on that?

Kevin Baughan: We have done a lot of work in robotics and autonomous systems, and a strategy has recently been published from the organisation. There are several dimensions to that, one of which is about pushing our boundaries, being able to go into places that are more dangerous, more dirty and more difficult than we would normally be able to as humans, and that is the inevitable direction that humankind has always taken in finding tools and vehicles to do those kind of things.

You could take another example and say, “What about driverless cars?”, but is it yet within the comfort range of most of us around the table to get into a car in a driverless environment? We are probably a little bit away from that. At the moment we are quite happy to get into a pod at terminal 5 and find ourselves delivered from the car park to the
Professor Nick Bostrom, The Hartree Centre and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)

airport. Fully autonomous systems will take some steps to get there. But at the end of the day is it about transport in the city becoming so congested that you need different types of solutions in order to make it work? If you did not have to drive a car, are you now more productive with additional leisure time and work time that you could have used when you were behind a wheel trying to negotiate your way through a difficult piece of congested area?

Every time the autonomy or the robotics brings in a change, at the same time it frees you up to do something else. If we are constructive about that transition, suddenly the productivity rises, or your own personal enjoyment rises, because in the time you would have spent driving your car you are now able to relax and enjoy it, and when you get to the destination, just as you would in a coach or an aeroplane, you are just grateful to have had that extra time to be able to get there.

It is definitely one that you have to think through, and quite often the benefits come through stronger than we were expecting. Quite rightly, the first step is to be concerned about the change, but then quite often the benefits flow through more strongly than everyone was expecting.

Michael Gleaves: I would just like to make a point. I was lucky enough to go round a Mercedes engine plant in Stuttgart six months ago, and that site has 120,000 working people on it but only five on each line with 12,000 engines, who are making the engines. So I asked the guide, “What has happened to the people who made the engines?”. They have been redistributed through the business into marketing, design, engineering, so the same number of people were working on that site but they just were not doing the manual construction any more.

The Chairman: They had planned it properly.

Michael Gleaves: They planned it properly. They had moved those people into the tourism, marketing, sales and design aspects of the Mercedes, so businesses can manage that difference if they maintain that high-value product.

The Chairman: Thank you, that is helpful. Lord Kirkwood.

Q35  Lord Kirkwood of Kirkhope: I am interested in inclusion and inequality, but I have a couple of quick questions first to Michael Gleaves. I am finding it harder and harder to sound fashionable at dinner parties these days. Can you explain to me what a petascale supercomputer is?

Michael Gleaves: Yes, I can.

Lord Kirkwood of Kirkhope: In six sentences.

Michael Gleaves: You flip a zero and a one and that is a byte, effectively. A petascale computer can do $10^{15}$ of those a second. That is it.

Lord Kirkwood of Kirkhope: I am really glad I asked that question.

The Chairman: You can read that answer in the transcript.

Lord Kirkwood of Kirkhope: I know. That is not a dinner party-type answer.

The Chairman: He goes to unusual dinner parties, clearly.
Michael Gleaves: The dinner party answer is it takes 10 minutes to run on a petascale system and 16 years to run it on your iPad. That is the dinner party conversation.

Lord Kirkwood of Kirkhope: That is what I was after, thank you.

Another question, Mr Gleaves—possibly the hardest of the morning. Why are you in Warrington?

The Chairman: There are all sorts of things in Warrington. I object to that.

Lord Kirkwood of Kirkhope: There is a reason for this.

Michael Gleaves: I am part of the Science and Technology Facilities Council, and I am based at Sci-Tech, Daresbury. A synchrotron used to be based there, and the first supercomputers arrived at the Daresbury Laboratory in 1957. They bought two: one as a control system, one as a data acquisition system. We have had supercomputers at that site ever since. The large facilities for Science and Technology Facilities Council are now mostly hosted at the Rutherford Appleton site, but at the Daresbury site we do compact LINAC design as well as supercomputing modelling simulation and virtual engineering, and a small cluster of businesses are formed around that. A cluster of 140 SMEs are on the campus, which are associated with the work that is done as part of the STFC science programme.

Q36 Lord Kirkwood of Kirkhope: That is a very good answer, and I am glad I asked that. Martin Wolf gave us some powerful evidence and referred to what Paul Krugman had done, which suggested that the clustering overwhelmed some of the aspects of industry itself because of competition for skills and all the rest of it. Should we worry as policymakers about these fantastically highly spec clusters of skilled people around physical facilities such as supercomputers and the inequality that that almost inevitably brings?

I was very interested in your Mercedes answer just a moment ago, because that may be part of the solution. But how is this going to affect Easterhouse in Glasgow? The communities are struggling to do anything. The evidence I heard earlier that glancingly discussed this is that you cannot stop the science, and you would not want to. I think Professor Bostrom was saying that we had to deal with it through redistributed tax and benefit policies. Maybe that is the answer.

This is going to have a massive impact. If everything that can go right does go right, you get your wishes and you predict the future accurately, inclusion and inequality are going to be a huge issue for policymakers. Maybe you will say that it is not your job. What should we be thinking about now to try to address it?

Michael Gleaves: Clustering is definitely a positive effect. If you look at the 120 or 140 SMEs that we have around the Daresbury site at campus that I understand quite well, some of these guys just rock up with an idea. They have no intellectual property, they have no funding, but by putting them in the community where everybody is trying to innovate in the same way, they have accountants, lawyers, infrastructure and ecosystem around them, access to TSB funding, help with that process, and access to EU funding. We have only lost three of these companies. Well, we lost seven but three of them have re-emerged, have phoenixed, so they have been combined with a different company to have a different product and service. Those are incredible figures, and that is the clustering effect. To wipe
out those clustering effects just because you want to smear it across the entire country seems wrong to me. It does not seem logical.

Then you are looking at what the policy instruments are to help the areas that do not have those clusters around them.

**Lord Kirkwood of Kirkhope:** But you would say that we would be right to do that right now: let you get on with what you are doing because that is what you know.

**Michael Gleaves:** So you encourage clusters and then you think about how do you drive up the level of opportunity in the other areas.

**Lord Kirkwood of Kirkhope:** But these two halves are equally important to try to get a sensible connection.

**Michael Gleaves:** Yes.

**The Chairman:** That is helpful. Does anybody else want to come in?

**Kevin Baughan:** Just briefly, to show that clustering can happen in every sector. If we look at digital being diffused through all kinds of different industries, we see that we get clusters appearing all over the country as a result of different sectors doing different areas. We have different forms ourselves to try to stimulate some of those effects. We have the catapults and the big innovation centres, which are a cluster in a building in the sense of bringing academics and industrial and facilities together all in one place, but we also have much smaller ones, such as information knowledge centres: we have one out in Belfast in Northern Ireland on security. That is flourishing. A whole lot of small industries have appeared on that domain or go to medical technology up in Leeds, and you have another set of industries appearing around that, so I think clusters will occur in every subject.

**Lord Kirkwood of Kirkhope:** That is a very helpful answer, but answer me this. Are these clusters self-forming or can government say, “Easterhouse is in a bad way in Glasgow. We want a cluster there for whatever”, and stimulate it? Can they say, “We want to go to a community that is disadvantaged. We want a cluster in whatever”?

**The Chairman:** Does there need to be a university connection as well, because in previous evidence in previous sessions we had that very strongly?

**Kevin Baughan:** We can only draw on our experience, which is we apply these things from a national basis. We do not look to drive them from the local side up, but that is not to say that somebody who is more experienced in a local community with local knowledge can understand what could be done there. Our approach is top down. We are coming at it from looking at the national interest, and then the competitions yield where the best location is. So we follow the opportunities. That is not to say that somebody with local knowledge could not understand what a useful cluster could be, but it would have a different shape to the ones that we create.

**The Chairman:** Lady O’Cathain, do you want to come in, since your question carries on from this, does it not?

**Q37 Baroness O’Cathain:** It does, indeed. How can girls be inspired and encouraged to choose STEM and pursue careers in the technology industry at an earlier age? I have my own views, but we are here to ask you.
Kevin Baughan: I am happy to start. I would like them just to believe that it is an integral part of what they are studying. If they are studying art and they are designing on an iPad, they are in a digital domain and digital world and can be just as creative as if they were sculpting and with brushes and paint and the rest. If they are studying biology, they could use it to see simulations of what is going on inside the human body and how biology works; they are inside a digital domain. So I would like to see digital becoming so infused that it is not seen as an engineering subject or any other barrier that might put girls off studying it but as just a tool that all of us can use to enjoy whatever we are pursuing, and make it more creative and more invasive in the different areas that people want to be in.

Baroness O’Cathain: The trouble then is the teachers.

Kevin Baughan: But the teachers could have fantastic resources, and this again is when you can use the power of digital. The big supercomputer centre could be a huge enabler. While there might be a cluster of expertise around it, the benefits from it are in the Cloud and available to everybody, so people could come in from any school, reach in and see a simulation that was running on a supercomputer wherever they are in the country. We have to learn to use the power of digital to also take the benefits back out to everybody.

Baroness O’Cathain: That is what I hoped I would hear. It is a bit like the Raspberry Pi, is it not?

Kevin Baughan: It is.

Baroness O’Cathain: We have to hold on to that and make sure that everybody has the right—of course the computers have to be produced.

Kevin Baughan: If a teacher is running through a simulation of their subject area, it is not so daunting for them to enter an ICT world because it is just showing in a more powerful way what they would have done on a textbook or on a blackboard.

Baroness O’Cathain: It would make it much more stimulating.

Kevin Baughan: Yes.

Baroness O’Cathain: Thank you.

Q38 Lord Aberdare: Can we think a little about infrastructure and what the UK’s infrastructure needs are to support a more digital technology-based economy? We have thought very much in terms of hard infrastructure like broadband, wi-fi and so forth, but what elements of infrastructure are needed for the availability of information, for example—I know libraries have concerns about that—or coding skills? Thinking about both hard and soft infrastructure, what could we do to improve that?

Michael Gleaves: We have benefited from the infrastructure funding from the E-infrastructure Leadership Council; I am sure they have presented at this Committee. David Willetts and Dominic Tildesley led an e-infrastructure leadership committee, which was a road map for 10 to 15 years on computing, modelling simulation and the application of that to industrial domains.

I think that, yes, there is an investment in hard infrastructure, but there is rarely the investment in the software, the algorithms and the programs that sit on that. If you imagine that they are the platforms for science for which the applied scientist comes and does the research, those investments in software, hardware and then Cloud or the bandwidth are just
the delivery mechanism that gets it out to the users without them having to physically be at the centre.

Another aspect that is important in this is visualisation. One of the things that in the short term can make a real difference to an engineer or scientist is returning the revisualisation of the results of their simulation or data-run analysis, and that empowers that scientist to make a better decision. It puts them in the loop rather than removing them from the workflow altogether, and that is a more empowering way of returning these simulations. So investment in software/hardware simulations is important.

Professor Bostrom: I think having strong broadband and moving to 4G can be helpful, not only because of what the immediate utility of these technologies are but also by being among the earliest countries that move in to the new regime. You will also be among the first to start to experiment with it, so you are more likely to develop the companies that take advantage of this: what you can do on 4G, for example, if you are one of the countries that introduced it first. There could be the spill-over effect for innovation.

Harping back to our earlier discussion about clustering effects, I do think it is important to allow the clusters to develop and reach critical mass, but one way in which one could mitigate the geographic impact of that would be to strengthen communications networks, whether it is roads or railways. It has the same effect of making the whole cluster larger, because it is not the number of miles between two points on the map, it is how long the commute time is. More people could participate in a cluster because the communications are better.

Kevin Baughan: Mike and I were talking earlier about an initiative going on at the moment inside the E-infrastructure Leadership Council, which is looking at “Onramps”—the title they have for them.

Lord Aberdare: What?

Kevin Baughan: Onramps, like an onramp to a motorway.

Michael Gleaves: It is a terrible name.

Kevin Baughan: It is a terrible name but it is the one that it goes by. But what is it after? It is trying to find a way to allow industries in a sector to gain access to high-performance computing and the appropriate codes of software that allow them to run on that, and I would also like to see a more vertical integration of data analytics. I think there is a movement afoot that is there as an investment now. Because it is moving up above connectivity, it is into data and the application of those data, finding ways to then allow industry sectors to have a focal point to understand how to get to the computing resources, the data skills and the visualisation skills that they need for their particular area. The three that have come forward that are the strongest at the moment are in the construction industry, in manufacturing and in finance, but creative industries are there as well, as are life sciences with the digital design of medicines. Each sector is starting to come forward to look at how an investment could be in infrastructure in a slightly different form because it is in a digital space. It is more about data, it is more about analytics, it is more about visualisation, it is more about finding access to things than building pipes.

The Chairman: Lord Lucas is going to nail you down a bit now.
Q39 Lord Lucas: What one change would you urge on us as politicians, through government, that we could make effectively? How would we do it, and at what cost, to improve our digital competitiveness?

Michael Gleaves: I wrote three down but I will go with one.

The Chairman: You can give us the three. We do not mind. Give us your top one and then the other two.

Michael Gleaves: The main specific centres of excellence, the main skills such as adding the digital savvy skills to the main expertise, are the key aspect.

The Chairman: How? What is your policy recommendation? You have given us quite an optimistic picture, I think, of some great stuff happening, and our questions back to you are: how do you make that happen more? How do you spread what you are talking about? How do we put it into practice?

Michael Gleaves: I think you look at market sectors. The north-west of England is strong in chemistry and material science in effect. That cluster is there, so it makes sense to place the main specific application of graphene technologies or new lightweight material technologies in that area. Glasgow has a heavy industrial heritage and perhaps you would look at something in that area to try to build a cluster around that. I think that those act as melting pots and things for things to cluster around to demonstrate that capability.

The Chairman: That is helpful.

Kevin Baughan: I had a very similar comment, which is a kind of one liner: do not make the next phase of digital an evolution of ICT. I think there should be a real break point in that so that we then inspire everyone to get involved. How do we do that in a powerful, cost-effective way? I think that comes back to the observation of using the power of digital to do that. If there is domain expertise in a particular area, do not be frightened to use the power of digital to take that out into every school or every college or every university. Do not confuse the fact that it is centralised for where it happens to be created with the ability to take it back out again. I think the costs are more controlled because you might be doing it once centrally but you then distribute it nationally. If we put those two pieces together we start to get a formula that might work.

Professor Bostrom: I think there will be a massive premium in the digital economy on being able to attract the top global talent to your country, and there should be policies that could help with that. You can imagine that instead of just passively sometimes opening the door to immigrants and sometimes closing it, you could have a headhunting programme where you might advertise in countries where there are few opportunities to try to attract bright, young people without means to come here maybe to study. If they started a company during those years, they might have the opportunity to get to citizenship, so maybe we could embed them during their period here with opportunities for entrepreneurship and put them in contact with networks of mentors and locals. We should seek them out and make an active effort, just as a company would do that tries to recruit the best: they do PR, they look around, they go to job fairs and advertise in all kinds of places. Countries might want to consider doing the same.

The Chairman: That is a controversial note on which to end. Thank you very much indeed. That was a great session.
Dr Jo Briggs – Written evidence (DSC0083)

1. I am Principal Investigator on an Economic and Social Research Council grant awarded to survey crowdfunding platforms and practices in the UK. This evidence shares early findings from my research but is further informed by my previous experience. This includes as Director of an undergraduate BA programme in Digital Media, which combined strands in design, computer programming and cultural theory to effectively prepare students for the creative industries. Subsequently, I undertook research into digital literacies and identity construction during a practice-led collaborative PhD which investigated the creative technology elements of Northern Ireland’s Revised Curriculum.

2. UK Crowdfunding

Online crowdfunding platforms enable individuals, groups and businesses to raise money through the solicitation of multiple micro-payments from ‘the crowd’. The three main types of crowdfunding are (UK platform example in brackets):

- **Rewards-based** which solicits money by offering a reward (Crowdfunder73);
- **Donation-based** which enables social innovation, where no tangible reward is exchanged (Spacehive74);
- **Equity**, which is profit driven and where investors enter into formal contracts with business start-ups and other enterprises (Crowdcube75).

There is a fourth, rapidly growing associated area of peer-to-peer or peer-to-business **lending**. One example of this is Funding Circle76 which enables lending to established businesses at pre-agreed rates of interest.

3. In the UK the economic value by crowdfunding type during 2013 was estimated to be £20.5m for rewards-based, £310m for donation-based (incorporating peer-to-peer fundraising) and around £28m for equity-based.77 What is striking are the equivalent annual growth rates — 387 percent for rewards-based and 600 percent for equity-based78. The chancellor George Osborne recently discussed crowdfunding as being part of the FinTech evolution of the UK financial sector.79 Meanwhile, the business press has cited London as the emergent global centre for equity crowdfunding.80 Yet, there is a lack of knowledge and understanding around crowdfunding’s wider disruptive and longer-term impacts across its multiple domains of operation, which clearly presents opportunities for research.

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73 www.crowdfunder.co.uk
74 https://spacehive.com
75 www.crowdcube.com
76 www.fundingcircle.com
78 ibid.
80 Moules, R. 'London emerging as world leader in crowd-funding' FT website15 August 2014 http://on.ft.com/1ujSuji
4. Facilitating Flexible Access to Finance
Crowdfunding platforms have enormous potential for facilitating a range of businesses, from start-ups to large firms, by providing flexible ways of raising capital. Companies may raise more modest sums than those associated with institutional investment81. While several local authorities, including Newcastle City Council, have launched non-bank lending schemes in partnership with Funding Circle to enable local businesses to acquire loans.

5. Other Benefits to Rewards-based Crowdfunding
Campaigns on rewards-based platforms enable market research and 'pre-sales' to take place prior to expensive product development. The number of rewards pledged and paid for by backers during the campaign determines the number of products then produced and distributed by the campaign founder. Other apparent benefits include: the mobilisation of business start-ups and relatively quick and easy access to desirable overseas markets. Further, UK platforms have innovated around community crowdfunding by partnering in Government and charity match-funding initiatives82. Citizens with a good idea and the necessary digital skills may produce a project campaign and potentially double its budget — and social impact — through matchfunding.

6. Challenges: Lack of Awareness and Ambiguity
Participation in crowdfunding is growing at an extraordinary rate in the UK. However, the crowdfunding phenomenon is only just emerging into wider public consciousness. One key challenge is how to raise understanding of its potential and motivate participation. However the heterogeneity of platforms and practices and ambiguity of associated terminology are just one challenging issue to overcome.

7. Digital Skills: Audio-visual and Wider Media Literacies
Digital skills issues include the range of competencies necessary for designing and managing an online crowdfunding profile and campaign. It is not enough to have a good idea or product as that idea or product must then be represented in an appealing way through written description, photographs and/or video.

8. Here, issues of enabling democratic access and diverse participation present some challenges. Meanwhile there is a whole new crowdfunding-associated industry of PR, marketing, social-media and video production companies which facilitate the design and management of crowdfunding campaigns to further advantage to those with the necessary financial resources.

9. Design Solution
I’m working with a range of civic and industry stakeholders in a 'community of crowdfunding practice' which is awareness-raising and exchanging knowledge in an informal series of networking events, 'how to' seminars etc. We are currently exploring how to produce a stakeholder-engaged, research-informed and contextually appropriate crowdfunding support tool or 'toolkit'. This will complement the ongoing 'offline' activities outlined above,

82 'Crowdmatch Challenge' Buzzbnk website http://crowdmatch.buzzbnk.org/how-does-it-work/4580214310
bringing together relevant information about the various crowdfunding platforms, link to existing information from the regional business support agencies, Business and IP Centre etc. We are also producing a small number of case studies and a step-by-step 'how to' guide on the design and management of a rewards-based crowdfunding campaign (including tips on producing a video), all in a Newcastle-upon-Tyne context. Many of the digital and cultural literacies which are required in this context bring together practical, creative and aesthetic know-how which aims to further enable take up, productive and democratic use of the platforms.

5 September 2014
Bristol City Council – Written evidence (DSC0126)

Introduction and Background
In the current age where all of the world’s information and knowledge is just a mouse-click away it’s reasonable to imagine that sometimes this sheer volume of data obscures or conceals valuable opportunities. So perhaps it’s understandable that Bristol missed the original call to submit evidence to the House of Lords Committee on Digital Skills.

Bristol is a leading Smart City, and has a considerable track record in this area, so is delighted to be able to submit our input at this later stage in the process. This evidence was collated very rapidly by the City Council’s Digital Apprentice and so is necessarily a ‘highlights package’

Interviews were conducted with key individuals (including our Digital Apprentice) to reflect the perspective of academia, industry, the community and the Council in this important agenda.

Full transcripts of these interviews are set out below. The videos themselves can be found at http://youtu.be/7ETkvecbCQ4.

Transcripts of Interviews
Dick Penny, Managing Director, Watershed (http://www.watershed.co.uk/)
INT: So if you could tell me a bit about yourself and what it is that you do.
RES: Yep. Hi, I’m Dick Penny. I’m Managing Director of Watershed in Bristol.
INT: And how does your organisation work with others to develop the digital sector and innovation in Bristol?
RES: I mean we’ve been working in the digital space in a really serious way since 1991. In 1991 we set up a digital dark room so we had chemical photography facilities here and, of course, in the ‘90s photographers were using Photoshop a lot so we set up a digital space for photographers. And then in 1999 we participated in a big University of Bristol Computer Science experiment, which was what would the Media industry do with serious bandwidth. So in 1999 we hooked up to 155MB synchronous, always on, fibre and we realised that the Internet was going to change the world.

So since then we’ve been working with university researchers, big corporates like HP, artists, SMEs, communities – really exploring the potential of this new technology. And it is still a very new technology. It is still changing all the time and so we’ve helped people to learn through making it work; it’s always been about ‘do real-world projects’; don’t do skills – do real-world projects that have meaning for you and along the way you will find the skills you need.

INT: And what lessons have you learned that you would most like to share with others starting in the same work now?
RES: I think the most important thing is that there are no rules in this space – we’re all still making it up. Innovation’s about doing something you don’t know how to do. I think too often structures are in place that say you have to achieve a particular goal. If it’s a known goal it’s not particularly innovative, so you have to be prepared to take risks but you have to really rigorously assess how ... what you’ve achieved and what you’ve learnt, what other people have learnt. So it’s all about crowding diversity, different people, different backgrounds, different skills so that you all learn together and you learn from each other. Because, at the end of the day, the technology is only a tool to allow you to do something and it’s what you do with the technology that really matters.

INT: Okay. What could government do that would most help increase the impact of your work?

RES: It could provide funding that didn’t have so many silly rules attached to it. Funding schemes are always over-prescriptive. Someone tries to design the outcome, so you’re asked to apply for some innovation money and you have to tell them exactly what you’re going to achieve – which is ridiculous. So free it up a bit, take some risks along with the communities, the practitioners and the researchers.

INT: Great – thank you for your time.

RES: That’s alright.

Julie-Anne Burrows, Project Co-ordinator, Get IT Together (http://bristol-getittogether.btck.co.uk/)

INT: So if you’d like to introduce yourself please.

RES: Hello, my name’s Julie-Anne Burrows, I’m a part-time project co-ordinator of Get It Together Bristol. I’m employed by Citizens Online and the Get It Together projects are UK-wide and we’re just nearing the end of our three year funding that we’ve received from BT.

INT: So how does your organisation work with others to develop the digital sector and innovation in Bristol?

RES: We’ll we’re quite unusual because we’ve come in with a specific brief. Our role is to offer free digital skills training to people over 55, carers and disabilities. And what we’ve chosen to do is have a model where we work in community venues, such as libraries and we run a five week course and we have a team of volunteer tutors to deliver it. So we work with libraries and we also work with organisations such as Age UK and Link Age.

INT: And so what lessons have you learned that you would most like to share with others starting in the same work now?

RES: The big picture is that there are challenges which have been recognised really in this year’s Digital Inclusion strategy. We’re aware that there’s a large number of older people who voluntarily exclude themselves – and that is a static figure. What we need to look at is what’s the most appropriate delivery model for older people and really its embedded outreach. What we offer is we offer courses, so it relies on people seeing posters, phoning us up and having the motivation and the interest and the confidence to come along to a
group. The people that we really want to reach are the people that have multiple barriers to getting online; the people that are multiply disadvantaged need the push. We need to be going out; we need to be going out into the community to where people really are. Most older people when you ask them don’t understand the benefits of being online and until there’s a large-scale advertising campaign, similar to digital TV switchover, where people were made aware of the changes that were going to happen with Universal Credit, where people are aware that in order to access government services and health services they need to be online, people will not see the relevance.

So the lessons is, we know that you’ve got to be local and informal and friendly and start from scratch. We’ve learnt about how best to work with groups of people and the resources that you need to engage. But really the main message is there is a large number of older people that are getting further and further behind. They’re scared, there’s a stigma attached to not being online, there’s all of this new digital language which I think makes people feel very excluded. So I think the lessons are for older people you need a specific strategy; you need specific marketing, you need to by hyper-local, you need to be trusted and the work that you do needs to be relevant.

If this training and support is not provided, what we’re going to have a greater digital divide and the people that are isolated and not involved and are not participating – that gap is going to get wider and wider. So my hope for the future is that there’s going to be sufficient resources put into a local level to enable the good work that is already going on to continue and develop.

INT: So are there other ways that the government could help to increase the impact of your work as well as resources?

RES: There’s a lot of really, really great reports out there that say how important it is. It all comes down to resources. Most digital inclusion work in the UK has been down to volunteers and there’s some great, positive outcomes from some inter-generational work. Bristol’s a city of service, so there’s lots of potential for drawing in unpaid workers as digital champions. There’s a great deal of goodwill and there’s skills that people want to share. But this isn’t free. So even if services are delivered by volunteers it needs coordination, it needs overheads covered, it needs administrative costs. So what would be really great in each geographical area is for there to be a named person – somebody that says, “okay, there’s going to be channel shift and we need to be ready” and then draw on all the assets that are already in the community to capacity-build them, to coordinate activities to enable people to make the best use of the time and the energy and the money that they have so in a geographical area, let’s all get together.

And the resources that the government can provide is some kind of leadership to say, “okay, in this area, who’s in charge? Who’s going to bringing this together?” The local government obviously is focused on saving money and making sure that their digital offer is accessible and I know that in the strategy of this year there’s a whole piece of work on assisted digital, where the government recognises that there’s going to be a number of people that, for whatever reason – for disability – are not going to be able to independently get online – and that needs to be part of a cohesive strategy as well.
Bristol City Council – Written evidence (DSC0126)

So linking in, in a geographical area, capacity-building, supporting and saying, “if these changes are going to come in, we need to prepare people so that everyone ... all of our citizens can move forward together”.

INT: That’s brilliant. Thank you for your time.

Justin Ricks, Green Digital Programme Manager, Knowle West Media Centre, (http://kwmc.org.uk/)

INT: And so if you’d like to introduce yourself please.

RES: Yeah, my name’s Justin Ricks. I’m the Green Digital Business Programme manager for Knowle West Community Centre. I run a programme which is a European-funded programme about looking in the community and looking at needs in the community that need to be solved with perhaps enterprising or innovative ideas, using green and digital technology. What we’re trying to do is find where people can become involved in those, local community members, and turn them into an enterprising idea with business.

INT: And how does your organisation work with others to develop the digital sector and innovation in Bristol?

RES: So we work in a local way with a very local community at Knowle West, but we also work city-wide and regionally, nationally and internationally. We’re a member of the European Network of Living Labs, which is called ENOLL, and that’s about really looking at how can you look at local issues, local concerns of our community and address them with perhaps best practice and learning from a network across Europe really.

So we have identified ways of really working as like a living lab in the local communities and organisations can ... businesses work with the local community to find solutions for community issues using the network, using digital technology as well.

INT: What lessons have you learned that you would most like to share with others starting in the same work now?

RES: Well we now have I think it’s four key areas of work which we feel out of that’s come a lot of learning so we particularly work with people around looking at digital manufacturing and technology that could find solutions for helping people find new forms of employment that are out there, address issues of green technology as well. We feel that some of these new technologies they ... we need to evaluate if you like really what actually happens with this technology, what the benefits are. We work with a group of young people called Junior Digital Producers, we work with young people about helping them find ways of developing their creative practices and find ways of getting into the creative industries and sometimes we call the first job/second job so it’s easier to find a way of getting your before-career job by having a job in the first place – so we have internships that last for six months.

We also work with local communities around using digital technologies to address issues like using applications, mobile phone apps to look at how we network and help local communities gather if you like information, share information – particularly around food and some projects that are going on in the area. And then the latter area, which is probably our first area of getting into digital inclusion where we very much work with a wider group of the
community – so it’s sort of technology for all really – but by looking at ... well the increasing services and access needs of say things like the local authority services etc need people to be increasingly aware digitally and, therefore, we’re trying to help them, Paul, with learning those digital skills and no be left behind really.

And so the learning I guess out of that has been we’ve got to work with local people to find ... to know those things that come round because we’re saying, “we’re going to do this” and it’s more about what is the need in the community. So we really work with the community and talk to community members about what are their needs, what are the issues in the community, what would they like to have happen in the community and what can we address? So we’d also ... really good to start there and really embed in the community.

We have been based in the community so I think there’s a credibility there and working in the community – not just coming in to the community, not parachuting in really.

Also I’d say it’s very much about collaboration, we don’t feel that other organisations are competition and we feel it’s much more about collaborating with other organisations and local authorities – local businesses as well really. So we’ve worked with the university ... so, you know, a real diverse sector to have an impact for the local economy.

But the really big thing that we feel is really important is evaluating the work and building that in from the very beginning. So planning evaluating before you even start a project because then you can constantly be evaluating as you’re progressing and deciding if there’s a need for change in the project or, actually, perhaps you need to not change it – even though it’s not going in the direction you maybe thought it would, there’s a real need to not change direction because that would be ... that would not kind of be correct for the aims and objectives of the project in the community.

INT:  Also, do you feel the government could do anything else to help increase the impact of your work?

RES:  I mean I think definitely from the work with the young junior digital producers, they’re very much trying to get more access and open access to data and information that could be in the public domain; it’s certainly easier from central government. So they work a lot with digital visualisation and helping young people understand what’s going on from things like democracy through to citizenship and becoming really active citizens as it were really. So we call it community activism really, so it’s kind of being engaged in our community. So by having open access to information and having it easy to understand and visualised is really important. So government departments could make that perhaps more available than it is.

We also feel that they could look at new ways ... and a really good example we’ve got of how a local authority is approaching it very differently and uniquely is there’s a local development called Thornbury Business Park and they’ve looked at procuring furniture to be made in a more innovative way locally, with digital manufacturing techniques. But also to employ local people to actually train and develop to be able to make that furniture. So we’re using things like CNC machines, laser cutting to make that furniture. They could have just gone out and procured commercially and looked at it as just a very purely commercial project so what we’ve pitched at them and they’re very progressive in their thinking about
this, is more of a training programme where they can procure local organisation, employing
and training local people and still produce the end product to the standard and quality that
they want and, in fact, we believe it’s going to be of a higher quality design aspects and the
local buy in really – so what we feel we bring is that added-value to procurement if you like
really – it’s not just a chair, it’s more of an investment of somebody’s time and energy and
local ownership of what’s been made.

INT: Brilliant. Thank you for your time.

RES: Can I say one other thing. Because I know it’s always the elephant in the room but I
think certainly a lot of the activities that are carried out do need a degree of funding to carry
them so it would be ridiculous not to say that, actually, something that could really help is
sort of longer-term funding; sometimes, more sustainable funding for community
organisations because sometimes they’re trying to address longer-term social, economic
regenerational issues which cannot sometimes be solved with short-term funding. I know
it’s kind of a message that people are very aware of but I think it would be very important to
say that – that feedback – that kind of degree of sustainable income on a longer-term basis
certainly would allow organisations like ours to work much more in partnership with
government, local authority and have higher impact.

INT: Thank you.

RES: Okay?

Nick Sturge, Centre Director, Engine Shed and Set Squared, (http://www.engine-
shed.co.uk, http://www.setsquared.co.uk/)

INT: What is your name and role of the company you work for?

RES: Okay, so my name’s Nick Sturge and I do two things; I’m an employee of the
university and I run two projects at the University of Bristol. One is the SETsquared Centre,
which is an incubator for high-tech, high-growth start-ups and also Engine Shed which is a
container if you like for multiple assets of the innovation ecosystem.

INT: Thank you. How has your organisation worked with others to develop the digital
sector and innovation in Bristol?

RES: Okay, so two angles. From a SETsquared point of view we’ve accelerated about 160
companies in the high-tech, creative and digital sector – more in the high-tech end of
creative and digital but, nonetheless, supported the high-tech ecosystem and encouraged ...
promoted the concept of entrepreneurialism which itself has had an impact on innovation –
and also raised the profile of the city.

With Engine Shed we have a broader focus than high-tech; so we’re also interested in
creative and digital and we are working with other organisations to help focus activity. So
we’re doing work with the high-tech sector group of the LEP, the creative sector group of the
LEP and working with schools to help encourage young people into the creative and digital
sectors.
Bristol City Council – Written evidence (DSC0126)

INT: What lessons have you learnt that you would most like to share with others starting in the same work now?

RES: Okay, so it’s complicated because of where we are. Everything takes a bit longer than you envisage but that’s classic project management. I think that the biggest lesson is there is far more goodwill within the business community to help things move along than you might expect – so tapping into that is good.

INT: What could government do that would most help increase the impact of your work?

RES: Okay, so I think the government has to encourage all its agencies, be they local government, be they government agencies to just move quicker and be more entrepreneurial. So all sorts of agencies have a play from a real estate point of view to a skills point of view, to a ... from a devolution and local government point of view, the Innovate UK teams – all of those entities play a role in promotion of innovation and skills and encouraging young people into those sectors. Those agencies all have to be more collaborative and more entrepreneurial and we have to do ... make a step change in promotion of opportunities; real life work opportunities to young people. We don’t have an effective careers service at the moment – that’s a shocking gap – and that has to be fixed.

What is good for this change, but we’ve lost a generation, in teaching young kids IT, which was using applications not developing learning what computing is really about and coding – that’s now starting to be taught but we have to accelerate developing coding skills with young people so that they’re able to go into the jobs that are being created in bucket-loads.

INT: Great, thank you.

Stephen Hilton, Service Director, Bristol Futures, Bristol City Council (http://www.bristol.gov.uk/)

INT: If you’d like to introduce yourself please.

RES: So I’m Steve Hilton. I’m Director of a department called Futures at Bristol City Council.

INT: So how is your organising working with others to develop the digital sector and innovation in Bristol?

RES: So the Council has recognised the importance of the digital economy – very strongly I would say – at least over the past five years. Very practically we’ve actively marketed Bristol as a location for high-tech and creative businesses to locate. We’ve worked with existing organisations in the city, such as Watershed and the Pervasive Media Studio and Knowle West Media Centre in order to create showcase projects within the city that demonstrate the benefits of digital technology in terms of creating value for citizens, in terms of showcasing the skills and talents that exist within the city and really in terms of how we can use digital to think about different ways of delivering council and public services.

So, all-in-all, we’ve very much prioritised creative, digital, high-tech as an area that we’ve wanted to see more of and stronger activity within Bristol.
INT:  So what lessons have you learnt that you would most like to share with others who are starting in the digital sector at this point in time?

RES:  So I would say it’s about building on existing strengths. So in all areas in the current time there will be academics, businesses, citizens who are really passionate about the opportunity that digital technology brings and they might all have a slightly different starting point – I don’t think it really matters – I think the important thing is that the local authority sees itself as the convener of this network of interested parties and that it actively engages those parties in a conversation about how they can work together to use digital to bring about improvements or opportunities for that place. So it’s very much seeing the council as a facilitator of an ecosystem, rather than being the sole body they trust to deliver everything.

INT:  So is there anything else you feel government could do that would help increase the impact of the work that you do now?

RES:  So of course it’s always easy to say that the answer is funding and, of course, more funding is never a bad thing but I think it’s broader than that. I think what we see in government is that some parts of government have a really strong understanding of digital technology and how it can help to solve city or urban challenges, but that that is yet to be completely recognised across all aspects of government.

So I would really like to see all big capital programmes, for example, having an element which is around technology and innovation. I would like to see it being a much stronger theme within Health and Social Care. I would like to see DECC and Defra recognise that in terms of behaviour change in relation to energy or the environment then digital is a catalyst for getting people to consume differently. And I’d really like to see the role that Martha Lane-Fox played, as Digital Champion for government, I’d really like to see that role properly embodied within government, because I think it did help to bring about some understanding of the benefits of digital inclusion and we really need that sort of figurehead to continue to spearhead this at government level.

INT:  Thanks very much for your time.

RES:  Thank you.

Pete Britten, Digital Apprentice, City Innovation Team, Bristol City Council
(http://www.bristol.gov.uk/)

INT:  Hi Pete. I know you’ve been spending the last few days gathering all of the information for this report and doing all the videoing and interviewing of people across the city to make sure that we’ve got a good dossier of evidence. Now it’s my turn to ask you some questions. So please begin by introducing yourself.

RES:  My name’s Pete Britton. I’m an apprentice in the City Innovation team at Bristol City Council. I’m now hoping to move into a Building Futures role to become a District Project Manager.

INT:  So, Pete, how do you feel your apprenticeship has helped you develop digital skills for your future career?
RES: I already feel like I had quite strong digital skills before coming into my apprenticeship but what it’s actually taught me how to do is apply them in a real-world situation and use them to deliver council services - so using my knowledge of social media and online applications, being able to help promote the Bristol Computer Re-use Scheme and streamline it and bring processes to make it more successful.

INT: What lesson would you like to share with others starting a similar apprenticeship now?

RES: One thing that I’ve learnt in my apprenticeship is that apprentices can be very highly valued members of the team and just before you’re in the education role doesn’t mean that your ideas aren’t better than other people around you. So it’s all about being confident with the ideas that you have and sharing them and you can have quite an impact on certain projects and be able to influence change around you.

INT: So finally Pete, what do you think government could do that would most help increase the impact of apprenticeships like yours?

RES: I feel that there could be apprenticeships offered which put young people into higher impact roles, so rather than just admin roles, people could be placed in roles to train to be project managers and things like that – a lot of young people are coming out of school now with much greater digital skills than some existing employees of councils and other public services – so it’s good to be able to use those skills and get them higher up in organisations, rather than just having them down at the bottom.

Links to Further Information

A video of all of the interviews can be found at http://youtu.be/7ETkvecbCQ4.

The Watershed (http://www.watershed.co.uk/). Watershed is a cross-artform venue and producer, sharing, developing and showcasing exemplary cultural ideas and talent.

Get IT Together Bristol (http://bristol-getittogether.btck.co.uk/). Get IT Together Bristol have been running free computer courses for the over 55’s and people with a disability. These courses are for complete beginners, and look to support learners in building their confidence as well as skills.

Knowle West Media Centre (http://kwmc.org.uk/). Knowle West Media Centre work to support individuals and communities to get the most out of digital technologies and the arts since 1996. In practice, this means providing exciting and relevant ways for people to get involved in community activism, education, employment, and local decision-making.

Engine Shed (http://www.engine-shed.co.uk/). Engine Shed is a collaboration between Bristol City Council, the University of Bristol and the West of England Local Enterprise Partnership aimed at stimulating long term economic growth by supporting business, inspiring young people and showcasing to the public and potential inward investors the exciting opportunities that exist in the City region.

SETSquared (http://www.setsquared.co.uk/). The SETsquared Partnership is the enterprise collaboration between the universities of Bath, Bristol, Exeter, Southampton and Surrey,
supporting high tech start-up companies, providing student enterprise and enabling academics to maximise the impact of their research. The Bristol SETsquared Centre provides coaching, mentoring, workshops, business review panels, access to professional service firms and services, access to a global network, investor readiness training, investor showcase events, and access to the new Gigabit Bristol experimental network.

**Bristol City Council** ([http://www.bristol.gov.uk/](http://www.bristol.gov.uk/)). Bristol City Council is the Unitary Local Authority for Bristol, a core City with a population of almost 440,000. Bristol is a leading European Smart City and the only UK City to have won funding as a Super-connected City and a Future City Demonstrator.

*17 December 2014*
Q4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

In response to this question, the British and Irish Association of Law Librarians (BIALL)83, will be referring to those working in legal practice and studying in Legal Education as those who fall under the ‘wider workforce’ who will need to work in the increasingly digital environment as opposed to those with the technical skills who will be building the future digital environment. As BIALL recently contributed to the Legal and Education Training Review (LETR), this response is a summary of BIALL’s contribution to the LETR.

The Legal and Education Training Review84 identified that technology has the potential to play a significant role in legal service delivery and the delivery of legal services education and training. The BIALL contribution to the LETR was to highlight a skills gap in the digital literacy abilities of ‘Millennials’ (those born between 1980 and 1995) in the early stages of their legal careers; “They (trainees) used Google extensively and their searches tended to be shallow and brief”. 85 BIALL’s findings also confirmed one of the critical issues identified in the ‘Higher Education in a Web 2.0 World’ report, that while Web 2.0 technologies are widely used in education, information literacy skills have not translated automatically into the online environment 86.

The distinction that has been made by the Digital Skills Committee, to distinguish between the skills needed by the wider workforce and ‘technically (IT) skilled workers is a positive development that can demonstrate how information professionals (e.g. Librarians) can support the teaching of digital and information literacy skills by discussing them as a distinct set of skills in their own right, as opposed to IT (technical skills) proficiency.

The LETR report is a good example of how information skills have been lost in the wider debate on technology and how information professionals are well placed to bring attention to these new skills which are vital as workplaces and education environments evolve through advances in technology. The LETR report ends with a series of recommendations including one stating that the BIALL Legal Information Literacy Statement87 can serve as an effective framework for digital literacy skills in the legal sector.

BIALL hopes that the Digital Skills Committee takes into consideration the part information professionals can play in the specific context of the workplace as to date debates on digital

83 British and Irish Association of Law Librarians (BIALL) www.biall.org.uk
86 http://www.jisc.ac.uk/media/documents/publications/heweb20rptv1.pdf p.7
literacy within the information professional sector have focussed primarily on digital access and inclusion

27 August 2014

88 http://www.cilip.org.uk/cilip/advocacy-campaigns-awards/advocacy-campaigns/information-literacy/information-literacy-0


Evidence Session No. 6        Heard in Public        Questions 66 - 75

MONDAY 1 SEPTEMBER 2014

Members present
Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Baroness Garden of Frognal
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Lucas
Lord Macdonald of Tradeston
Baroness O’Cathain

Examination of Witnesses

Marcus Mason, Policy Manager, Employment and Skills, British Chambers of Commerce,
Angela Morrison, Chief Information Officer, Direct Line Group, and Paul Willmott, Director, McKinsey & Company

The Chairman: Good afternoon. Thank you very much indeed for joining us and helping us this afternoon by coming to give evidence. You have a list of interests that have been declared by Committee members, which were also declared orally at previous sessions in July. They can be found in the transcripts. This is a formal evidence-taking session of the Committee and a full note will be taken. That will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript. If you want to revise minor errors, that is fine. The session is on the record. It is being webcast live and will be accessible via the parliamentary website afterwards. You are very welcome—in fact, you are encouraged—to submit written supplementary evidence if there is anything we get into

where you think you could give us more information about something. I am advised that you should speak up and speak clearly. We are fortunate that this is one of the rooms that is fairly good, so you do not need to shout. In some of our Committee rooms you probably would need to.

That is it from me. I suggest you introduce yourselves in turn. If you want to make any opening remarks that is fine. If you do not we will go straight into questions.

**Marcus Mason**: Hi there. I am Marcus Mason, policy manager for employment and skills at the British Chambers of Commerce. We are the national body that represents accredited chambers of commerce across the country. In opening, I would like to say simply that chambers of commerce are very well placed, given their local nature and their interaction with local businesses, to address many of the issues on digital skills we will probably raise today. As we progress, I am particularly keen to talk about business and education partnerships and how those might be developed to future-proof against changes in the technological and digital landscape, particularly around school accountability and the involvement of businesses within schools.

**The Chairman**: If you feel we do not give you sufficient opportunity to do that in this session, that would be something we would be very happy to receive further evidence on.

**Angela Morrison**: I am Angela Morrison, chief information officer at the Direct Line Group. I also sit on the advisory group of the e-skills board, which is a CIO advisory board. There are two boards, a CIO board and a CEO board for companies such as Accenture. I sit on the CIO board.

**Paul Willmott**: My name is Paul Willmott from McKinsey & Company. I head up our digital practice globally. Thank you for the opportunity to give evidence.

Q66 **The Chairman**: Thank you very much indeed. Let us kick off. It may be that only one of you will want to answer on some of these questions. You do not need to feel you all need to answer every question. Let us see how we get on.

I will start with the broad, big question: what do you think are the main challenges for economic growth as the UK transitions to a more knowledge-driven economy? We are particularly interested in how people can prepare for that and take advantage of the changes. As a Committee we are also interested in how that can be done everywhere in the country, not just in London.

**Marcus Mason**: The term “knowledge economy” is in some ways a difficult one; it might obscure the topic more than it enlightens. It is often conflated with the service economy. What we are talking about here is the digital skills and digital economy. In looking at digital skills and digital economy, there are a number of different factors and challenges worth highlighting, first around having the right workforce with the necessary skills and flexibility in order to lead careers in the modern workplace.

Essentially we are talking about workers with the base level of digital skills to function across all the sectors that now need those skills, as well as high-level skills to participate in careers in the growing digital industries. Secondly, having the right infrastructure for knowledge or digital-based firms is incredibly important. We hear often from members that they do not have the right digital infrastructure for fixed broadband or mobile broadband technology to

grow and expand in the way they want to. Finally, an issue that we hear about all the time is access to finance and having the right finance in place to allow SMEs to grow and get the investment they need to become world-leading firms.

The Chairman: Before we come to the other contributors, one issue that has been raised with us in earlier sessions is knowledge. For instance, SMEs use The Cloud. How do people find out about that? Do you have any examples that perhaps you could send to us of where that works, of where good information networks have been set up, particularly to help SMEs? We have had fairly clear evidence that knowledge of what is available now is a problem.

Marcus Mason: We have a number of examples of accredited chambers doing this very well. In many ways, the accredited chamber network is the premier network for information-sharing between businesses. Thousands of businesses are members of chambers across the country. Collectively they employ millions of people, so they are very good places to bring businesses together and develop the infrastructure and skills of local businesses. For example, Norfolk Chamber of Commerce runs a series of events throughout the year on digital skills, not just for individuals but for firms themselves, where it brings in some of its local businesses to give workshops and talks on the latest technological and digital advances so that the rest of the local business community can benefit from that and in some cases exploit that in order to grow.

Angela Morrison: The ability for everybody in society to understand basic technology, whether it is security or The Cloud, is hugely important. We have to do it in education and for SMEs. I have an example from Norfolk of my nephew, who grew up in Great Yarmouth and worked in a small printing firm, doing just a small graphics job, but he got a passion for Apple computing and taught himself graphic video. He put up a YouTube video. He now works for a Shoreditch company; he is still based in Norwich because they set him up locally. He does piecework for Apple employees in America. All that has been through the internet, none of it through any infrastructure or anything but the very local. That is the beauty of it—if we can get the skills out there and allow people to understand what they can do and use, it is not geographically constraining at all. That is great to see.

The Chairman: It is knowledge—spreading knowledge.

Angela Morrison: It is spreading knowledge and just getting there so people can see what they can do, and get the skills. The internet and broadband are great but we need to have superhighways out in small villages and places like that so that those villages can be accessed.

Paul Willmott: No doubt you will have heard evidence on this, but the shift to the knowledge-based economy is very significant and has profound implications for our country, economy and society. To put this in perspective, a recent Oxford Martin School study looked at the impact of automation on US jobs. It estimated that 47% of jobs would be subject to automation within the next 20 years, which, if you think about it, is both profoundly complicated to navigate but also a huge opportunity if you think about the productivity implications. Compare that with the first Industrial Revolution, when the maximum labour productivity growth seen in any one year was about 1.1%, and you can see that the opportunity here is very significant.
The challenge is two-sided, if you like. One challenge is about how you grow new businesses but also whole new sectors. Another challenge is about how you enable the transition of the sectors that are being impacted less positively. I agree with everything that Angela and Marcus have said about the need for skills as a way of supporting the growth of new businesses, and the importance of infrastructure. I would add that I think that the Government have a role to play with regulation and support, such as the right financial incentives, guarantee schemes and so on.

There is a broader question here about where the new sectors will come from and what our participation should be. For example, the video games sector hardly existed 20 years ago but is now a substantial sector of the economy; it is actually larger globally than the movie industry. We in the UK have been a leading player. I do not know what the answer is, but we need to find the next sectors like that and invest in them so that we remain globally competitive and provide productive opportunities for our workforce.

On the transitioning—helping the sectors that are less positively impacted—finding a way of enabling retraining would be helpful. I am quite optimistic about the opportunity to retrain colleagues and employees who are mid or even late-career into digitally productive jobs. That is something that we should explore.

**The Chairman:** We have had similar thoughts.

**Lord Haskel:** I agree with you about the challenges, but how well are we doing at meeting them? You spoke about productivity but we have not seen that move in the right direction for some years. You spoke about labour flexibility. That seems to be the equivalent of low pay and insecurity. How well are we doing at achieving this?

**Paul Willmott:** On productivity, many commentators have noted that the theory is there but the practice is yet to be realised. Again, looking back to the Industrial Revolution, it was some 60 years after the steam engine appeared that productivity gains started to come through as people learnt how to use it and it became efficient. I think the same thing happened with technology, particularly software. My own view is that we will see an acceleration of productivity coming through. At least, firms will be able to deploy the technology that is now available to improve their own productivity. It is up to the broader economy to work out how to translate that into a broader economic uplift, which again comes to my point on the need for new sectors and helping entrepreneurs to grow.

**Q67 Lord Janvrin:** Picking up on that issue of helping entrepreneurs to grow, one point that has come out frequently is the importance of networking and the growth of hubs. I would be interested in the panel's views on how one can encourage that kind of activity and create an environment where hubs grow—not, perhaps, in your village in Norfolk, but you know what I mean.

**Angela Morrison:** I live in a village in Norfolk but it does not have a lot of those connections, I can tell you. However, my cousin's village does and it makes a big difference. On creating an environment of safety, the flexibility of the internet and indeed of all technology means that it might not be the nine-to-five job that everybody is used to. One of the challenges in my life is gender and trying to get more women into the technology workforce. Actually, they want more flexibility. They do not want the nine-to-five but want to be able work at home. If you look at job websites to try to find IT jobs, you will find that very few are part-time. They are all looking for full-time. The whole recruitment business is around full-time

employment. We have to work out how we move ourselves on so that we have networks available for people who do not work full-time but have time to do work in the hours when their children are at school or in the evenings, or even where men want to do home-working as well. My husband stays at home with the children but he finds it very difficult to work. He does some work but not a lot because the market is not geared towards that. We have to create some completely different socio-economically that enables that efficiency and productivity in flexible working. That is what this technology and digital skills enable. Most of these games companies started at home with people on PCs. That is where they all came from. They did not come from some big organisation creating a game but from people doing it at home. Somehow, we have to move society on.

Lord Janvrin: The geographical proximity of some of these creative industries or entrepreneurs seems to be important. My question is about how you create more and more hubs, which we have seen grow up in—

Angela Morrison: Shoreditch and places like that? You have to use chambers of commerce and you have to create networks and environments where people can do that. My nephew has moved from Great Yarmouth to Norwich because Norwich has more of a hub than Great Yarmouth did. There is no reason why we could not create one in Great Yarmouth.

The Chairman: In answering, Mr Mason, can you go further on how we move from an individual working at home? The other piece of evidence we have had quite clearly is that there are lots and lots of little start-ups. We are rather good at that, but less good at taking it and scaling it in any way. If you could help us address that, that would be good.

Marcus Mason: First, on the hubs or local networks question, it is important to build on what is already there. Clearly there are good examples across the country of hubs or networks of different digital and creative companies coming together very successfully in local ecosystems. That is something that policymakers want to look at replicating, but from a policy perspective it is really important to build on what is already there—for example, where there is a budding latent cluster of firms or excellent research facilities in a certain area. There needs to be the basic infrastructure to build on to get a successful local network. It will not work if the Government come from on high and decide that there has to be a hub where the basic infrastructure is not there. Coming back to the point I made earlier, we think business-to-business interactions are the solution. Drawing on examples from the accredited chamber network, chambers can be delivery partners. For example, Manchester chamber delivers 900-odd apprenticeships a year, many of which are in the digital sector. It supports small and medium-sized enterprises to find the right training at the right price. Chambers can also be disseminators of information, as I mentioned earlier.

When it comes to scaling up from small and micro-firms to bigger ones, micro-firms account for most businesses across the country. Not all of them should be or need to be scaled up, but for those where growth is a viable option, access to finance is the main challenge that we hear about, across our membership, for those types of organisation, as well as accessing the right talent. On access to finance, if you look at the most recent SME Finance Monitor’s results, only 30% of first-time SME applicants pended the process of getting a loan or overdraft, compared with over 60% of other applicants. It is a real issue. Perhaps the British Business Bank could be better capitalised and given a remit to work directly with SMEs to support the financing of smaller firms.
Finally, on accessing the right talent, going from a small or micro-firm to a much larger firm, those types of organisations often need the right senior management to grow: the types of staff that have had experience of going through the growth phase. It is important to recruit from the global talent pool. If we want globally competitive businesses, businesses need to be able to recruit internationally. Having a visa system that helps to recruit international students and graduates coming out of university would be incredibly helpful. Smoothing some of the distortions in the tax system would also be helpful. We often hear from SMEs wanting to scale that the personal allowance limit, which comes into effect at a salary of £100,000, acts as a bit of a cliff-edge for firms wanting to hire high-level executive directors to come in and help with that growth phase. Scrapping that personal allowance limit could help in some ways for those firms to recruit the right type of senior management.

The Chairman: That is quite a list.

Q68 Lord Lucas: Looking ahead 20 years, are hubs going to be physical locations at all, or are we looking at an HS2 situation where we are going to build a railway only to find out by the time we get there that driverless, autonomous vehicles are more efficient?

Paul Willmott: That is a discussion being had down the hall. It is hard to predict. My view is that physical hubs will continue to be important. The one thing—at least in the foreseeable future—that cannot be automated is creativity. Creativity is often sparked by interaction, often unplanned interaction. We were fortunate to have the opportunity to work on the business plan for Tech City a couple of years ago. From that we looked at hubs around the world to see what mattered. We found four things. The first was presence, both physical and virtual, and the right leadership. The second was connectivity: building social networks and leadership and meeting opportunities, but also building networks with elite universities to get the right ideas. In this country we are good at producing great ideas. Having those as a feeder into these hubs was important. Third was the right capabilities, i.e. scales and so on. We have discussed that at length. Finally there was the right level of support, which would include financing, as Marcus has said, but as well as bank financing, venture capital financing is important, since we need that kind of risk appetite.

Lord Macdonald of Tradeston: Just to follow up on that, we have been told it is imperative for growth that we get a movement from micro to macro in SMEs and so on. Paul, from a McKinsey perspective, what evidence is there of this happening on any significant scale? Can you cite in figures how this has changed over the past decade and how it might change over the next? Apart from what you have all been discussing, are there any particular measures that might accelerate it?

Paul Willmott: I am not sure that I have any stats on the rate of growth in SMEs. One review we did a couple of years ago suggested that digitally enabled SMEs grew at just over twice the pace and twice the number of jobs as non-digitally enabled. It is clear that the digital economy creates a great opportunity for these companies’ growth. Anecdotally, as I travel around the world, I would say that we are slower at scaling in this country than some others. I partly put that down to the scale of our market—in comparison, the US market has five times as many consumers. There is a natural benefit from that, which we need to overcome through improved trade connectivity. The point that I have just mentioned about venture capital stands. It is improving hugely in London, but it is not where we need to be. At this point it is probably not improving around the rest of the UK as well. Those are two factors.
Q69 Baroness Garden of Frognal: What skills do future workers need in order for the UK to be globally competitive? Mr Mason, in your opening remarks you mentioned the importance of the interaction between business and education, and I see that you have been involved in setting up an apprenticeship scheme in Parliament as well. Specifically, what part do you think apprenticeships can play in upskilling the nation in the digital age?

Marcus Mason: At the British Chambers of Commerce we hear from our members that the skills that are the most valued are often soft skills: communication, teamwork and the like. Of course, digital skills come up very highly in the surveys that we do of our membership. We have initial results from our 2014 workforce survey of 7,000 businesses across all sectors. Basic IT and computer literacy skills came out very high. Seventy per cent of firms say that these are important when recruiting, and a quarter of firms say that they have skills shortages in those areas. Apprenticeships can play a very important role in supporting school leavers in particular to access these skills on the job because they prepare people both for those digital skills if the apprenticeships are digital-related, but the soft skills that I mentioned are also very important to businesses.

The policy trajectory on apprenticeships has been positive for many businesses. There is much more emphasis on employer involvement in designing the frameworks for apprenticeships and in the delivery of them. There is some danger that the new funding mechanisms that have been proposed for apprenticeships might alienate small and medium-sized enterprises. For example, with regard to the Employer Ownership of Skills programme that is being run by BIS, there are some questions as to how many SMEs are involved in designing those apprenticeships. It is really important to retain that involvement.

With regard to business education partnerships, rather than trying to guess which skills are going to be the most important in 10 or 20 years’ time, which is a very difficult game to play, we think that strong partnerships between businesses and the education sector are probably the best way of future-proofing the economy against the changes that we see. For example, having business governors on secondary school boards systematically across the country can help to make schools more responsive to business needs.

With regard to school accountability, we need to think about the destination of pupils—whether they go into further study or employment over a two to three-year period—and how school inspectorates such as Ofsted can take this into account when making a judgment on the success of a school.

Finally, experience of work within schools and embedding the changes in accountability measures that I have outlined will, I hope, help bring about much better and robust careers advice and employer visits, and ensure that schools are better networked with the businesses that matter to them locally.

The Chairman: Do any of you have anything on older workers? We are receiving quite a lot of interesting evidence on how schools should change and the transition into work from school. Another issue that we are trying to get underneath or come up with some recommendations on is what to do about older people in the workforce who in a sense have been left behind and have not been upskilled with the skills that they need now. Do you have any experience or suggestions in that area?
Angela Morrison: e-skills UK has done some work on that. I can get that sent through to you. Personally, I am not au fait with all the work, but it has definitely done some on the IT workforce.

Q70  Lord Haskel: When we speak to employers about skills, they usually say that they might be able to find people with the technical skills, but they complain about the lack of soft skills—the fact that people are not used to working together and that they lack leadership, reliability and personal development. Is this an important part of preparing people for an e-world or will it become less important? Is this something we should pay attention to?

Paul Willmott: My view is that both are important—this is an “and” not an “or”. Anecdotally, from the clients that I talk to, businesses are struggling to find the right technical core skills as well, not just how to write code but how to analyse a complicated problem and create an algorithm for it or how to design a beautiful-looking application, which is a creative skill. It is also clear that the kind of problems that emerge in the digital space and the solutions to them are much more cross-functional. It often requires the person in manufacturing to talk to the person in the supply chain to talk to the person in sales in a more joined-up way than they used to, hence the softer skills are equally important.

Lord Haskel: Mr Mason said that we need to dip into the local talent pool, but of course immigration is a political hot potato. The Prime Minister is going to put a limit on it, or that is what we are told. Is there a need for increased high-skilled immigration in the short term? What are the implications of this? How are we going to get over these political difficulties?

The Chairman: That is an easy one.

Marcus Mason: I am not sure I am the best person to advise on how to get over the political difficulties. I think I will leave that expertise to you.

The Chairman: I suppose our question is: is it needed? We have heard contrary evidence. We have heard that there has to be, at least in the short term, high-skilled immigration. We have also had at least one other witness saying, “Actually, that will slow down our ability to generate the new skills we need”. That is the question we are asking.

Marcus Mason: We should not regard high-skilled immigration as just about plugging a skills gap. If we want global businesses that can compete across the globe, they need to recruit from this talent pool. They need access to the best global talent. Of course, there are huge spillover effects of hiring international candidates such as building relationships with new markets, and so on. It is important to view immigration not just as plugging a skills gap. Of course, in the short term there is a need, particularly in the digital and tech sectors. If you look at the visa system for foreign graduates who come over, we often hear complaints that that does not work for businesses that want to recruit high-skilled graduates from different countries. Perhaps looking at reinstating the two-year post-study work visa for graduates might be an option.

Paul Willmott: It is very important that we are globally competitive in our ability to attract talent. Digital business is global business. Talent is mobile, ideas are mobile, trade is increasingly global—for example, 12% of global trade now is e-commerce—so we absolutely need to be attractive to talent and be able to bring the talent in. Anecdotally, every day I see the need for skills from a global market. There is no question that this is an issue.
Baroness O’Cathain: I wonder why we have never looked at the green card idea from the United States, because that works. People in this country who are not as skilled up as they might think they ought to be if they wanted a job in the United States jolly well get skilled up before they apply for a green card to go to the United States. What is so repugnant about a green card that people are not prepared to even consider it, or is it just because it was not invented here?

Paul Willmott: I have no idea what the reason is. Certainly, colleagues who have gone to the States with a green card find that the system works rather well.

Baroness O’Cathain: There is no reason why we should not suggest that, because most youngsters—anybody under the age of 25—are aware of this. If they have made it their goal to go to the United States, they have made it their goal to get equipped in such a way that they will not have any problems with a green card.

Q71 Lord Holmes of Richmond: Does the UK have the competitive infrastructure to support the knowledge-driven economy? How do you think it shapes up to other countries?

Paul Willmott: If you look at infrastructure and what underpins it, the critical thing in my view would be to look at broadband and 4G broadband penetration. I do not have the exact numbers to hand, but I know that we are in the top tier globally on those metrics, so we are in quite good shape. One evidence point is that UK consumers now spend more per head online than in any other country globally. We have about $1,100 per head digital spend. The next highest is the US, which has around $1,000 per head. That is evidence not only that the infrastructure is there but that people are using it. This is also an opportunity for the UK because it provides a ready market for digital services, at least in the consumer sectors.

The Chairman: I am quite surprised you have given such a positive answer, because we have not had such positive evidence from other people about the state of our current infrastructure. Everybody knows it is necessary but we have heard much more concerning evidence from other people about it.

Angela Morrison: As the growth continues at the rate it is, I think that might become more of a struggle. Living in a little village in Norfolk, unless you have a super-highway you struggle on a Saturday afternoon. There is point where we have to grow that infrastructure at the rate that use is growing.

The Chairman: The speed is what is at issue, and keeping that speed.

Earl of Courtown: That does not affect a great many people. I live in a village.

Angela Morrison: I was at a house near the Oval while there was a cricket match and you could not get on the internet because you had a concentration of 50,000 people in the Oval trying to use it. So there are limits. As we get more on-demand stuff, it will peak out more.

Paul Willmott: To clarify my point, I was not saying that more could not be done, just that we are globally competitive.

The Chairman: We were quite surprised to hear in one of our earlier evidence sessions that even in Hoxton the speed was limited. That is exactly what you were saying: there are so many people using it that the speed is not keeping up with what is needed.

Angela Morrison: We are doing so much. The Cloud is fantastic, but the more that goes into The Cloud the more that has to come over the internet to get to your device. You have
nothing actually on your device. The more we have those devices, the greater that demand. I am not sure we are keeping pace with need.

Marcus Mason: From our perspective, we hear far too often of businesses having issues connecting to fixed and mobile broadband. That is in rural areas—everyone is aware of the issues that some rural areas face—but also in more urban areas such as Essex. We have a number of case studies from Doncaster as well. Businesses really feel that this can hamper their growth, both in trading internationally and in developing e-commerce businesses. While we have done well in our 3G development, we have begun to lag behind on 4G. Perhaps the development of 5G could be an opportunity for the UK to take the lead once again. One of the huge benefits of seizing the opportunity on 5G is that you then have the infrastructure for a whole new type of firms and businesses to develop off the back of it, ones that have a global competitive advantage as the result of being early entrants into that market and technology. We would very much push for more ambitious targets both on fixed broadband penetration and speed, as well as mobile broadband technology.

Lord Aberdare: Is there also an issue of the nature of broadband provision? I have heard that so much of the focus is on downloading that very often businesses that actually need greater uploading speeds find themselves at a disadvantage.

Marcus Mason: That is absolutely something that we hear, yes. The main issue for many businesses is often upload speeds.

The Chairman: If you have any good, hard evidence on that, we would be very happy to receive it. There are always lots of anecdotes. In producing a report, to back up any recommendations it would be very good to have some hard evidence from different locations.

Q72 Lord Haskel: Do you consider servers to be part of the infrastructure? We have read recently that there seems to be a big shortage of server capacity, about having to put them in the Arctic where the cold weather cools them down and the shortage of power. Is this another aspect that we must be aware of?

The Chairman: Mr Willmott is nodding.

Paul Willmott: This is an ongoing huge challenge at the moment for almost all companies and certainly the large ones: the need to continually build out more processing power. Moore’s law obviously works in our favour in that we get more processing power over time, but at the moment the demands on processing power outstrip Moore’s law for many businesses as their customers shift from, for example, going into a shop to purchasing online. That is leading to a need to purchase more boxes, and more boxes produce more heat, hence moving to the Arctic or elsewhere. Iceland is the new destination for data centres, and so on. It is a reality of life that that infrastructure needs to be continued to be built and invested in. Obviously, efficiencies will improve over time as technology improves but right now we need to keep building up that infrastructure as well as the networks.

Baroness O’Cathain: Who has championed that building up? Who is actually saying that? I never hear people say it. They say, “Oh, it is just that customers are not very good at using their computers”. I have never heard any government Minister or anybody say, “We need to invest more and more in that”. Have you?

**Paul Willmott:** At the moment, no, but I think most of the investment comes from corporations. As a consumer, we are increasingly using The Cloud as well for storage through the big technology companies such as Apple who provide that sort of storage for us. At the moment, commercial interests are taking care of it.

**Lord Lucas:** Looking ahead, do we need data centres, or can we handle this in a more distributed way where the heat might actually be useful?

**Paul Willmott:** That would be interesting. That is another great question that I do not have an answer to. I think that in the foreseeable future you will need centralised processing because the technology is simply not there yet to harness distributed processing effectively. That may change in time.

**The Chairman:** But your question, Lord Lucas, is whether we could heat Newcastle on the back of it?

**Lord Lucas:** I am just looking at the possibility.

**Q73 Lord Kirkwood of Kirkhope:** I want to turn to inclusion. The evidence that we have had to date suggests that there may well be an increasing problem about the dispossessed and the divide between those who have access to these skills and opportunities and those who do not. I have a narrow question and a broad question about that to ask you all in a minute, but I will just take advantage of this. Your evidence and experience is very valuable. Can I ask each of you individually about what you find in the positions you are in? Mr Mason is obviously still doing some very important work with NEETs and young unemployed people. In terms of the dispossessedness of that generation, do you have any particular recommendations? All we can do is merely make recommendations to Governments to do things. Drawn from your work with young unemployed people and people outside the digital divide, do you have any suggestions about what we might ask Governments to do to put that right for the future?

**Marcus Mason:** From my personal perspective, from my previous experience of working with young people and supporting them into work, I have found that people often make the assumption that young people are very good technologically and digitally. In fact, often that is not the case and they are the most marginalised and, as you say, dispossessed. It is important that policymakers do not jump to that easy conclusion about young people all being digitally very savvy. In terms of what can be done, it comes back to strong business and education partnerships and partnerships between third-sector organisations and businesses as well. Of course, accredited chambers can be an enabler for this.

**Lord Kirkwood of Kirkhope:** Governments cannot order chambers around. Well, that is not strictly true: Governments can do quite a lot—they have a bit of influence with funding. You have made a powerful case, which I have written down, about the importance of the work that chambers do, but what can Governments do that would make a game-changing difference to these young people who, as you rightly say, are not that familiar with what they need to be doing?

**Marcus Mason:** At least on the education side of things, government can encourage schools to work more proactively with businesses. That is probably the solution, along the lines of some of the recommendations that I mentioned earlier on the accountability of schools.

**Angela Morrison:** That is what we do through e-skills UK. e-skills UK is very much led by the CEOs and CIOs of businesses. We absolutely work together to define, for example, the ‘Behind the Screen’ hub of GCSE resources, which is all about getting not only the coding part but also the creative parts and the whole piece about creating technology solutions. We have a cyber security module so that we make children aware of cyber security, because they do not understand it but they need to because their entire lives are online these days. Then we go to the ITMB, a degree course that is all about technology in business and how you bring those—

**The Chairman:** What does that stand for?

**Angela Morrison:** IT Management for Business. This year we have also created and launched the IT Software Development for Business degree —so we have created two degrees. The first one is very much about business solutioning, which is where I focus. We do not do a huge amount of coding in Direct Line Group; we mainly do what I call “business solutioning” and putting technology in there. Google and Microsoft are very much into software engineering, so Software Development for Business is their type of degree. Those two degrees have absolutely been built by us as an advisory body saying what we think are the important parts of them.

**The Chairman:** Who is delivering those degrees?

**Angela Morrison:** Universities such as UCL. The ITMB is in 19 universities now. Kick started by government co-funding, this is work that we sponsor and that we partner to get it landed. We need to do more of that. We do computer clubs for girls who are 10 to 14 years-old. That is basically an online club that they do at lunchtime or after school. They do all sorts of things. The teachers only have a tutorial to tell them how to support it; they do not need to be technically knowledgeable themselves. We work that through with them. We have had over 150,000 girls through that programme. We then need to have a good GCSE for them to follow on to that is similarly inspirational, and an A-level that is similar, and then into a degree course. At the moment we do not have that full lifecycle. We need to get that educational lifecycle of being able to have a broad technical understanding from a very young age right the way through to a degree course and have a good career. You asked what my history was. I did computing and electronics O-levels. I then did maths and sciences for A-levels and an engineering degree.

**Lord Kirkwood of Kirkhope:** What were you being fed at home, and what gender-neutral Christmas presents were you getting, that enabled you as a young graduate to go to Bristol and get an electrical engineering degree? What is the secret? How do we package this?

**Angela Morrison:** I am the youngest of three girls. My father was a headmaster but actually always wanted to be an engineer, so when he got these three girls he steered me into those ways. I am a very mathematical, logical person. It is not the right thing for everyone—not for every man or for every woman—but we need to work out how we enable everyone to have the choice. That is what we do not do today. How do we enable everyone to have the choice and see the broadness of the career that I have had? I have had a great career.

**Baroness O’Cathain:** This is most interesting. I would like to know how many in that sort of age group, the 14s to 18s, actually know about this. Is it being pursued by the Government and the Department for Education? Are they forcing schools to enthuse those students? I doubt it.
Angela Morrison: I think that there is probably a level of frustration about the education system and how we get a broadly enough skilled course around there that gives them those things and get the teachers educated so that they can deliver that and have the right teachers to do it. I have three sons. They are all technically pretty good—my husband is a technician as well, so we are all pretty technical. However, one of them absolutely hates it at school, not because he does not love the subject but because of how it is being taught.

Q74 Lord Kirkwood of Kirkhope: Mr Willmott, I am still thinking in terms of broad and narrow questions about inclusion. You mentioned the figure of 47% dislocation in the future labour market, which is really scary for Governments. You do not need to be a psephologist to notice that there are number of people in this country who are beginning to feel left behind already. If you are telling me that there is a fighting chance that they will be 47% dislocation—that is not to say that I believe that they are all going to be thrown on to jobseeker’s allowance because there will be churn and there will be opportunities, as you made clear—what can companies like McKinsey, which operate at a global strategic level, do to drill into the scale of that problem on top of the digital illiteracy that we are starting with? It is a wholly frightening political problem.

Paul Willmott: Yes, it is a huge problem, and it is up to all businesses, Governments, not-for-profits and so on to tackle; it is not down to one sector. I do not think that there is a silver bullet; it builds on many of the things that we have already discussed. There is no question that skills are at the very centre of this. To diverge from that for a second, the good news about skills now is that the resources are terrific. I was lucky enough to be in a school with a BBC Micro and my maths teacher booked six of us, aged 11, into a room one day, which is why I am here today: I got very excited about the whole thing. Now the resources are available such that every child has access to the technology. There are amazing free resources out there such as Codecademy’s An Hour of Code, from not-for-profit organisations that create online tutorials and apps for teaching yourself how to master technology. This is more about awareness, which is to your point, and encouragement and leadership from teachers and other role models, for getting kids and young adults into this sector.

That is the micro part. At a macro level—again, this is for business, government and so on—helping to identify where the growth industries and sectors are going to be is important. This morning I was rereading one of our old reports, called Internet Matters, which said that some of the surprise growth areas, particularly in the US economy, have been leisure-related, such as personal trainers and massage therapists. There are a lot of skills that cannot be automated, and, as you say, through the churn a whole new set of opportunities will be developed. In addition there will be whole new sectors, like computer gaming, that we cannot even envisage yet but that will emerge, and it is about spotting those early and getting behind them.

Angela Morrison: There is a huge amount going on in getting girls and women into computing. It is vast. There are so many different initiatives; how can we bring them together and create a larger force? There are so many small things going on that are all fantastic—the Hour of Code, Your Life—but it is lots of little bits. How can government help to create a much more coherent plan of what we are trying to do?

Lord Kirkwood of Kirkhope: That is a crucially important point. People tell us that there are all these really good little things happening. Sitting centrally as policymakers, we see none of

this. It is invisible. The trouble is that the risks of doing nothing and getting this wrong are so great. On the other hand, you do not want to get into the tendency of centralising everything because you might strangle it. How do you persuade me that there is not more we should be doing?

**Angela Morrison**: e-skills UK has just been morphed through the opportunity of the BIS Employer Ownership strategy. Employers have created the “Tech Partnership”, building on the work of e-skills UK. The Tech Partnership is working across and representing the entire sector, bringing together all interested parties under a cohesive umbrella. The issue is almost how we take that complete representation and move that Tech Partnership quickly into being really a centre of excellence for action on digital skills. If you are going to make a difference in girls in IT or digital skills, that is where everything gets funnelled through because it has business and chambers representation, and all the other representation. We just need to make the most of the cohesion it can bring.

**Lord Kirkwood of Kirkhope**: Is that a structure you could put money into?

**Angela Morrison**: Yes. The Government do.

**Lord Kirkwood of Kirkhope**: How much money do you need?

**Angela Morrison**: We have just been given £22 million for the next two years, to start with.

**Lord Kirkwood of Kirkhope**: £22 million? Who by?

**Angela Morrison**: The Government, through BIS and the funding it has worked through.

**Baroness O’Cathain**: That is million, not billion.

**Lord Kirkwood of Kirkhope**: I did not think it was billion.

**Angela Morrison**: The issue is how you give that real teeth and strength to enable us to have some ultimate framework for where that is going. Loads of other stuff still goes on that basically dilutes its impact, so the issue is how you create that bigger impact.

**Marcus Mason**: I have a couple of points to add to that. On the issue of girls accessing STEM careers and taking up STEM subjects, obviously the Committee will be aware of the challenges there. Once again, we think that cracking that issue comes back to strong business/school partnerships. We have launched a pilot with five different chambers of commerce across the country, piloting different interventions, getting female business leaders into schools, giving talks and careers advice, and building those partnerships between business and schools. We will have the initial results of that pilot early next year, which might be slightly outside the timeframe of this, but if it is useful we can share that when we have it.

It is also worth thinking about how some of the inclusion issues are framed and communicated to business. Of course, there is a social imperative but there is also a very strong talent pipeline imperative. If you can crack the issue of getting more girls into those types of career, there are huge business benefits.

**The Chairman**: You are not doing girls a favour; you are doing business a favour by educating girls properly.

**Marcus Mason**: That is right. It is really important to think about the incentives for businesses when getting them involved in these types of partnership and appealing to their self-interest as well as the social argument, as well.
Q75  Ear of Courtown: It has been great hearing what you have to say. Basically, we have asked all our witnesses the best thing they could do to increase the UK competitiveness in digital skills. You have mentioned a number of things in the course of your responses, but what are your key suggestions? How would you make that happen and how much will it cost? A nice simple one to answer in two minutes.

The Chairman: Who would like to start?

Paul Willmott: Listening to the debate today has made me wonder about this. It is such a multi-faceted problem. Does it need a real focus? Is the single point that this agenda should reside with the Government? That would be my idea. I am sure you have better views than mine about exactly how to put that into motion. How much would it cost? I do not know. Maybe the way to think about that is to estimate the economic opportunity or downside if we do not get it right.

The Chairman: That is very a good answer, thank you. I am in interested in the idea of focus instead of it being disparate. I am sure that is right.

Angela Morrison: I would like to see technical skills being equivalent to reading, writing and arithmetic in schools. I know that is a big struggle because you need many skills, but the way that society is going we need three hours in computing—“computing” is not the word, but just that broader digital world. That needs to be up there because everybody uses and is impacted by it. They need to understand what they are doing so that needs to be a core subject.

Marcus Mason: I think we would like to see better reform of the accountability system for schools by having more business governors on school governing boards, and by having schools judged more on the employment outcomes of their pupils.

The Chairman: That is really helpful. Thank you very much indeed. That was really concise and excellent.
British Sky Broadcasting – Written evidence (DSC0036)

Executive Summary
The technological landscape has a significant impact on Sky’s business; in terms of the service we deliver to customers and the employee skills we require to succeed in a competitive marketplace. Advances in connectivity have revolutionised content consumption in recent years and the pace of technological change continues to accelerate.

Digital skills are an integral aspect of Sky’s business, and the number of technology employees – 3000 at present – is growing year on year. There is a rising demand for technology skills and the global nature of the market is contributing to the digital skills gap– not only is there a shortage of digital skills but we are competing against multinational firms for employees with the skillsets we require.

Sky recognises the need to source, develop and maintain a competitive workforce to remain successful in a rapidly changing environment. We are responding to this challenge in a variety of ways –

- Driving awareness of digital careers through Sky Academy. Sky is working with thousands of young people to inspire and cultivate a passion for digital careers. For example, our Skills Studios experience allows students to use state-of-the-art technology to create their own TV reports. We are also developing a new careers initiative which will expose pupils to the breadth of career opportunities available at Sky. If young people are to be prepared for digital careers in the future workforce, it is vital that they are exposed to working environments and understand such skills and their applications.
- Training young people in digital careers and the creation of specific youth employment initiatives. For example, Sky’s Software Engineering Academy is equipping apprentices and graduates with the technical and soft skills required for a career in software development at Sky. Since its launch in 2011 we have recruited 118 graduates into the Academy, who work across the business in development roles.
- Developing existing employees through general and role-specific training, across all 25,000+ employees. We have harnessed the latest technology to transform certain roles – for example, Sky’s 2,900 engineers receive digital skills training and iPads to educate customers on Sky’s technology offering.

Introduction
1. Sky welcomes the opportunity to respond to the House of Lords Digital Skills Committee’s review into digital skills. Sky is Britain and Ireland’s leading home entertainment and communications provider with 11.5 million customers. Around 40% of all homes have a direct relationship with Sky through our range of TV, broadband and home telephony services.

2. In today’s connected world, home entertainment and communications are central to people’s lives. The emergence of new technologies is driving an ever-faster pace of change in our industry, creating new ways to entertain, inform and connect people better. At Sky, we
want to be the best in the business at delivering entertainment and communications to UK customers.

3. In recent years, Sky has transformed the size and scale of our business, making a significant economic contribution to Britain and Ireland. Sky directly employs more than 25,000 people, supports 117,000 jobs across the wider industry and has nearly 7000 UK suppliers. Our business contributes £6 billion to UK GDP and generates £2.7 billion in tax revenues for the Exchequer.

4. Sky prides itself on delivering the best and broadest range of content to our customers, whilst harnessing new technology to provide customers with the best viewing experience, wherever and whenever they want.

5. Technology is at the heart of Sky’s business and we require employees with general digital skills across our workforce, in addition to high-level digital skills for specialist technology roles. We currently employ around 3,000 people within technology and this figure is increasing annually.

6. Sky’s business is focused on the connected home and increasing the connectivity of customers. We enable this through several platforms - connected set-top boxes, Now TV (Sky’s over-the-top TV service), broadband and WiFi. Over the past five years, the changing nature of our business and the way we deliver our content to subscribers has radically altered the type of digital skills we require as a business.

The changing technological landscape

7. The future digital technology landscape is difficult to predict, but it is likely that the pace of change will only accelerate. We recognise that our continued success is dependent upon sourcing, developing and maintaining a competitive workforce.

8. Sky has harnessed the latest technology to drive new trends in TV viewing and revolutionise content consumption. Sky was the first provider to mass market the PVR box and give customers more control over their TV viewing through Sky+; we provided a step-change in picture quality with High Definition and 3D; the introduction of OTT platforms (Sky Go and Now TV) have transformed the way in which our customers consume content; we have developed a new targeted advertising service to open up markets through Sky AdSmart and technology has been an enabler in improving our customer management systems (e.g. the introduction of the Sky service app).

9. Further advances in technology and connectivity will continue apace, and mobile and device-to-device connectivity will remain key driving forces. The average household now owns four different types of internet enabled devices.

10. The changing technological landscape impacts on the skills we demand. We need more people who can write software and apply technology to infrastructure management, customer management and app creation, as well as people who can invent and develop the breakthroughs of the future in mobile, big data, the internet of things and cyber security.
11. Competition for digital skills in the UK is no longer limited to UK businesses. The technology market is increasingly global and as a result, Sky is competing with multinational firms such as Google, Apple and Microsoft for talent.

**Digital skills gap in the UK**

12. The UK starts from a position of strength and has some of the world’s best creative talent. Changes to the school ICT curriculum and support for high quality apprenticeships are also welcome. But shortages in maths and computing skills, alongside digital exclusion and the gender imbalance in ICT remain significant barriers to the UK’s ability to compete in an increasingly global marketplace.

13. Sky’s total technology employee numbers are growing by over 10% year on year. There were approximately 700 technology hires last year out of a total of 3000 technology employees.

14. In addition to a growing digital skills requirement, Sky is witnessing a skills shortage within technology for a variety of reasons:

(i) The skillsets Sky requires in technology are in very high demand - the market for iOS and Android developers is particularly competitive. This shortage has resulted in a contractor-heavy employee landscape. In recent years, Sky has become more reliant on temporary contractor staff, despite a drive within the business to get as many skilled members of permanent staff as possible.

(ii) In addition to meeting technology-specific skills requirements, we require employees to have sufficient transferrable skills to ensure integration with the wider business – e.g. ability to innovate and strong communication skills.

(iii) There is a limited talent pool to meet the needs of our business and we are competing against a host of established technology-specific businesses, many of which are global with significant resources.

(iv) The nature of many computer science qualifications in the UK fails to account for certain skills which would better prepare young people for entry into the workplace. Taking software engineering graduates as an example, candidates are not familiar with the collaborative nature of software development – i.e. working in pairs. While we understand the difficulty of formulating curriculums and examinations that account for this, working in teams and communicating progress and requirements to other parts of the business is at the core of what makes a good developer. Sky would like to see greater recognition of this fact in schools and universities.

(v) Testing is also an integral part of software development (especially for a fast-moving consumer-facing business like Sky). In the majority, graduates entering the business do not have previous practical experience of testing, despite it playing a vital role in the software development process. We would like to see a greater emphasis on testing as a component in all computer science and coding specific qualifications.
Driving awareness of digital careers

15. Awareness of digital careers should begin in the classroom. As a growing sector, young people need to be exposed to the right skills and knowledge that will enable them to pursue digital careers and better market themselves to potential employers. The reform of the ICT curriculum is a welcome start, but more must be done to emphasise the value of digital skills.

16. Sky recognises that a collaborative relationship between education establishments and businesses is essential in preparing young people for employment and transition into digital careers. In response, Sky has developed a structured initiative through Sky Academy, with the goal of cultivating a passion for technology and digital careers amongst young people.

(i) The Sky Academy Skills Studios experience takes schools behind the scenes at Sky, giving them the opportunity to use the latest technology to create their own news reports on subjects they’re studying at school. Sky has welcomed over 23,000 students, aged 8-18, to the purpose-built facility in West London in less than two years since launch. Building on its success we will be launching our second Skills Studios in Livingston, Scotland in 2015.

(ii) Sky Academy Starting Out offers a range of youth employment opportunities to prepare young people for employment – including work experience, apprenticeships, placements and graduate roles. The programme reached almost 600 young people in the last year and we aim to double the number of places across the business over the next three years, helping to create the next generation of talent at Sky and giving more young people a head start in their careers.

(iii) As part of this, we’re set to launch a new one-day career experience for 16-19 year olds in the autumn, which will aid transition from education to employment. The initiative, which offers various themes, is designed to give young people an insight into the workplace and exposure to the variety of job roles available across Sky. Taking the technology theme as an example, students will deliver a mobile and web app in code for their work challenge, with supervision from Sky software engineers. The experience will offer exposure to Agile processes\(^89\), professional software and the technology roles available within Sky. Each student will take on a role (e.g. developer, tester, business analyst) and will be required to develop the appropriate skills (e.g. developers will learn code, build software and fix bugs).

Training young people in digital careers

17. Sky offers several in-house programmes aimed at developing young people to succeed in technology careers.

18. Sky’s apprenticeships offer a vocational route into employment, providing permanent opportunities for circa 100 apprentices per year across five business areas.

(i) The combination of real world experience and rigorous learning through professional qualifications enable apprenticeships to provide a key role in boosting technology talent.

\(^{89}\) Agile is a widely adopted software development method which is iterative and promotes flexibility.
(ii) Apprenticeships offer a supportive framework to develop young people whilst meeting the specific skills requirements of the business.

(iii) Sky offers three technology-specific apprenticeship schemes (levels 4&5) – in IT software development, broadcast technology operations and electrical engineering.

(iv) Sky plans to double the total apprenticeship intake over the next 3 years to correspond with the growing business needs. For example, Sky’s broadcast engineering department has an ageing population so we have introduced a broadcast engineering apprenticeship (level 5) to anticipate this future skills shortage.

19. Sky set up the Software Engineering Academy in 2011 to ensure our business has the right skills to compete in a competitive global marketplace. Our requirement for software engineers and developers has grown in recent years with the expansion of our connected TV services.

(i) The Academy takes 24 graduates each year who are fresh out of university and passionate about technology, and over the course of seven months helps turn them into fully-fledged developers.

(ii) The accelerated programme begins with an intensive four week training boot-camp to ensure that all entrants have a number of core skills, followed by a series of educational projects which are genuine business-sponsored projects across the technology department. This enables graduates to add value to the business from the very outset.

(iii) We particularly value a passion for all aspects of technology and some experience, however amateur and informal, in developing software applications. Wider skills are also vital, such as the ability to pick things up quickly and work well as part of a team.

(iv) Our assessment day is designed to give candidates an experience of what it is like to be a Software Engineer at Sky. All applicants are challenged to run a practical development task that provides an indication of their ability to fit into the Sky team; measuring a combination of technical ability and soft skills.

(v) Our assessment process enables all candidates to gain experience in their chosen career path – whether they are offered a job role or not.

(vi) Sky has so far recruited 118 software engineering graduates since 2011 and scale-up is already underway – we have this year recruited 36 software engineers into the Academy compared with 24 in 2013. We expect annual intake to further increase as the needs of the business become more software-focused.

(vii) We also created a Sky Development Operations Academy in 2013, to train graduates to work on Sky’s hardware and infrastructure requirements; we have so far recruited 12 in total.
20. We are further responding to the scarcity of directly applicable skills and highly competitive technology marketplace by increasing the number of direct-entry graduate roles we offer. Through recruiting at an early stage in an individual’s career, we can train and develop in-house employees to meet Sky-specific requirements.

21. Sky proactively targets graduates in low-level entry roles across the business. The nature of the graduate market has resulted in a high population of graduates in contact centre positions, who are over-qualified. Sky is capitalising on this talent pool – in our Livingston office, contact centre graduates who demonstrate good technology skills are offered roles within the technology team.

22. Sky has worked hard to reduce the barriers to application across the recruitment process, in a bid to encourage diversity across the business. For example, our graduate opportunities are available to candidates from all degree disciplines and the application process does not consider the ranking of education establishments. Furthermore, we have removed the requirement for our apprentices to have A-level qualifications.

**Developing existing employees**

23. As a business we work hard on strategic workforce planning, which attempts to assess future business needs and works back to achieve a more accurate picture of talent requirements.

24. Our aim is to create an environment where all of our people can fulfil their potential. To help them progress, we provide a wide range of opportunities for development such as mentoring and new skills training.

25. Sky gives all employees access to technology training as part of the company-wide development programme, offering a variety of learning resources and courses, regardless of role. In recognition of the increasing need for all employees to be more aware of technology trends as they affect our current and future business, we have introduced the availability of technology training to all employees. Content includes education on over-the-top (OTT) service provision and The Cloud. The development programme offers a combination of face-to-face and online learning to maximise accessibility to all employees. Last year, more than 90,000 hours of e-learning was delivered across the business.

26. Sky has equipped each of its 2900 home engineers with iPads and technology training. This ensures that customers are provided with the necessary digital skills to enable them to maximise the value from their Sky subscription – for example, through interaction with technologies such as Sky Go. These digital skills are passed on to significant numbers of customers each year - approximately 900,000 engineer visits take place in the UK and Ireland per annum.

**Diversity**

27. At Sky we have been concerned by the historic imbalance of women in digital and technology roles. As a major UK employer, we are determined to show leadership in this area and are working hard to increase our outreach to girls and women and improve their access to digital careers. We want to see as many people as possible equipped with the knowledge and skills they need to become informed citizens in an increasingly technological
society – and improving access is also the best way to fulfil our business’ increasing need for skilled digital and technology roles.

28. Sky has a specific strategic HR plan to attract more female technology candidates. We work hard to make sure that we are as welcoming as possible to young people of all sexes but also have specific measures devoted to increasing female representation in our technology roles.

29. The needs and realities of girls and young women must be consistently embedded into all messaging from the technology sector. We recognise that young people need to be engaged as early as possible in order to build the talent pipeline into STEM subjects. Sky participates in a number of schemes focused on redressing the gender balance in technology at school and in the workplace.

30. Specific events such as “IT’s not just for the boys” – a one day workshop solely for female grads from all university years interested in technology – allow us to reach young women and raise the Sky brand in key target demographics.

31. We reviewed the online media we use to advertise graduate jobs to ensure our positions are viewed by as many female candidates as possible. We have also redesigned our careers collateral to have more female case studies relating to traditionally under-represented career areas, especially finance and technology roles.

32. Sky’s commitment to diversity extends beyond the gender imbalance. For example, in partnership with the charity MAMA Youth Project, Sky trains disadvantaged young people in broadcast media and technology skills. The scheme has been running since 2011 and has supported 50 young people from black, Asian and minority ethnic (BAME) groups and disadvantaged backgrounds into employment.

5 September 2014
Broadway Academy – Written evidence (DSC0059)

How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

1. At Broadway Academy we believe working in direct in partnership with the Birmingham Chamber of Commerce and its network of 500+ businesses is the key way forward in order to inspire and prepare young people for occupations that currently do not exist.

2. This partnership will ensure that employers will be centrally involved in co-designing our curriculum content and delivery, critical in giving students positive insights into the world of work, its challenges, demands and opportunities. Beyond this, the partnership will inform the ethos and principles that shape all aspects of the operation of the school, from where and what students learn to the style and approach taken to learning and teaching.

3. We are developing a centre of excellence in teaching and high quality personalised learning for young people who seek an employment focussed curriculum and related challenges. The Broadway Chamber of Commerce Academy proposal will combine a range of project based learning approaches, technologies and teaching styles that are best suited to the learning needs of students.

4. At Broadway Academy, by working with local, national and international enterprises, our curriculum will blend academic and applied qualifications that equip our students with the skills, knowledge and experience that traditional 11-19 programmes cannot match.

5. Students will have regular opportunities to learn in work-based settings, benefiting from industry specific learning approaches that build confidence, critical thinking, teamwork and resilience. The involvement of students with local enterprises will grow as they move through the school, ensuring that ‘work experience’ is just that – not a one-off and brief insight but the development of a meaningful body of experience that is transformational.

How can the education system develop creativity and social skills more effectively?

6. The education system could develop creativity and social skills by working in partnership with real businesses solving real business issues and projects. This close working partnership will force creativity and social interaction between parents, students, staff and businesses. As a result, students will be inspired and motivated to have curiosity, optimism and determination. Employers will help in influencing those values through real dialogue in building attitudes and influencing aspiration.

7. Social skills and values will be continually developed and assessed throughout students’ education so that the “soft skills” businesses require are as equally important as academic qualifications.

5 September 2014
Evidence Session No. 2  Heard in Public  Questions 15 - 25

TUESDAY 8 JULY 2014

Members present
Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Baroness O’Cathain

Examination of Witnesses

Professor Judy Wajcman, Department of Sociology, London School of Economics, Professor Alan Manning, Department of Economics, London School of Economics, and Professor Phillip Brown, School of Social Sciences, Cardiff University

The Chairman: We are ready to move on. Welcome to our next set of witnesses. Thank you for joining us at our first session today. You have the list of interests from Committee Members in front of you. A couple of people will put them on the record orally, who did not in the previous session. This is a formal evidence-taking session of the Committee, so that means we will take a full shorthand note, it will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you can revise it in terms of any minor errors. The session is on the record—it is being audio broadcast live and will subsequently be accessible by the parliamentary website. Perhaps you would not mind speaking up quite clearly, as there is a bit of noise outside today and we want to make sure we capture your words well as we go on. I should also say that anything
Professor Phillip Brown, Professor Alan Manning and Professor Judy Wajcman – Oral evidence (QQ 15-25)

else you want to send in addition after this session we would be very pleased to receive, so please do so if you wish. Do you want to say anything briefly by way of introduction or shall we kick straight into the questions? It is entirely up to you.

**Professor Wajcman:** Can I, please? I have the advantage of having been to the previous session so I cannot wait to get in. What I did want to say is that I think the future is unpredictable. We all agree there is great change, but it seems to me that one thing we agree on is that there is a very profound shortage of skills in IT, in computing and in engineering. It seems to me that in that context the fact that we have the worst record in Europe for the number of women employed in professional engineering—it is 8%—is really shocking. That is very important for three reasons. I will be brief. One is an issue of equity. Girls and women should have half the good jobs and the interesting jobs, now and in the future.

The second thing, which is much less remarked on, is that the kind of innovation we are getting relies on the whole on young men with narrow engineering degrees thinking about the future. I go around to these companies and they say, “Will it not be a wonderful future with the Internet of Things, where we can use the smartphone and turn all the lights off in the house immediately?” I say, “If we had a more diverse workforce, would we not be able to think of and tap talent for lots of different things?” If we want a creative industry, we need a diverse workforce.

The third thing is that all the reports I read say that there is a real public thirst for having more citizens involved in decisions about science and engineering. How are we going to do that with such a small proportion of women and girls in STEM subjects? I feel like there have been lots of fabulous reports, lots done, there is a wonderful report by the Royal Society on Visions for teaching maths and science. The Royal Academy of Engineering has a lot of initiatives. There are wonderful sets of initiatives; they all have targets in them. What we really need now, rather than thinking more about these problems, which I can talk to at great length, is some leadership. We need some targets and we need to have some kind of national force behind these things. We have now 30 years of reports about these problems. I think we understand them well but we need a bit of political will.

**The Chairman:** I am going to come back to you on the last question. If you can give us a specific recommendation that we can take forward on that, that would be extremely helpful. So you have notice that I will be coming to you. Does anybody else want to make a general opening remark?

**Professor Brown:** Not really. I am sure it will come up in discussion anyway.

**Q15 The Chairman:** We will kick straight into the questions. Mine, in a sense, follows on from what you heard in the previous session, which is: can you help sketch out for us the big picture on the level of change that is happening? How enormous is it? How positive or negative should we be about it? What are the broad implications? So if can you set the landscape, in a sense, at this stage for us that would be very helpful.

**Professor Brown:** Shall I start? Three points: one is that new technologies in many respects have changed the nature of global competition and one of the things that has been quite surprising is that we assumed that the knowledge economy, especially the global knowledge economy, would mean that the world would be divided between head and body nations. We being one of the head nations, we would do the thinking for the rest of the world and it
would take China and India a very long time to catch up. But what we see is the way in which new technologies have allowed China and India to leapfrog decades of development and come into key areas of competition with western economies, which I do not think we have been prepared for. One of the real dangers of that is that we have more of the workforce in high-skill but relatively low-wage employment. That is a fundamental challenge for us in the UK and elsewhere in terms of this sort of agenda.

The second point is that we have made the assumption that we need many more people with creative skills. We need some for sure. But what this fails to understand is the nature of capitalism and the nature of productivity. If you look at the early 20th century, what you see is the rise of mechanical Taylorism—in other words, it is the capturing of that craft knowledge that was converted into the production line of Ford and others that was the driving force of productive change during quite a lot of the 20th century. What we are now seeing is what might be called the rise of digital Taylorism, whereby this is the fundamental change to office and professional work because what new technologies allow companies to do is to align their business practices globally. What they were trying to do is to understand how they engage in their business: what they are actually doing. If they can capture that, they can describe it. If they can describe it, they can standardise it. If they can standardise it, they can digitalise it. If they can digitalise it, they can put it into software and if they do that they can transport it anywhere in the world in terms of work. I would argue that we are seeing increasing segmentation of the knowledge workplace, if you like, where you have this cadre of talent at the top who will have permission to think, who will be doing the kinds of jobs we would normally associate with the knowledge economy, but many others will not be in that situation.

The third point I want to make is quite different. That is the possibility—and this is kind of blue skies—of the democratisation of the means of production, by which I am talking about the implications of 3D printing. What are the implications of technologies being used on the ground—the digital commons idea, the shared economy ideas? What that does is suggest that we need to think about the kinds of mindsets and skill sets that are required throughout the population. In other words, technologies are the tools of citizenship as well as in terms of what is needed for the economy itself. So there is something interesting going on. We do not know the answer but it is something that is worth exploring alongside these other broader points.

Professor Manning: Lord Chairman, you raised one issue of how fast or slow it is going to be. Clearly since the Industrial Revolution there have been massive, massive changes and there will continue to be those changes. I do not have any particular reason to think this will necessarily be faster now than in the past or slower. I know there are the techno-optimists and the techno-pessimists and there are people who feel confident, but I am not sure I feel so confident. If you look at productivity growth at the moment, it does not look so fast. If you look at some people describing some of the new innovations, you think, “Wow, that might be a bit more dramatic”. But my best guess would be that it is going to be steady as it has been in the past but continued. It is a wave that you have to ride; it is not a wave that you can hope to stand up against—you will just be swept away with it. So that is the challenge.

I think you also asked the question: is this good or bad? The thing is that new technology has the power to be good because it allows us to do everything that we could do before and some new stuff. New technology has been the source of all increases in prosperity since the
start of the Industrial Revolution. It is primarily the only driver of increases in prosperity but it is not inevitable that technology is a force for good. People can use it to do bad things: in an extreme form invent new weapons to kill each other in more horrible and more efficient ways than before. Or they can use it to make gains at the expense of other people—for example, the high frequency traders that were described in *Flash Boys*. It is the job of people like yourselves I guess to make sure we have a system in which new technology is used for good, and the distribution of that is inclusive so that everybody generally benefits from it. There is the opportunity for that, and to make sure that opportunity is seized is the challenge.

**Professor Wajcman:** I agree with what has been said. I think what people are worried about is the power of a small number of big corporations and the sense that they are setting the agenda, so that there is daily discussion of Big Data and the Internet of Things as I go around these companies—there is an agenda being set, whether it is self-driving cars or whatever, and there is a sense that the public and citizens do not have the skills and competency to be driving the direction of research and development. It seems to me that is a big concern. I feel quite optimistic, but I am worried about the extent to which we are in the driver’s seat in terms of these changes.

**The Chairman:** Yes, that makes sense, thank you.

**Q16 Lord Haskel:** First of all, I have to declare my interest as a board member of the Parliamentary Office of Science and Technology and the honorary president of the Materials Knowledge Transfer Network of the Technology Strategy Board. My question follows on from what you have been saying. You have described what changes we have and the transitions that are taking place. How do we adapt to it? How do we adapt so that we can continue earning our living?

**Professor Brown:** I think there is a rather big difference between talking about digital skills and skills for the digital economy.

**The Chairman:** Could you define that for us?

**Professor Brown:** Digital skills, for me, conjure the idea of a high-tech toolbox. How do you use the internet? How do you use wi-fi? How do you use basic video editing and such things? It is all rather important but it strikes me that the agenda that has to be addressed is much wider than that. The skills for the digital economy or the knowledge economy, or whatever you want to call it, have to be much broader. I have interviewed many multinational companies’ HR but also operations directors and what always strikes me anywhere in the world is the same thing. They say there is no real shortage of technical skills. It is not their issue. They feel that if they want scientists or mathematicians, they can go to Russia—there are many places that they can access them. But the problem they always state is the problem of mindsets: the problem of people who are proactive, who can work in interdisciplinary and cross-cultural teams and who have international experience of that. It is those sorts of issues that are really important. So when we talk about the skill sets required to adapt for the future, we have to have a broad-ranging understanding of both the hard currencies and the soft currencies. Language skill is a major problem for the UK. If you talk to virtually any of these people in these organisations, they all have at least two or three languages. So we are at an immediate disadvantage as far as that is concerned at that level.
Lower down—I get to one of the points I was probably going to make later but I might as well say it now—it strikes me that the whole way in which we structure the educational system completely undermines the development of those mindsets, that risk-taking behaviour, that we need in this country. You are encouraged to play it safe. The reason is that we have such a high-stakes competition. I have kids who are 17, 19 and 21. They are in the system. You can see how you respond to them about risk-taking, about the need to jump through the next hurdle, to make sure you get the appropriate grade. I think a lot of the kids, by the time they get to university, are totally turned off. They do not know what the purpose is apart from going through the hoops. There is a real issue of how we deal with the high-stakes system and of course that high-stakes system, going back to what has been said, is based on inequality. When the stakes in terms of labour market are so huge at the top end, as opposed to the others, then everybody wants the same thing. That increases competition right at the top end and basically it means that more and more people are struggling to find a way of reaching those top jobs, whereas if we could do something about the state of inequality within society, the state of inequality within the labour market, then what you will find is that more people will want to do apprenticeships. More people would want to go into technical areas because the labour-market signals out there are not the ones we really need to adapt to this world in which we are now entering.

Professor Manning: I would just say that increasingly our prosperity depends on the skills that we have. Those are the resources that we have in the UK. So we have to make sure that we have people with the skills to produce things that other people want to buy. I go back to the point that Phil made about digital skills versus skills for the digital economy. When you get technological advance in some areas, that becomes a declining share of employment. So ironically employment moves to areas where digital skills are used less rather than more. So we would see, because of lower productivity growth in things like caring jobs, we are going to need to move people there, more professional care and so on and so forth, which will involve some element of digital skills but not a huge element. I just caught Martin Wolf at the end talking about the education system. Our biggest failing has just been giving people basic skills—numeracy and literacy—over many, many years and I think that will remain the case. Of course we need people to have digital skills but we should not get too preoccupied by that or divert too many resources towards that at the expense of this other big problem just because it has been there for so very long.

The Chairman: By the way, you do not all need to answer every question. Professor Wajcman, do you have anything to add?

Professor Wajcman: I was just going to say that the Royal Society report, like most of these reports, really does argue, as a lot of us have been arguing for years, for a very broad-based education. The issue of the Baccalaureate has been going on for as long as I know. I think there is a sense that a broad education is the most flexible education and there has been agreement about that. The issue is how to get on with it.

Q17 Lord Aberdare: I was just going to ask about how the UK compares internationally. Professor Brown has already mentioned some of the contrast between us and China and India, but are there countries we should be looking at? Are there case studies of countries that have been more successful than we have in these areas? What can we learn from what other countries are successfully doing in this whole area?
Professor Phillip Brown, Professor Alan Manning and Professor Judy Wajcman – Oral evidence (QQ 15-25)

**Professor Brown:** I think one of the places to look might well be Singapore and I say that because I am doing some research in Singapore at the moment, funded by their Government, because they are worried about precisely what you are talking about here. The reason I have been interested in Singapore is that they have probably the most sophisticated skill-formation system in the world and so I have been trying to understand how that works. But because they are so dependent upon multinational companies, they are worried about those companies now hollowing out employment in Singapore. They keep the top echelons that are high-cost and require high skills in Singapore, but the other jobs might disappear or there is a lot of cost pressure on those employees. Their real problem is that right at the top end the companies see a talent deficit in Singapore. In other words, the locals do not seem to have the kinds of skills we have been talking about in order to take those global jobs and so they are dependent upon foreign talent. That is a real issue for them and one for us. What is quite interesting, of course, is that Singapore has those issues and yet in PISA it is right at the top. If you look at all the league tables, it is almost always right at the top and yet underlying it there are these same sorts of issues that are concerning them. We are not alone, if that is any help.

**The Chairman:** That has cheered us up.

**Professor Brown:** It makes us feel a bit better, I suppose. What I would throw in, just because I find it intriguing rather than anything else, is that South Korea is digitalising its entire school curriculum and it will be complete by next year. All their education will be based around tablets and what have you, rather than pens and paper, and the question is whether we have reached a stage where we would be willing to give up our pens and paper for the same kind of initiative and what the benefits and downside of that might be.

**The Chairman:** That is the interesting question, is it not?

**Professor Brown:** Yes, the downside as well. It is always the thing to explore. The unintended consequences are always as important as the things you are trying to achieve.

**Professor Manning:** The Singapore economy is based around a very liberal low-skill immigration regime that I do not think is relevant for the UK economy. They do not have to worry too much about the skill of who is doing the low-skilled jobs in their economy, the skills that those people have and how much they earn, but in the UK we have to worry an awful lot about those because they are going to be our citizens. Again, that is going back to saying I think that the issue is down there, which is on things like PISA where we perform extremely badly, in the lower tier, and it is just basic skills.

**Professor Wajcman:** If I can disagree—

**Professor Manning:** Yes, please.

**The Chairman:** It is unusual with a group of academics.

**Professor Wajcman:** My impression in terms of the high skills is that, certainly from what I read, there is a shortage of engineers, which is why there is a visa problem in Britain in terms of bringing in engineers. That is why in America there is a lot of discussion in Silicon Valley about the visa issue. It does seem to me that there are shortages of skills in places. I have looked at the figures recently and one of the things is that quite a lot of very good British-trained engineers end up in Silicon Valley. One of our concerns is this moving workforce and how we keep those. How do we make an environment here so that we keep the very best of our own rather than everyone shifting along with this importing?
Professor Phillip Brown, Professor Alan Manning and Professor Judy Wajcman – Oral evidence (QQ 15-25)

The Chairman: What is your view of why that happens? We know the visa issue, but what is the issue of us losing our engineers to other places?

Professor Wajcman: Unfortunately, it is to do with scale. I have just been at Georgia Tech. The scale of Caltech and Georgia Tech and MIT is just phenomenal compared to what we are able to do here. I am sorry. I was absolutely going to be positive, but I think that is true.

Q18 Lord Giddens: Can I ask you just to elaborate on a few aspects of implications for the labour market of the technological changes that are happening? Judy, I think you were here, but we talked about this issue with Martin Wolf and there are two things that arise. One is the issue of productivity: what it means that productivity seems relatively stagnant in an era of what appears to be very high technological change. I was quite taken with what you said originally about the emergence of a new kind of economy, because in a digital economy things are basically free and they can be shared across the world and they can be produced locally for a global marketplace for the first time. When we were talking with Martin I mentioned the Jeremy Rifkin book. If you pick up a book by Jeremy Rifkin you tend to think, “Oh, this is going to be exaggerated,” but I think it is interesting. There is something different going on here that could be quite transformative and I would like to hear what your opinion is. I think the issue of inequality needs teasing out a bit more for us because it is clear that there are big structural inequalities. Are they primarily winner take all, as seems to be indicated? Surely not. There must be several sources of the emerging pattern of inequality in the labour market and it would be useful to hear any comments that anyone wants to make on those two issues.

Professor Brown: I would be a bit more positive about your first point than the second one in the sense that I have also been looking at Rifkin’s book. There are a couple of others out there. There is Brynjolfsson’s book as well—The Second Machine Age, I think it is called. That seems to me to be a positive. I think the way in which new technology enables things to be driven down to the ground level and then allows for initiative at that level is very important. The issue then is how that leads to new forms of employment and what kinds of skill sets you have around that, but also who is likely to engage. There are likely to be major inequalities even at that level about who engages, who has the networks and who is able to use that initiative at that ground level. I would suggest that this is something that is worth exploring. I disagree with Rifkin. I think he is overly optimistic about the possibilities of all this because he is basically ignoring the underlying inequalities and I cannot see them shifting that much as a result of the collaborative commons. We already know about crowd sourcing and the way in which that is being used by companies to basically get free labour a lot of the time. You have a competition. The winner wins and everybody else’s labour is free. That is how it sometimes works, so I think we have to be realistic about what might emerge from that.

Q19 Lord Haskel: Could you comment on the fact that this destroys whole industries, the fact that things become free and available to everybody? If you look at the recording industry or the music industry and so on you have fantastic—

Professor Brown: Yes. I think the problem with this zero-marginal-cost argument is that it works in some areas but not in others. What is intriguing about companies is the way in which they use branding and other forms of identification of quality and need and desire that prevent that zero-sum outcome for them, but it will vary by sector. I think that is an
important thing to say about all our discussions. The sectoral level and the cross-sectoral level and the new areas of interdisciplinary activity are the points of opportunity because they are the points where you can lock in, for example, to global value chains. Companies are constantly looking for new ideas and it is those points of doing different things in different ways that they are particularly interested in. If we have the technical skills along with some kind of embedded capability within some of those key fields, that will certainly work to our advantage.

Professor Manning: If we look at the way the structure of employment has been changing, we have seen big growth in employment in occupations that are traditionally well paid and smaller growth, but still growth right at the bottom and big falls in jobs in the middle, typically jobs in manufacturing that were reasonably well paid and mid-level clerical jobs and so on. I think the explanation for the way in which the inequality has been evolving is just simple demand and supply. There is a little bit of winner takes all in some areas at the top, but there is nothing else mysterious. Well-paid occupations have seen faster growth in the demand for their services than other people.

As I said, I think that weak productivity growth at the moment in the UK is a cyclical phenomenon connected to the crisis more than any statement about the impact of technology. Through the crisis, productivity growth in the US was extremely rapid and the discussion there is entirely inverted, but obviously the underlying technological changes that are happening are essentially the same. As I have said before, I think we would go back to productivity growth of 2% to 2.5% as we have had for a very long period of time. That very steady cumulative change will destroy whole industries over 30 or 40 years, but it always has done. Although there are always losers from that and the losers are often very visible, there are also the gainers. The gainers in the past, who have been much more diffuse and much less visible, have always outnumbered the losers. That goes back to what I said before. New technology has been the only source of our increased prosperity over 200 years.

The Chairman: Yes. Professor Wajcman, anything to add?

Professor Wajcman: Only that I think pay inequality is not literally connected with technical skills. I think we all feel, after the banking crisis, that there are lots of ways in which, where people are rewarded for pay, it is not clear that the pay should be at that rate. In a future society where there are even more people in the service sector, it is partly a cultural decision about whether we will revalue caring labour and other forms of work and how we think about what we pay for particular things. It may be that, if we are in a different future with a different service sector, we will value skills in a different way and pay for them accordingly.

Q20 Baroness O’Cathain: How do practices such as offshoring impact on the labour market? I think we know, but I am of the view that onshoring can begin again if we get the proper skills here because there are social problems in terms of offshoring, particularly the point you made about our language skills. Will innovations such as cloud computing and automation negate the need for offshoring?

Professor Brown: I wish I could agree with you all the way. There is no doubt that one of the aspects of the rise of some of the emerging economies—China, India and elsewhere—is that as they look for access to European markets there is an opportunity for places like Britain to be a centre for research, development and so on. Tata, in terms of Jaguar, is a very interesting example of that process. Having said that, however, I think we always have to
remember that from a corporate perspective this is always going to be a quality/cost equation. The price issue is always going to matter. They will only move here if they want access to the regional market or they think that the quality standards cannot be achieved elsewhere or there is less of a price differential. The costing of these things seems to be critical for companies. One of the dangers is that we might see some of the call centres come back—they do not work very well—but we might see more high-skill work being offshored. As the quality standards and benchmarking of quality become increasingly globalised and spread well beyond China and India, companies are already looking to follow the sun in terms of their design, because basically they need to speed up the process of innovation. How do you do that? Well, you just have teams working the three areas of the world who are basically working on the same project and their digital skills are vitally important.

**Baroness O’Cathain:** That is the point. Does it hinge on digital skills? Certainly one of the reasons why I think we are looking at it is the fact that we are really concerned about being uncompetitive internationally because our digital skills do not match up with south-east Asia and South Korea and places like that. If we could improve digital skills here, would we get back the business?

**Professor Brown:** My view is you can get back some but certainly not all because a lot of this is based on cost and access to markets. You have this concentration in one or two parts of America, Silicon Valley for example, and the reproduction of that elsewhere is less likely. One of things we probably need to explore is the nature of global value chains. If they have high-skilled labour around the world, it does give these companies more choice about where they move to. The question then is: can we create clusters of embedded capability in key areas of digital activity that would allow these companies to recognise that this is a really good place to go? One thing is for sure: these companies are constantly looking out—for example, elite universities where the ideas are. So if they hear about ideas in Cambridge or Cardiff—LSE, to include everybody—then this is basically how they begin to develop these kinds of connections.

**Professor Manning:** I think offshoring is driven primarily by differences in labour costs and as China and these other places come up you expect to see less of it. But another important point is that offshoring is just trade, really, and it is just trade in things that we are not used to being tradable. That is facilitated by the improvements in ICT. But there is a long-run historical trend towards economies being more open and trading a higher fraction of what they produce. I do not think the response to offshoring is to think, “We want to do that here and not trade”. It is more that we have to have things that we can sell to other countries. Trade is based around specialisation and this goes to back to what the skills are that we need to have to make things that other people are going to want to buy.

**The Chairman:** We want to go on to that now and what I suggest, because we are quite tight on time, is that Lord Holmes and Lord Janvrin take their questions as a collection and we will get you to answer at one go on all those. Then we will come back to question of immigration.

**Q21 Lord Holmes of Richmond:** Thank you. Good afternoon. I think we skated around this a lot so feel free to answer in bullet points. What do you think the future workforce needs to look like to ensure UK global competitiveness?
Lord Janvrin: I also have to declare my interests, having not done so the last time round. I am Deputy Chairman of HSBC Private Bank UK; trade envoy to Turkey; member of the advisory board of the UK India Business Council; Chair of the Royal Foundation and the Entente Cordiale scholarship scheme; and a trustee of the National Portrait Gallery and the Gurkha Welfare Trust. I want to come back to Professor Brown. You mentioned the distinction between digital skills and skills for the digital economy. I think we will keep coming back to this. You mention mindset. What kind of education system do we need, or how do we adapt the education system, to get into that mindset change that you were talking about? I know that is a very broad issue but I think we have to get into it.

The Chairman: Yes, that is a clear theme here.

Lord Janvrin: It is part of what Lord Holmes is asking.

Professor Brown: I go back to what I began to mention earlier. Our current education system is simply not up to the challenge of what we are talking about. I see my own children go through this process where the teaching for the test, the encouragement of acquisitive rather than inquisitive learning, seems to be what defines the system. There is no space to think. There is very little permission to think within our current education system. There is no permission, in a sense, allowed within our society for people to think because basically the competition is too intense. For example, if one of the kids comes home and says, "I got a B", you hear, "Oh, that’s a bit disappointing". I would have been delighted with a B in my day. It is like that: unless you get A*s you are not really achieving. What we need to think about is how we move towards challenge-based learning, for example. So you start if you like with social problems and you start with problems and issues that are of interest to the students. Then you use whatever kinds of resources you need—you might bring in different disciplines—in order to examine a particular issue. The teacher might later on in the educational experience, in the process, recognise their own limitations in not fully understanding these issues and that is really important for students to learn as well as how you work in a team and how you seek out knowledge. I would suggest we need a fundamental root and branch rethink and it goes back to something that was said before. Ultimately International Baccalaureate, scrapping A-levels, has to be the way to go. We must have a broader curriculum. We must change our forms of assessment to allow a different kind of mindset to develop so that when, for example, they get to university they are fully engaged whereas what you have to do is find a way of turning them back on to education when they get into university. There is something fundamentally wrong.

Professor Wajcman: I completely agree with that but I think there are a lot of initiatives going on that we could learn from. I was reading yesterday about an American college called Harvey Mudd College in California, where the woman Dean turned round the number of young women studying computer science in an incredibly short space of time, doing all the things you suggest: making them do problems; taking different approaches. Young people are on their social media all the time. They have skills at some level or other and the issue is how to translate the everyday usage of those screens into more creative ways and to make them realise that these are skills that can translate. Jessica mentioned the example of art and design schools. I think we should have more initiatives at that level, saying, “Let’s look at art and design”. Lots of people there will not have maths A-levels or whatever, but there are loads of conversion courses we could do with adults. I am rather frustrated with the notion that we are going back to eight year-olds and I am going to have to wait again for what happens with the eight year-olds. I think we could have a lot of conversion courses with
graduates, like we have law conversion courses now. Lots of my graduates do that. Why can we not have those? I have talked to people about this. It is true that you cannot in a year learn electrical engineering, but you can learn a lot of software programming. There are lots of things you can learn if you are bright and able. We would get not just more young women, but young men who did not do maths and engineering. We would get different sorts of people with more rounded skills. I think there are lots of industries we could explore.

The Chairman: So you have two recommendations.

Q22 Earl of Courtown: I think you have covered much of this question. Professor Brown, at one point you said there is no real shortage of digital skills but I think you were talking about it on a worldwide basis. Bringing this back into the UK, we are going to have a short-term need of increased high-skill immigration. Would you all agree on that? What will be the effects of this over the medium term and long term? Before I finish, I have a comment on what Professor Wajcman said in her opening remarks on a totally different area from my question but particularly on the gender imbalance: I thought that was really interesting and shows a way to sell this gender imbalance and how we can improve it in some way.

Professor Manning: On high-skill immigration I think we have to be careful. The problem is that we have had a longstanding problem with providing specific skills in the UK economy because individual companies do not want to pay for the training themselves and they cannot get their act together well enough to agree on a system. So then it is very attractive option to say we are going to take someone whose training has been paid for by somebody else. But I think it is a dangerous route to go down. The failing is really with the training system and these are typically skills that are quite specific to particular industries.

Earl of Courtown: This is where conversion issue you were talking about comes in.

Professor Manning: Yes and it is used quite a lot, particularly in the case of IT people. I know the visa regimes are not meant to be a source of cheaper labour but I think in practice they are. I think they are meant to pay what is the prevailing wage but I think in the practice that is very hard to enforce and is not done. So I think companies tend to lobby for it because it is a very attractive option for them, but I am not sure whether for the wider society it is such a great option, although I concede there are going to be short-term bottlenecks sometimes.

Professor Brown: I completely agree with that. Microsoft is now getting desperate and is suggesting that it will offer, I think, $10,000 for a STEM visa in the States to be used for training for STEM for Americans and $15,000 for a Green Card. So it is still good value for them in terms of being able to do this. But when you think about it, we have so much graduate underemployment in this country. In terms of conversion courses, come on: there must be thousands of graduates out there willing to go on these conversion courses if there was some kind of loan system that would allow that. They do not want to add to their current debts, but some way to give them a chance to do this would be a worthwhile thing, I would say.

Q23 Lord Kirkwood of Kirkhope: Could I turn briefly to inclusion and exclusion? I listened with interest to Professor Wajcman’s very positive contribution towards the gender question. Even at this early stage in the inquiry I think the Committee has been struck by the need to do something about that. I was completely ignorant of the scale of the imbalance and I think you have made a powerful contribution. But there are also the perhaps more developed arguments about the unequal impacts to which Martin Wolf referred in the last
session on people with disabilities, people who are older and the other protected characteristics under the 2010 Equality Act. Do you have any view about that? Another dimension I began to pick up on in the course of this session is that an unequal impact might, as Tony was saying, be about the scale of unemployment to an extent. We may have to consider it by way of dealing with unequal impacts. I think we can bang the bit about the gender imbalance rather strongly but in terms of these other lists of characteristics that we have to pay attention to, and maths skills and inequality on a large scale, do you have anything that you can add—help us to suggest what we should be thinking about—by way of recommendations?

Professor Brown: In the digital divide that we have already talked about, that is one thing that is real. That is one thing that is really real and in a sense it is just repeating what we know, have known for a very long time, and that is that we have to do something to narrow the inequalities that we have in access to education and opportunities and—crucially—access to technologies. Sorry, but I might as well use my own kids again. If I think about the access they have as opposed to kids who are 100, 200 yards down the road, there is no comparison. There is a massive divide in access to that kind of knowledge and that sort of usage. So we have to do something at that level—there is absolutely no doubt about it—in terms of those social inequalities. One other inequality in relation to this that I think is also important is age. When you think about the older kind of population in terms of access to basic amenities—banking is an obvious example—this is where for example digital literacy really works, certainly for that older population. That is really important. The other thing in relation to age that intrigues me is I remember sitting in a group discussion of IT professionals and there was a massive difference between the old ones and the young ones. The young ones were saying, quietly, “They haven’t got a clue about new technologies. They don’t know what’s going on”. So I think it is one of those areas where the older managers, senior managers, have a huge amount to learn from their junior colleagues. Most of this is top-down but there should almost be a day where there is a complete role reversal where the older managers and staff learn from their junior colleagues because they are the ones who really understand where these technologies are going.

Professor Manning: On age, it is very hard to reskill older workers whose skills have been reduced in value by technical change. I think it is much more about making sure that when they suffer from the loss of demand for their work the consequences for their lifestyle are not as great as they are. But I think there is also a danger in the fact that our eye is drawn to those sorts of examples; they are very visible. But if you look at the way the labour market has been changing, it has entirely been to the benefit of older relative to younger workers. The ONS last week produced this statistic that said in 1975 earnings peaked at the age of 28; now they peak at the age of 38 and it is younger workers who are the ones who have been finding it harder to do well in the labour market, as a whole, not older workers. This goes back to the point that education cannot stop at 18. We have to find a way of giving young people, particularly at the lower end, skills that are valuable.

Lord Kirkwood of Kirkhope: In terms of people with disabilities, do you think we would be safe to draw on the point that was made earlier in the afternoon about the intuitive nature of the devices overcoming inaccessibility in different ways? Obviously there are different aspects, different categories of disability. But can Governments and policy-makers start insisting on this and threatening people perhaps with the Equality Act if they do not do some
of this stuff properly, otherwise people with disabilities are going to be inevitably left unable to take advantage of the opportunities?

Professor Manning: I think so with physical disability. I think the big challenge is going to be mental disability, which is completely different.

Q24 Baroness Garden of Frognal: We are in a sense back where we started now. I think this is a key issue that even the younger generation still seems to see certain subjects at school as being ones for boys and ones for girls. How do we break through that? There are some tremendous role models of women and girls in STEM subjects and in ICT. How do we engage girls more in these critical subjects, which you set out so clearly?

Professor Wajcman: There are lots of fantastic examples and I can see I should send some of them to you.

Baroness Garden of Frognal: That would be helpful.

Professor Wajcman: It is a range of strategies and I would also like to say that there are different kinds of engineering and computing and software and IT. So there is not one solution for all of them because we are talking about different skills and it is the whole range of things, from teaching in different ways, changing the curriculum, role models, shifting the culture and teaching at different places in a more interdisciplinary way. I know I have spoken mainly about gender, but I was really trying to make the point about the narrowness of engineering and computing skills. What I do not want is what happens in India, which is that boys at the age of eight are just put through an education system where they do nothing but hard science, go to those big tech schools, then the best of them end up in California. It seems to me that that is not a model we want to follow. We want to have a different kind of education system that will include different kinds of boys and girls and give us different kinds of technologies so that we can make the world in a rather different way than it is being made currently by these big corporations.

Q25 The Chairman: Thank you very much. Final question: we have already had Professor Wajcman’s recommendation, I think, so maybe this is to our other two witnesses today. Can you give us a specific recommendation you think we ought to be considering for our report? We are going to ask that of all our witnesses because obviously there is no point in just producing reports without clear recommendations for action, particularly at government level. So is there anything specific you would like to put on record for us today?

Professor Brown: I would expect to have said something about the labour market but I am not, I am going to say something about the education system. I think we should look to digitalise some of the school curriculum and to go for much more challenge-based approach education of blended learning at all levels, because I think it is going to come in anyway and we need to embrace it. And I think we should scrap A-levels and move to an International Baccalaureate to allow this kind of development and to avoid that narrowness of education that we have been describing.

Professor Manning: I am not sure that I am going to be very helpful because I feel I want to say something about skills and delete the word “digital”.

The Chairman: That is fine.
Professor Phillip Brown, Professor Alan Manning and Professor Judy Wajcman – Oral evidence (QQ 15-25)

**Professor Manning:** I just go back to saying that the biggest weakness over generations of our education system is in basic literacy and numeracy among a sizeable fraction of the population and we should not lose sight of that. It is our single biggest problem.

**The Chairman:** Thank you very much indeed. That has been incredibly helpful. Thank you very much for coming. Anything else you can send us would be very gratefully received, so thank you very much. As for Professor Wajcman’s point, she answered our first question. In fact she has given us two points, I think, because she has given the stuff on women but also the conversion courses. So we have four for the price of three, I think. So thank you very much indeed.
Transcript to be found under Boston Consulting Group
The changing technological landscape

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

The central trend in the digital technology landscape is a proliferation of connected computing devices; whether they are smartphones, tablets, PCs or even televisions, they are all essentially connected computing devices. They are all driving an enormous amount of data traffic on to communications networks. In the past eight years we have seen a thirteen-fold increase in peak data usage on our network. That enormous growth in data demand is changing the way people work and live, and is driving need for investment in networks.

As a consequence of that, all networks are investing to increase speed and capacity to respond to that level of data demand, whether fixed or mobile networks. For BT in particular, the data growth trend is driving our broadband and fibre broadband agenda. We are responding with capital expenditure investment in our fibre broadband network of about £3 billion over a number of years. We already have the UK at about 78% coverage of fibre-optic networks, or superfast broadband, which is ahead of the major countries in Europe. We have a goal to get well beyond that—to get over 90%—and we support the Government in doing that.

The pace and change of future digital technology will continue to progress rapidly and the potential to predict what will be the next big thing in terms of business or social applications will remain a challenge. So determining exactly how the UK should position itself to exploit the future will, in turn, also be difficult.

However, a number of themes are likely to continue, and these provide insight into how best to prepare the UK digital infrastructure to maximise flexibility to meet future demand and underpin the digital technology landscape. We have highlighted below some of these themes, not as an exhaustive list, but as illustrations of likely key features of a future landscape that BT is preparing for and seeking to position our network and services to deliver against. Of course, BT plays just one part amongst the many in the future of digital technology in the UK; other businesses, consumers, regulators and policy makers have potentially significant roles to play in shaping the future landscape.

- **Ongoing proliferation and evolution of mobile devices** – Smartphones, tablets and wearables, etc, are gaining ever more advanced features and functionality. This is leading to ubiquitous access, increasing online activity, enhanced collaboration, communication and remote working with knock-on effects for economic activity, productivity and innovation.

- **Continued expansion and development of cloud-based platforms** – With greater power and storage at lower cost per unit, for many businesses cloud-based will further lower barriers to entry and enable greater innovation and productivity. For consumers, this will allow them to utilise a growing range of advanced services remotely and enable virtually limitless access, instantaneously to all desired content, media and information at any time and any place.
• **Increasing data volumes & processing speed** – The volume of data that users consume and send over networks will continue to increase exponentially. However, the relationship between the amount of data consumed and access speed is arguably not closely related. For example, a user who watches one HD film per week today consumes around 5Gb of data and needs access speed of circa 6 Mbps to stream it. The same user next year could consume 10 HD films per week or 50 Gbytes of data but still needs an access speed of circa 6Mbits/second to consume it unless they choose to watch all 10 films at the same time on 10 different HD screens at once.

• **Coverage and connectivity** – The UK is already at near universal broadband coverage by premises (99% plus) with very high levels of superfast broadband coverage. The latest Ofcom data puts the UK at 78% with Northern Ireland and Cornwall, where public subsidy was deployed early, already well above 90%. This continues to grow. Similarly, the level of mobile geographic coverage is also very high and still growing, with an obligation from Ofcom on 4G providers to have achieved 98% coverage targets by 2017 (current 4G coverage is at 73% according to Ofcom). Given the proliferation of mobile devices, virtually all communication will involve a switch from fixed fibre and copper to wireless at some point, either via traditional macro cell mobile (2G, 3G, 4G and even 5G) or in home wi-fi or wider area wi-fi, etc. Similarly, users will be increasingly agnostic to how their communications links work. They will simply want to be assured that they do work, when and where they want them to work and with the performance they need.

• **The internet of things**[90] (IoT) – With more and more demand from devices, the internet of things and also increasing reliance on mobile communications, the coverage requirement for performance ‘on the move’ will increase further. But many of these mobile and device-based applications are unlikely to need the high access speeds associated with video-based and other human communication applications.

The ICT network is therefore increasingly moving towards one based on: ‘Fibre as far as possible, wireless at the edge’. What is changing is how big ‘the edge’ is and thus how widespread, how far and fast does it need to go and how best to get the fibre to where ‘the edge’ starts.

In order to position the UK to meet these emerging themes, innovations could focus on the below.

• Increasing capacity to mobile devices at ever lower cost through different mobile architectures and further utilising access to spectrum and mobile infrastructure (traditional mobile, wi-fi, femto/pico cells, etc). For example, the current wi-fi network through its architecture of millions of very small cells (including wi-fi routers such as BT’s Home Hubs, which allow secure access to other BT broadband users away from home) already carries 75% of the total broadband data volume using dramatically less spectrum than the cellular network currently does to carry relatively tiny data volumes.

• Continuing to drive to get fibre out to the edge of the network; for example, using new technology such as fibre to the remote node[91] (FttRN), G.fast[92], or through innovative

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[90] Where objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without computer interaction.

[91] FttRN brings fibre closer to premises by using a smaller piece of street furniture, as opposed to a street cabinet, further on in the copper network.
deployment techniques for the fibre cable itself or through better co-ordination, licensing and access for the civil-engineering work necessary to build the physical infrastructure.

- Approaches to markets and access to infrastructure. For example, as broadband users become increasingly agnostic to the technology that connects their devices, the various access markets (narrowband, fixed broadband, mobile) become increasingly substitutable. The ability to deliver effective services across the UK to all users will therefore increasingly depend on how effectively service providers can access all the various platforms, consistently and cost effectively. This is something that regulators and policy makers at UK and EU level (where such market rules are effectively defined) will need to increasingly focus on if the right environment is to be created for UK innovation to thrive.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

Deploying the infrastructure that supports and drives an information and communications technology (ICT) based knowledge economy is a key challenge for economic growth, but it is only one of the challenges. It is also one where the UK compares very favourably with major economies across the EU and indeed the globe. Whilst there is still more work to do in achieving a near ubiquitous superfast network, the UK, at 78% coverage and with firm plans, funding and delivery contracts in place to take this to well over 90%, is already well placed to realise the ICT infrastructure the economy needs to remain competitive.

Compared with other major nations, the UK also does very well on use and exploitation of the infrastructure with a thriving competitive market and UK consumers and businesses showing a willingness and desire to adapt and transform their lifestyles and business practices to take advantage of the opportunities ICT networks can deliver. However, there is much potential for further take-up among consumers and businesses to ensure the economic benefits that from the investment in infrastructure are fully realised.

The availability of ICT in many forms is an important driver of productivity and growth. Its value is not restricted just to ICT industries either. Firms that adapt their business models and supporting processes to take advantage of the benefits of high-speed ICT can realise benefits irrespective of their sector. However, countries, industries and firms continue to show great differences both in the intensity of ICT use and in their ability to reap the productivity gains. Thus, areas for policy intervention should focus not just on the availability of ICT but on ensuring that businesses and consumers access and exploit the full potential technology benefits in their business to maximise the productivity gains associated with its adoption and use.

Some case studies that demonstrate how the UK’s advanced infrastructure is driving competitive potential across the UK include:

- JR Annett, which has been manufacturing and selling pictures and mirrors since 1980. Based in Northern Ireland it is now selling its products all over the UK.

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92 G.Fast is a technology that enables copper to provide much faster broadband speeds.
• Media, arts and music business, Genius Loci, based in Cornwall is, providing advanced violin classes to clients around the world, from Goldsithney, near Penzance.

3. What is the employment impact on the UK’s labour market? What are the regional differences?
In 2012 BT commissioned Regeneris to conduct research published in a report: ‘Superfast Broadband – Boosting Business and the UK Economy’.

The report found that, based on case studies from around the UK, for any one location such as a rural area, town or city, superfast broadband could create between £143 million and £19.8 billion in additional GVA. This equates to an annual increase in GVA of between 0.3% and 0.5%. These increases arise from a combination of improved business performance; business creation as a result of cloud computing and enhanced home-working opportunities. The report further highlighted that:

- for a rural area (or set of rural counties) superfast broadband could lead to around 1,810 jobs created through business creation and improved business performance
- for a UK town superfast broadband could lead to around 225 jobs created
- for a UK city superfast broadband could lead to around 436 jobs created
- for the UK’s capital city superfast broadband could lead to around 26,200 jobs created.

In addition to the Regeneris research, DCMS commissioned research by SQW to specifically quantify the economic benefits arising specifically from superfast broadband deployment. The research found that by 2024 there will be 56,000 additional jobs owing to the deployment of superfast broadband with approximately 20,000 jobs attributable to the publicly funded intervention. The bulk of these benefits come from improvements in the productivity of firms using broadband, but there are also significant benefits related to the safeguarding employment in areas that would otherwise be at a disadvantage. Overall, the SQW report said that for every £1 invested in infrastructure projects, such as the rollout of fibre, there is a £20 benefit, together with the employment boost supporting long-term economic growth.

Future workforce

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?
Ensuring the UK has a well-educated and highly skilled workforce relative to the world’s developed and fast-developing nations is vital to ensuring it remains well positioned in an increasingly competitive global environment. Indeed, given the pace of skills development and education in other parts of the world, the UK will need to invest significantly in education and workforce skill development to retain its current position.

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93 Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. It is used in the estimation of Gross Domestic Product (GDP).
In defining the types of skills necessary for success, workers across the wider economy will need to possess strong analytical, critical thinking and communications skills, while being highly adaptive as technology-driven innovation continues to reshape all sectors. Moreover, as all sectors increasingly become technology driven, virtually all will need to have a basic competence across a broad set of common digital skills (use of communications devices/software, internet navigation, social media, etc) if they are to be fully effective in their chosen vocation.

Technical roles will require the broad competencies mentioned above but with further and deeper emphasis on specific digital skill sets depending on the nature of their technical role and sector of the economy they participate in.

From BT’s point of view, skilling future workers in cyber security, digital media and specialised diagnostic skills, will enable us to remain not only competitive but at the forefront of customer and business global requirements.

However, skills that can support converging markets and technologies are increasingly important. Our experience tells us that developing and skilling a technical workforce to evolve with the converging markets, ie, mobility, digital and TV, amongst others, will create more opportunity for new products and new markets. Convergence is starting to dictate the skillsets now required from a new type of skilled workforce, which understand the fundamentals of convergence and potential resultant products and services.

Historically, skillsets have been developed in isolation, for example, a highly skilled technical engineer who has the knowledge and capability in software engineering, but has not been encouraged to expand their skills into wider digital application, such as internet TV, remains in a silo allowing valuable skills and knowledge to be underutilised. This is now being recognised by the technology sector and it is starting to be addressed through initiatives such as Trailblazers, a government and industry initiative to reform apprenticeships, and industrial partnerships, where employers are taking a far more proactive role in developing these digital skills further. This learning needs to be shared throughout with educational establishments to ensure there is a joined up approach for when young people enter employment.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

Whilst it is challenging to develop a curriculum based on as yet unknown occupations, core skills in science, technology, engineering and maths (STEM) will always be critical. It is possible though to provide students with up-to-date insight into career opportunities and progression routes to reach those opportunities, such as university and apprenticeships. Close collaboration is required with industry to ensure that consistent, high-quality careers advice is provided to students at every stage in their education.
6. How are schools preparing to deliver the new computing curriculum in an innovative way?

The new curriculum provides teachers with a good deal of latitude in how they teach students computing. BT believes this will in time enable teachers to deliver the curriculum in ways that are innovative and inspiring to their students.

However, the challenge at present is to provide the teachers themselves with the subject knowledge and confidence to create their own lesson plans and to understand how to select existing resources and develop new resources that are appropriate to their students and school learning environment.

For many primary school teachers, computing is an entirely new subject and so BT is pleased to support initiatives such as Barefoot Computing, funded by the Department for Education, that are aimed at accelerating the preparations of teachers through industry-led workshops across England.

BT has 472 STEM ambassadors who are using their skills and training to support events including weekly code clubs for schools, Raspberry Pi workshops, Lego Mindstorm Robo’lympics, the Techniquest School programme, the STEM Goblin car challenge and the annual BT Young Scientist competition in Ireland. We host around 3000 children a year at our global engineering HQ at Adastral Park, Suffolk, to help highlight computing opportunities, including organising the UK finals of the international RoboCupJunior coding competition.

7. How can the education system develop creativity and social skills more effectively?

Communications technology greatly enhances the variety of media and channels of interpersonal communication available to people, socially, in business environments and in education. Just as writing greatly added to oral communication millennia in the past, and as telecommunication has add a whole dimension to inter-personal interaction over the last century, so the explosion of modern messaging – whether text, email, on social media or integrated into other applications such as in gaming – holds the potential to multiply again the dimensions of social interaction. Integrating these opportunities into the educational process is already driving innovation and creativity inside and outside the classroom.

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

The post-16 system should encourage students to do well across all the core areas, as well as individually chosen subjects, as inevitably all new ideas and technology will start or relate back to these core fundamentals. Modern apprenticeships can be used, as BT has used them, to encourage young people into technology orientated careers.

Short- and medium-term support to the digital sector

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

Using the sector skills council, e-skills UK, as the pivotal and focal point, employers across the sector are starting to engage in common issues and common desires, but these initiatives need to be nurtured, developed and encouraged ideally through incentives, as the
digital sector needs collaborative working if it is to stimulate new skills and entice new talent into it. The short- to medium-term requirements from employers’ perspectives are fairly basic but not simple to resolve.

They fall into three key areas:

- the attraction of young college and university students into the digital sector. How can this be stimulated, especially to young women where the attraction is minimal
- developing new skills and training to fill the gaps and meet new technology
- to offer new vocational opportunities to allow the up-skilling of existing work force and to offer new apprenticeship opportunities through the creation of new frameworks.

With help from the private sector to add its expertise and knowledge to the subject matter, the educational establishments could demonstrate in a far more aggressive and positive manner the opportunities and the skills to young people so they understand what the sector has to offer.

Colleges and schools are limited in what and how they can teach and often lack the commercial/work experience as to how the learning plays back into the digital sector and how this drives growth and new opportunities for start-up companies and well established companies. There ought to be a more joined-up approach in terms of how the private sector can support and where, at the moment a lot is dependent on good will and volunteering which is a start but lacks strategic direction and is random across the country depending on attitudes of educational establishments. This area is prime for picking as both the private and public establishments have common needs that can be fulfilled for both if only they shared and worked more collaboratively together.

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

The UK is a leading performer globally in the calibre of its talent, in the openness of its economy and in its attractiveness as a destination for talent. This openness allows us to attract people of high skills into the technology professions where we have needs. The openness of the European Union presents the UK with a huge pool of talent to recruit from without barriers. Our connections with the breadth of talent in many countries with which we have strong links from our history around the world are a strength on which we can draw. The public policy environment does not need to be specifically adapted to increase or reduce immigration given these existing strengths, so long as the basic openness of our society is assured.

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

BT is a member of the Government Digital Services (GDS) VCSE/SME Working Group, supporting the GDS Digital Inclusion delivery board. The group’s aims are to bring together public, private and third sectors to identify synergies and collaborate to increase digital skills across charities, social enterprises, voluntary groups and SMEs.
This includes a unified approach to build on the work being done by Local Enterprise Partnerships or through mentoring programmes for voluntary, community and social enterprises (VCSE) and SMEs and government activities, such as BIS’s digital capability programme or the Office of Civil Society’s VCSE masterclass work. The working group will also identify where different approaches need to be developed specifically to meet the unique needs of each sector and identify ways in which these needs might be addressed.

By way of example, other schemes already under way include:

- The Get IT Together partnership between BT and Citizens Online focuses teaching older people digital skills
- BT and children’s charity The Transformation Trust asks young people in schools and colleges to get involved in the BT Digital Champions programme. Each student spends at least one hour with someone in their local community helping them to get online. The programme aims to recruit 10,000 BT Digital Champions from schools in England, Wales, Scotland and Northern Ireland
- BT has been working with e-skills UK to support ‘Girls Get Coding’, which encourages young girls to take an interest in computer science by connecting them with positive role-models such as BT’s own female computer scientists.

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

BT has undertaken comprehensive research and evaluation, including a two-year study and social return on investment analysis of those we have trained to determine the long term efficacy of our digital skills (Get IT Together) programme. Detailed work with Job Centre Plus and local authorities has also provided deep insight into systemic problems.

The output of this research shows the following:

- poor data use and lack of profiling of individual needs
- lack of early assessment of client skills
- lack of consistent and appropriate training with suitable aftercare and monitoring
- poor digital skills competency amongst front line staff in key agencies.

Additional findings reveal that whilst 80% of beneficiaries have continued using their new skills and 60% have taught friends and family, without ongoing support some 20% will not continue to use their digital skills. Key stakeholder interviews (Job Centre Plus, housing associations, LAs) have highlighted the need to map the end-user journey starting from when they enter Job Centre Plus and their digital skills are assessed. The skills required need to be mapped according to the needs of individuals and all stakeholders should work together to ensure they are reinforcing the learning journey, ie, not duplicating or providing insufficient support assuming other partners are plugging the gap.

Digital skills surveys and testing with Job Centre Plus demonstrates an inconsistency between the declared digital skills of those seeking employment and reality (people are inaccurate through fear of repercussions or confusion). Anecdotal feedback from our project officers and local partners demonstrates a lack of consistent provision, libraries being unable to meet demand and beneficiaries under pressure or feeling let down by providers. We are
currently undertaking action research to demonstrate triage, training analysis, the value of mapping and joint targeted / “nudge” marketing. We believe these are the solution to the above issues and are sustainable in the long term.

It’s clear from the above that a productive ‘digital ecosystem’ can only be achieved by local government, LEPs and the third sector working together in partnership, supported by private sector organisations. Each brings different elements of the solutions, from libraries and unused LA office space, to funding and skills training.

Industry

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

Advancements in communications infrastructure, internet infrastructure, data processing and storage power has created the start of a golden age of technical empowerment; reducing costs, expanding and opening new markets while rendering size and distance much less of a competitive barrier. Indeed, there has never been a time where advanced technology has been so readily available, that can achieve so much for businesses, large and small. Small businesses can use systems that make them look bigger and enable them to trade worldwide and big businesses can look more local and approach different segments of their audiences in different ways. These are just a very tiny example of what can be achieved. However, the barrier, for smaller businesses particularly, is knowing which way to go; the choice of IT and opportunities is overwhelming. By way of example, should back-office systems such as finance, HR, salesforce management, etc, be streamlined to make cost and efficiency gains or should complex front-office systems as online and offline retail services be converged to gain economies of scale?

Without deep IT skills and experience of converging technologies it’s often difficult for businesses to define the IT roadmap which will underpin their business model and strategies for the future. They can of course use managed services and consultants but knowledge embedded within a business is key. A huge step forward will be for businesses to recognise this and encourage their people to develop skills that can cross a range of disciplines within a business rather than just focusing on one aspect, such as driving ecommerce sales to a back office that can’t handle any extra work.

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

Apprenticeships in a wide range of industries should include digital skills. Whether technology apprenticeships or not, digital skills have become a fundamental part of the workplace and must become a core part of training. Companies of all size can be helped to offer apprenticeships through financial assistance and by educating them as to the benefits of employing young people with new skills that can potentially take a business into new areas.

Further engagement in schools and colleges must be the way forward with initiatives such as ‘Believe in Young People’, a partnership between employers and schools, providing work-related lesson plans, work experience, careers talks and opportunities such as jobs and
apprenticeships. This is a model that could be used more extensively. The issue is how to publicise this across the sector.

The digital skills shortage affects not only business growth but the growth of the economy too. The dilemma for all is where the support and help should come from to deliver up skilling? If it is left totally to employers then skills tend not to be transferable as qualifications are missing; if we introduce qualifications and funding to support, then the debate on accreditation versus skill transfer starts. There is a need to clarify both of these, skills need a qualification if they are to be transferable but employers need support to do this. There has to a compromise between both.

Infrastructure

15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

Overall, the UK has a highly competitive broadband communications market, with hundreds of service providers offering products and services. This competition has resulted in some of the lowest prices in Europe, very high levels of coverage and usage for standard broadband and superfast broadband and continued investment by public and private sector in pushing the ICT network ever deeper into the UK.

Recent reports from Ofcom\textsuperscript{94} and Analysys Mason\textsuperscript{95} have confirmed the UK’s position as the leading player across the major EU economies in terms of superfast deployment, usage and pricing. With contracted and funded programmes underpinning the government’s targets of ever deeper deployment, the UK stands apart from most competitor countries that have political ambition, but little committed funding or concrete deployment plans.

For example, in 2013, the French government set out plans to invest €20 billion of public and private funds in next-generation fixed and mobile broadband, aiming to cover half of the population by 2017, with the remaining homes covered within a further five years. As yet though there is no agreement on where this money is coming from, how it will be split between public and private sector and how the target will be achieved. Similarly in Germany the coalition government set an ambition of delivering ‘50Mb everywhere’ but there is as yet no agreement on how this investment will be funded or how it will be achieved. Although we understand that Deutsche Telekom has been campaigning for the monies raised by the 4G spectrum auctions to be utilised to pay for this.

Contrast this situation with the UK, where targets clear, funding has been clearly allocated and committed by government at both national and local level, formal EU state aid approval has been sought and granted (a necessary prerequisite to any government investment in this space), formal EU compliant procurement processes have been conducted, contracts have

\textsuperscript{94} Ofcom’s Communications Market Report 2014 http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr14/
\textsuperscript{95} Analysys Mason Superfast Broadband Benchmark report 2013 http://www.analysysmason.com/PageFiles/44401/Analysys_Mason_Superfast_broadband_benchmark_Nov2013.pdf
been signed and formal funded projects to deliver against the targets are underway and actively delivering.

Some countries, notably Japan and Korea, benefitted from very early state intervention and are currently ahead of the UK. Some of the smaller EU countries such as Belgium and the Netherlands with their legacy of wide cable TV coverage have also inherited an advantageous situation compared with the UK. However, these gaps are closing fast and the issue is increasingly not one of availability but of take-up and effective exploitation. The UK undoubtedly has the most competitive market in the and the cheapest prices amongst the major countries in the EU so is well positioned in terms of infrastructure provision, availability and use.

10 September 2014
Commercially unviable areas in cities and urban areas

The Committee asked for one suggestion or recommendation that the government should consider for action. I described the situation with regard to commercially unviable areas in city and other urban areas, where the economics of deploying fibre can be just as challenging as in rural areas. These difficult areas are often characterised by low residential population densities and streetworks and network topography issues.

The most significant opportunity for the UK to transform its competitiveness is by achieving effectively near universal coverage of fibre broadband infrastructure across the UK. Whilst the UK is a leader today with 78% coverage and with clear plans in place to get to over 90%, achieving effectively ubiquitous coverage of fibre broadband will deliver opportunities to improve national productivity, innovation, social cohesion and competitiveness.

While there are a number of different coverage challenges to address in order to achieve that goal, most of which we have plans to overcome, the most significant remaining challenge is addressing these difficult urban areas. To get to 99% fibre coverage, the UK will have to deal with the “white areas” in cities where there are no commercially viable fibre deployment plans. However, EU state-aid rules treat cities differently from rural areas, discouraging fibre deployment in these areas.

The European Commission has drawn distinction between rural areas and urban areas based on a misunderstanding of the commercial case for fibre deployment, and it allows use of public funds in cities only if subject to particularly burdensome “access” requirements. If this continues, it will deny the UK an opportunity to achieve a further step-change in the competitiveness of our cities and will leave them lagging coverage in rural areas. To address this, the solution is for the government to work with the EU Commission, to lay the facts before it and to seek approval for an effective supply-side intervention in cities.

The EC state aid guidelines for fibre require that any infrastructure built in cities with state aid funding is available for all other uses, unlimited in use and unlimited in time, and not just for the delivery of superfast broadband for which the aid is intended. This rule applies not only to the subsidised infrastructure, but to any other commercially funded infrastructure that connects the subsidised investment to the rest of the network. The problem with this is that it undermines commercial investment in competitive Ethernet (high-capacity broadband services aimed at larger businesses and SMEs, provided over private lines) markets in cities. Many operators have invested in Ethernet networks in cities already. If subsidised infrastructure can be used for Ethernet, then all the operators who have made investments will be undercut by subsidised operators. The consequence of this is that it is not in the interests of any network operator to take aid on these terms, with the result that superfast broadband coverage in inner cities will end up, absurdly, being worse than in rural areas.

To solve this problem, the government should approach the European Commission with an application for state aid approval for a public subsidy of fibre investment in inner cities on
terms that are viable for likely partners and that do not undermine commercial investments in Ethernet markets. This may be a prolonged negotiation with the EC, but the evidence of the economic barriers to fibre deployment, evidence of the barrier to achieving 99% that cities represent, and a proper understanding of the impact of subsidies on unrelated Ethernet markets should all be properly evaluated by the EC.

Incidentally, this policy position does not presuppose that BT will win any competition for such aid, as Mr Butler suggested in the hearing. The aid scheme needs to provide for competition in the bidding processes and wholesale access on equal terms for all operators once it is built, whoever is successful in winning any tender.

It is important to note here that solutions exist already for larger businesses in these areas: our Ethernet products for medium and larger businesses are widely available across all cities in competitive commercial markets. The point of state aid is to promote network roll-out for consumer and smaller business-level fibre broadband, for which there is no commercial case for deployment because of the costs of network re-engineering and customer demographics, the same logic that applies in rural areas.

**Infrastructure, a definition**

I was asked to define infrastructure during the session and I summarise my definition of five component parts as follows:

- the hard infrastructure: this consists of the cables in the ground, whether copper, fibre or coaxial cables, as well as exchanges and other equipment
- innovation: broadband is not just a static technology; innovation in this environment is key to satisfy the demand for coverage, speeds and new services
- people skills: the recruitment of suitable people and training them in information and communications skills (ICT) services
- customer skills: these range from understanding the largest corporations in the world and the complex technology solutions required for their business problems, delivering to SMEs moving to cloud-based services, to the mass market of residential consumers who are at varying digital skill and experience levels
- public policy environment: this includes all the relevant public policy supporting the digital agenda, including school curriculum, vocational training, internet policies, planning policies (to install and maintain hard infrastructure) and the establishment of public funds to push the network even further into rural areas.

*18 September 2014*
The changing technological landscape

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

- The pace of digital technology change is accelerating and it is difficult to predict the precise nature of the change or the likely technologies that will impact on society at large. However, there are clear indications of the major themes that will influence the rate of change. These are:
  - Extension of mobile applications allowing access to the Internet anywhere and any time
  - The growth of the social network effects of rapid instant communications and enabling the formation of communities of interest and campaign groups such as Avaaz, 360 Degrees etc. further eroding the power of large organisations to represent themselves other than they are
  - Digital connections further reinforcing globalisation of economies as consumers being able to access global as well as local supply chains
  - Further commercialisation of “The Internet of Things” evidenced by applications like British Gas’s Hive Home
  - The evolution of new business models and the development of new economic ecological niches enabled by digital technology

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

The main challenge for the UK is the exploitation of the potential benefits that may result from the increasing penetration of digital in all aspects of life. In addition to the Programming and Software engineering skills, the UK must also educate business leaders in Digital Acumen. Currently, one of the main barriers to exploitation is the lack of awareness of the potential benefits and risks in embracing digital. The attitude that Digital is a “technology” issue and can be delegated to specialists is still too prevalent in leadership of organisations.

We expect all leaders to have knowledge of finance, strategy and Organisational Behaviour yet it still seems acceptable for business leaders to claim that they have no knowledge of technology or interest in Digital. Digital offers the possibility of integrating and cutting through “functional silo thinking” but requires leaders to embrace the possibilities enabled by technology. Therefore, Digital Acumen must become part of the core curriculum of management training at both undergraduate and postgraduate levels.

We should also encourage current organisation leaders to increase their own Digital awareness through CPD.

Government policy should also focus on making life easier for starting Digital businesses to explore new business models enabled by Digital technology. Although crowd-funding and easier access to Angel and VC funding is helping, the regulations required for new businesses,
individual taxation and company taxation still makes the risk/reward balance unfavourable for business start-ups.

3. What is the employment impact on the UK’s labour market? What are the regional differences?

Undoubtedly, London and the South East will remain a centre of gravity for business particularly with the siting of Tech City in London. However, by investing in regional hubs around the major cities and fast broadband will enable these hubs to interconnect with the London and other global centres. The knowledge economy will make larger conurbations more attractive but this can only be enabled if Government policy and infrastructural investments make the regions attractive places to cluster.

Future workforce
4. What skills do future workers need in order for the UK to be globally competitive?

How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

It is my opinion that the current supply chain will not deliver the skills and attitudes required to thrive in the future Digital economy. The education system is too focused on pedagogy and developing specialist knowledge in individuals rather than critical evaluation of knowledge, its application to real-world issues and collaboration in solving problems. Whilst specialist knowledge is important and there will be a need for specialists in specific areas, the availability of knowledge through digital channels changes the game. The real need is for sufficient understanding to access content that is freely available, evaluating the trustworthiness of the knowledge and applying the knowledge to specific problems in collaboration with others.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one?

We need people to collaborate to invent new services, new business processes and new business models yet at school we discourage this through examination systems that test remembered knowledge rather than application. Little or no work is done in empowerment and developing self-confidence in schools.

How can this be improved?

Whilst initiatives such as Maths Inspiration and Code Club are helpful in inspiring young people to take STEMS subjects, perhaps the DBIS may look at attitudinal interventions such as Drucker for Future Leaders designed specifically for young people would be a useful supplement.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

7. How can the education system develop creativity and social skills more effectively?
8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

As stated previously and in answer to questions 7 and 8, the key issue is the mind-set of the management within the Education system. In the short and medium term, the most effective way to foster change is to design the incentive system to encourage the use of Digital as part of the student learning experience. So suggestions like equipping students with pads, submissions in forms other than text and the use of digital in teaching non-STEM subject would be a good first step.

**Short- and medium-term support to the digital sector**

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

Although institutions have a role to play, there is a key issue in the balance of incentives for start-up Digital businesses. The present risk v rewards only encourages the bravest to invest their time and effort to start a business. Perhaps initiative like the Young People Start-Up Scheme might be considered.

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

If the UK has insufficient Digital skills, then we must allow immigration of those with the appropriate skills otherwise we will be uncompetitive. Perhaps more could be done in PR and Communications proactively rather than letting the tabloids set the immigration agenda.

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

Potentially the Digital agenda could address inclusion but there needs to be means of giving access to digital to those who might be excluded. Perhaps, charities and not for profit organisations could help to disburse any discretionary funds for things like broadband connections and equipment.

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

**Industry**

The risk in including these groups is that it becomes a bureaucratic nightmare. I would prefer Third Sector involvement but this needs to be carefully thought through.

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

One way is to encourage SMEs business leaders to have a greater awareness of digital; perhaps additional tax breaks for such training. The courses do not have to be long and we could task UKTI to include Digital Acumen as part of their SME training offerings.
14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

*This is again a mind-set issue. Whilst business leaders are unaware of the potential benefits and unaware of the risks, it is difficult for them to exert a leadership role for their workforce.*

**Infrastructure**

15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

*C*learly no. We need faster broadband and greater penetration. *W*hen we look at connection speeds available in places like South Korea, Singapore and Dubai it is clear we are behind. *T*he consequence of this lack of investment in broadband infrastructure is that we will not be able to compete internationally.

*6 August 2014*
Channel 4 welcomes the opportunity to respond to the House of Lords Digital Skills Committee’s inquiry into digital skills in the UK.

Channel 4 is a publicly-owned, commercially-funded public service broadcaster, with a statutory remit to be innovative, experimental and distinctive. Unlike the other commercially-funded public service broadcasters, Channel 4 is not shareholder-owned: commercial revenues are the means by which Channel 4 fulfils its public service remit. In addition, Channel 4’s not-for-profit status ensures that the maximum amount of our revenues is reinvested in the delivery of our public service remit.

As part of its long-term multiplatform strategy, Channel 4 has continually led the way in providing digital innovations in the broadcasting sector – from being the first UK broadcaster to provide its programming on video-on-demand with 4oD in 2006 to developing our upcoming new digital service All4 which will integrate catch-up, live and upcoming content – for the benefit of UK audiences.

Channel 4’s ability to continually develop these, and similar, pioneering initiatives is reliant in no small part on having a skilled workforce equipped with the necessary digital skills required to navigate and understand technological developments. As such, Channel 4 takes a keen interest in this area and, as outlined below, as a publisher-broadcaster itself plays an important role in supporting the development of those with specialist digital and technological skills both internally and in the wide range of digital companies and educational institutions we work with.

In conducting its inquiry into digital skills, Channel 4 believes that it is important that the Committee remains clear about the scope and definition of ‘digital skills’. In the broadcasting sector, and at Channel 4 specifically, where engagement with digital and technological work spans a range of business activities, we believe it is important to focus both on core technical production and broadcast engineering skills as well as accompanying work – such as our developments in big data – that underpin digital strategies.

Channel 4 and digital skills

As a public service broadcaster with a remit to demonstrate innovation and experimentation in our content, Channel 4 is committed to engaging with viewers on a range of platforms – from television to online and on mobile – and across different genres. In an increasingly converged world, where viewer demand for second screen experiences continues to rise, Channel 4 recognises the importance of developing digital innovations to accompany its on-screen content.

In recent years, these innovations have included the development of apps related to its programming, including play-along versions of live games (such as the Million Pound Drop app, which has been downloaded over three million times since its launch in 2012) and those providing supporting content in addition to the television offering, such as the My HealthChecker app accompanying Embarrassing Bodies which allows users to utilise particular functions of the iPhone to carry out a range of health self-checks.
Alongside these apps, Channel 4 has also extended a number of key programmes into the mobile games market, allowing it to deepen the experience around television viewing and meet audience demand for further interactivity. Highlights include *Made in Chelsea: The Game* – which overtook long-established games *FIFA* and *Grand Theft Auto* to become the number two game app in the country – and *The Snowman and The Snowdog Game* which allows users to join the Snowman on his journey to the North Pole.

In addition, Channel 4 continues to innovate in its online content, with online and television commissioning teams integrated to ensure a cross-platform approach across the whole organisation. This has allowed for a number of integrated TV and online experiences such as the award-winning *D-Day: As it Happens*, which recounted online and in real-time the events of 6 June 1944, as well as special web-only content to accompany Channel 4’s recent *Live from Space* season.

This multiplatform content has enjoyed both critical and commercial success, with Channel 4 commissions winning a number of industry awards – including four at the British Interactive Media Awards 2013 – and several apps receiving over 1 million downloads.

The development and maintenance of this content requires a skilled workforce with a significant knowledge base in digital and technological work, both at Channel 4 and in the wider digital and technology companies that we work with externally each year. In 2013, Channel 4 invested £8 million on digital media – covering its websites and cross-platform media – with digital and technology companies from across the UK. This investment helps these organisations to prosper and develop, which in turn increases demand for a supply of individuals with the necessary skills required to develop digital products.

As a not-for-profit public service broadcaster, we are able to ensure that the maximum amount of commercial revenues raised from Channel 4’s digital innovations are reinvested back into further commissions and, in turn, into digital and technology companies that continue to drive the development of digital skills in the UK. Within this work, Channel 4’s position as a publisher-broadcaster allows it to operate within a mixed economy in which these digital and technology companies sit alongside external contractors and Channel 4’s own staff to develop our digital products and support the technology and engineering behind them, which itself encourages a transfer of skills and longer-term movement between the sector.

**Engagement with educational institutions**

The Committee is right to focus on the role that higher educational institutions can play in providing young people with the necessary skills required for the UK to remain digitally competitive. As the range of specialist skills required within the sector continues to widen each year, universities and higher education colleges must continue to ensure that the courses they offer remain relevant to both graduates and businesses alike.

Given the unique characteristics of the digital landscape – where the pace of change and rapid demand for skills required for new technologies can often outstrip the duration of a university course – it is increasingly important that industry and educational institutions collaborate where possible to ensure the skills of individuals reflect the demands of the sector. We would note that, where this engagement has taken place in other countries,
these nations have remained competitive within the global digital sector. Channel 4 itself has worked with companies in Sweden on the development of its 4oD app for set top boxes given their strong skills base in mobile, driven by successful university training in this area.

Channel 4 recognises the importance and mutual benefit of this collaboration, and works with a number of educational institutions in the development of many of its digital and technological innovations.

In games, for example, Channel 4 has supported the video game competition *Dare to be Digital* – run by the University of Abertay Dundee – since 2012, providing a £25,000 award and mentoring the winning student team to help them establish a company and publish their game. Following this initiative, Channel 4 has recently published the game *Size Does Matter*, a music arcade game which received the BAFTA Ones to Watch Award in 2013 following its success in the *Dare to be Digital* competition.

Channel 4 also engages with a number of higher education institutions on a range of its work placement schemes where digital skills are increasingly important, with its extended training scheme offering students from the University of Westminster the opportunity to embed themselves within the Channel 4 Technology team and support the delivery of many of their projects.

Our Scholarship Programme also allows two individuals to work within the Audience, Technologies and Insight department for five years and receive mentoring while attending University College London on a part time basis working towards a PhD in Statistics. This programme allows Channel 4 to identify graduates with the required core skills and technical training and provide them with hands-on experience of our work with data that is central to developing our digital and technological products.

Channel 4 believes that this engagement between industry and higher educational institutions should be encouraged across the digital industries where possible, to help provide students with the opportunity to practically apply their skills within industry while ensuring that educational courses focus on developing skills that are relevant to the current and future workforce.

**Digital entrepreneurialism and competitiveness**

Channel 4 welcomes the Committee’s focus on ensuring that the UK remains a competitive digital player on the international stage. The UK remains at the forefront of a number of technological and digital innovations and possesses a strong educational and industrial infrastructure to help ensure that this remains the case in the future.

In order for the UK to remain competitive in an increasingly globalised market, Channel 4 believes that it is important that the strong technical skills base we currently possess in the digital sector is matched with an equally strong business skills base – including in commercial exploitation and marketing – to ensure that the value of digital innovations remains in this country.

We would further note that the Government can also play a central role in promoting the development of digital skills, both directly through the schools curriculum and indirectly
through specific policy initiatives directed at the digital industries. We welcome the introduction of the new computing curriculum following the Livingstone-Hope Skills Review, which will help to equip young people with the necessary skills required for the UK to compete as a global digital economy.

More broadly, we would also note that the recently introduced Games Tax Relief is similarly a welcome intervention that will help to stimulate growth in the sector and, in turn, improve skills given the increased demand for employees able to create and develop games products.

**Industry-led initiatives**

Channel 4 recognises the important role that organisations operating within the digital sector play in further developing skills within the industry, and itself offers a range of training and skills initiatives aimed at engaging individuals – both internally at Channel 4 and externally – in its work in this area.

In addition to the apprenticeship, graduate and scholarship programmes outlined above, Channel 4 operates a Production Training Scheme each year, providing twelve month paid placements for entry level staff at one of the independent production companies it works with. The scheme covers a number of technical and digitally focused roles, including a Technical Assistant position which provides support to post-production teams and involves developing multi-platform productions. In order to promote diversity in the media industry, and to address the under-representation of disabled people in particular, Channel 4 aims to fill half of the positions with disabled applicants.

Alongside this scheme Channel 4 has recently developed Open4, a pioneering online learning platform and traineeship programme offering learning modules designed to educate users about various aspects of television production. The scheme is part of ‘Open Channels’ – a collaboration between Channel 4, Creative Skillset and the BBC to create a new ‘end to end’ programme of training and work placements to support recruitment into production and technology roles in the broadcasting sector.

In addition, as part of the 4Talent initiative – Channel 4’s nationwide outreach scheme aimed at supporting people from a range of backgrounds looking to develop a career in the media – Channel 4 also engages young people from across the UK with its digital work, holding open days outside of the traditional media ‘hubs’ where careers advice and workshops are provided by Channel 4 staff and local television and digital companies. We believe that these schemes help to broaden the diversity of entrants into the creative and digital industries, which in turn strengthens the sector through a broader range of experiences and ideas.

Channel 4 hopes this submission is of assistance to the House of Lords Digital Skills Committee, and would be happy to discuss any of the points raised above further if this would be useful.

*12 September 2014*
Chartered Institute of Library and Information Professionals – Written evidence (DSC0045)

CILIP
CILIP: the Chartered Institute of Library and Information Professionals is the leading professional body for librarians, information specialists and knowledge managers. CILIP’s vision is a fair and economically prosperous society underpinned by literacy, access to information and the transfer of knowledge.

More than three thousand of our members work in public libraries and their practitioner voice is represented here.

As our funding comes from member subscriptions and our own commercial activity we are able to act as an independent voice of the profession reflecting the knowledge and expertise within our membership. CILIP is a registered charity, no. 313014 and more information about us can be found at www.cilip.org.uk.

We have responded to eight of the fifteen questions in the call for evidence.

You will find a summary of the key points we wish to make in our answer to question two.

The Changing Technological Landscape

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

1. There are a number of big challenges ahead if the UK is to thrive in the knowledge-driven economy. Four stand out for CILIP:

1.1 The transition from manufacturing to a knowledge driven economy will see the value of intangible assets such as intellectual property rise. The World Intellectual Property Office (WIPO) predicts that they will grow from 20% to 80% of the value of that economy. A report from Price Waterhouse (PWC) goes further: “It is estimated that..as much as 90% of the value of the world’s top 2000 enterprises will consist of intellectual property”. The challenge is to capitalize and leverage intellectual assets to drive the knowledge economy. At the moment it is difficult and unusual to include them in a balance sheet and so accord them their proper weight when assessing the health and performance of an organisation and its future direction.

1.2 Increased mobility within the workforce means the ability to telecommute is more attainable than ever. This brings with it an increased threat of competition, especially from overseas, as digital economic activity reduces dependency on location/proximity to clients and colleagues.

1.3 Recognising the “I” for information in ICT. If technology is the plumbing then information (content) is the water. It needs managing well and the skills and expertise of information managers need acknowledging as they will be an essential component to future success in a knowledge driven economy. These specialists are experts in the
collecting, organising, storing and exploiting information, data, expertise and other knowledge assets which are held within an organisation, ensuring that these assets remain available for future use. This includes important areas such as information governance (e.g. freedom of information, data protection, copyright), data assurance and security and more recently the use of big data.

1.4 Ensuring a digitally and information literate population able to participate in all aspects of human life whether as consumer, employee, learner or citizen. We define information literacy as “knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner”. We would see digital literacy as not only being about basic technical abilities in using technology but also embracing information literacy within a digital environment.

2. It is on the last two points especially that CILIP is active. We are concerned that the importance and value of information management is not sufficiently understood by organisations across all sectors. We are currently engaged in a workforce mapping exercise that will include information and knowledge managers and strongly suspect that the results will indicate patchy provision of suitably qualified staff across organisations and raise questions about the supply of such expert staff. We are also in the process of establishing an Information Management Alliance with other professional bodies which we see as an important advocacy platform for the value of information and knowledge management and the need to promote information and knowledge management as a profession, and one which is critical to the future economic success of all organizations and the UK.

3. In terms of the broader set of information skills that everybody should possess there is still a long way to go. Libraries, especially public libraries and those serving educational institutions, are important in addressing the literacies necessary for life. It remains still a profoundly shocking statistic that about 16% of the UK adult population have a reading and literacy level below that expected of an 11 year old child — reading is as important in the online world as it is in the print world. There are various estimations of digital skills but most suggest that around 11 million adults (23%) have no digital skills, again an astonishing figure to comprehend in a developed nation such as the UK. This is why CILIP is so concerned at the continuing cutbacks to public libraries and has recently campaigned for a professionally qualified librarian in every secondary school. They are essential to ensuring that the knowledge-driven society is inclusive and optimising the opportunities and capacity for future growth.

4. Our answers to the questions below expand on some of these points.

Future workforce

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

Size of skills shortfall

5. We suspect the current supply chain will not be able to deliver the workforce required in the future: At a general level it is estimated that
5.1 745,000 additional workers with digital skills will be needed to meet rising demand from employers between 2013 and 2017 (O2, The Future Digital Skills Needs of the UK Economy, 2013).

5.2 90% of future jobs roles will require IT skills. (The Digital Agenda- ICT for jobs)

6. CILIP is also undertaking a workforce mapping exercise that will focus specifically on the Library, Archives, Records, Information, and Knowledge Management workforce. Although all parts of the workforce covered are of interest to the digital skills agenda, it is the information and knowledge management sectors that have especial relevance to the effective management of the information resources of organisations. The workforce survey will provide badly needed statistics on the size and qualifications of the existing information and knowledge management workforce and point to future needs.

7. Early results will be available from April next year but the full findings won’t be available until Autumn 2015

**Skill requirements**

8. It is wrong to assume that the types of skill required are only technical. Although these will be essential there are other equally important skill sets that we will need. As change is happening so fast no person can be “educated” in systems, processes or technologies that will last. Instead we need to develop independent learners able to keep abreast of developments and equipped to cope with change. We say more about “learning to learn” in answer to question 5, but here it is important to note the importance of continuous professional development (CPD) as the only realistic way of meeting the challenge of constant change.

**General Skills**

9. In the knowledge economy everyone should have a basic competency in information handling techniques – where to find, how to create, store and use information. To be able to operate competitively in the knowledge economy employers will need a workforce with not just the technical digital skills but an overarching understanding of the nature of information in an online environment. This includes understanding the ethical use and re-use of information, e-safety and how to mitigate the risk of operating in an online environment.

10. Citizens Online have a definition of core digital skills; to communicate, share, work and transact online as well as staying safe online. Their recent research points to a deficit gap emerging with many people only able to engage in basic activities online, lacking one or more of these core skills and these core skills link to employability.

11. Recent research into information skills (which includes digital literacy skills) in the workplace suggests that the traditional “soft skills” such as communication skills and building relationships with others become increasingly important in a digital environment not less so.
Specialist

12. There will, of course, be a need for technologists. CILIP is concerned that the “I” in ICT is not forgotten. If the technology is the plumbing then the information (content) is the water - it needs managing well and the skills and expertise of information managers need acknowledging as they will be an essential component to future success in a knowledge driven economy.

13. CILIP define information and knowledge management as: “collecting, organising, storing and exploiting information, data, expertise and other knowledge assets which are held within an organisation, ensuring that these assets remain available for future use”. This includes important areas such as information governance (e.g. freedom of information, data protection, and copyright), data assurance and security. Big data is now being deployed in most sectors and new skills such as data analytics are becoming important. Social media is also being used in a variety of ways including customer relationship management and new techniques in crowdsourcing and participatory design and research are emerging.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

14. There is little that can replace a good teacher or school librarian in inspiring learning amongst the young. However there are some key elements which we wish to highlight.

Learning to Learn

15. Young people coming into the workforce today are likely to have not only more than one job but more than one career over the course of their working lives. This means people will need to be motivated to learn and continue to learn as society and the online world changes.

16. This is about laying the foundations for a lifetime of continuing professional development (CPD) – schools need to provide the desire to learn how to learn. The only way you can prepare students for a future workplace of such volatility is by inspiring them to become confident independent learners.

17. However there is a strong danger that children are being “taught to the test” rather than being given time to explore and develop their own ideas. Schools that offer the IB have an advantage as those students are required to undertake an extended project and it is through this type of work that such skills are developed.

Underlying principles

18. We need to ensure that skills are developed in a generic way that can be transferred to new software / hardware or entirely new situations and that students not only develop transferrable skills, but the understanding of how to transfer them. This is an area that is often missing in schools. Schools need to move away from just teaching students how to operate specific pieces of software.

19. Ensuring that students are stimulated into acquiring not just skills but a firm knowledge of the fundamental principles that underlie the core knowledge areas in which they are
interested gives them a foundation on which new knowledge can be built and absorbed—a personal knowledge management.

The school librarian

20. In all this the school librarian should be a pivotal person in inspiring and resourcing this learning. However only a third of secondary schools in England have a professionally qualified librarian and we have been advocating that every secondary school needs such a person. They are crucial in helping pupils develop information literacy skills and become confident independent learners. They can also advise teaching staff and parents on such matters.

Access to latest technology

21. Research by OxIS (Oxford Internet Institute) has shown that people with access to technology especially to mobile devices in the home are more likely to develop their digital skills. This is possibly attributable to the time factor and the fact that training has greater impact when followed up by reinforcement.

22. Schools have noticed an attainment gap arising between those pupils who have ready access not only to the internet at home but mobile devices, and those who do not have this access. Some schools are trying to close this gap by using the pupil premium funding stream to buy devices for pupils. But again the issue is not just about access to hardware or indeed free Wi-Fi access in libraries, though these barriers are relevant, but in issues around the motivation to continue to learn.

23. Cost is an ongoing issue—the running and replacement costs of hardware can be prohibitive to many. This is a justification for proper investment in public libraries so that they are able to provide the latest technologies and support in using them. The digital universal offer being promoted in public libraries in England is to be welcomed but it must be underpinned by the necessary investment in technology and the presence of appropriately trained staff at each service point. A national investment in this infrastructure is required along the lines of the National Lottery Funded People’s Network in the early 2000’s that was such a success.

The new Computing syllabus

24. We do not think that the new computing course covers information literacy skills or those skills relating to “learning to learn”. These definitely need to be catered for in every school even if outside the formal curriculum. We would also endorse the following comment in the recently issued Technology Manifesto, adding that it will be the librarian and the resources they provide, online and physically, that will help spark the linkages set out below:

25. “We should be clear about the goals of computing education: the aim should not be to create a workforce of programmers. Britain must instead differentiate itself in the global marketplace by educating students to combine technical expertise with analytical thinking; digital skills with creative pursuits; and coding ability with business acumen” (Copeland, Fink and Scott, Technology manifesto, 2014)
7. **How can the education system develop creativity and social skills more effectively?**

26. Professional librarians within schools and other educational institutions will play an important role in this as:

   26.1 They promote independent learning that goes beyond the needs of the curriculum, and encourage making links across subjects, so stimulating creative thinking.

   26.2 They have skills in the creation and evaluation of digital information which have formed part of library and information qualifications for at least 15 years. Too many schools are unaware that professional library staff are qualified in this area and do not make use of their skills and knowledge (Libraries All Party Parliamentary Group, The beating heart of the school, 2014).

   26.3 They are able to use social media to communicate and open source software to work collaboratively, creating information, re-using information, learning to cope with risk in an online environment, and teaching resilience. However, often such creative approaches to learning are hindered by outdated filtering policies which have the consequence of overblocking access to legitimate resources and software.

**Short- and medium-term support to the digital sector**

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

**The Challenges**

27. There can be little doubt that there is an important inclusion agenda relating to digital skills. The following research findings are indicative of this:

   27.1 Levels of literacy are a significant inclusion issue, affecting those with learning disabilities as well as large numbers of average students. Reading and literacy are as vital in the digital world as in the print world. According to the National Literacy Trust 16% of adults in the UK have a literacy level below that of an 11 year old.

   27.2 In the UK around 22% of over 16s (11 million people) do not have basic online skills. We have become used to using the term “digital natives” to describe an assumed digital agility amongst young people but a surprising 6% of people in the UK who lack digital skills are amongst 15-24 year olds (GDS)

   27.3 25% of job postings are only online (Tinder foundation – Jobs report) and a large number of employers say they would not even interview somebody for a job if they did not have basic online skills. The inclusion agenda starts at the very beginning of the employment chain.

   27.4 Current research also points to groups of people who only use the internet in a very limited way. A new report by Citizens Online (The case for a systematic approach to digital skills, 2014) says that these people are at risk from going back to being offline because although they have received initial help they may struggle with new devices and online services that are changing at a fast pace.
27.5 Prisoners are one of the most digitally excluded sectors of society. Prisoners have only limited access to technology and minimal access to the internet and those who have served long sentences are likely to leave prison with very limited digital skills. This limits their prospects of employment. 40% of prisoners have literacy skills so low that on release they are ineligible for more than 90% of jobs according to the Shannon Trust. The rate of re-offending drops from 90% to 10% if a person leaves prison and goes straight into the world of work.

**Some ways forward**

28. CILIP is clear that no one organisation or sector can hope to solve the digital divide alone. CILIP have signed up to the UK Digital Inclusion Charter which has an underpinning UK Digital Inclusion strategy. As signatories CILIP have agreed to support the joint actions and share knowledge and best practice. But investment is also needed to support the strategy. Digital skills training needs to happen both within the education sector and for those who leave school without the baseline digital and information skills required of a future general workforce.

29. There are points to be made about how the digital divide can be addressed:

29.1 The role that libraries can play, especially public libraries, in encouraging people online needs to be recognised by national and local politicians and senior planners – libraries should be a partner within all local digital skills partnerships. They have a presence in most local communities; they are trusted institutions; and they have skilled staff.

29.2 There needs to be a strengthened National Digital Offer for public libraries, underpinned by a proper investment programme in technology and infrastructure and a national staff training programme, to ensure an excellence of service in promoting digital literacy and inclusion. The investment in the People’s Network in the early 2000’s illustrates the dramatic impact and returns such investment can bring.

29.3 Technology can be used to promote digital skills – The development of MOOCs (Mass Open Online Courses), for instance, to support those who are engaged in promoting digital literacy to groups with protected characteristics, including library staff, and also for use with disadvantaged groups themselves.

29.4 Designing inclusivity into hardware and systems from the outset so that assistive technologies are not an add-on but integral to the system and probably of benefit to all users not only those with disabilities.

12. **What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?**

30. Most of the points we would wish to make on this have been made in answer to other questions. In particular the need for a partnership approach that includes libraries (see our answer to question 11).

31. We would emphasize two points:
31.2 Library and information professionals work across all sectors; education, health, public and commercial and they have an important role in teaching digital literacy to their particular user groups having both on the ground knowledge and delivery opportunity. They are trusted by the people in their communities and have a proven record of engaging with and motivating people through what interests them personally. They have an understanding of information and appropriate skills set to teach how to use, create and manage it in an ethical way. Information is what librarians deal in. It is the currency of their profession.

31.3 The locally-based strategies will help produce the generalists. However a national scheme will be needed to both identify and satisfy the need for the skilled information and knowledge managers of the future. CILIP is undertaking a workforce survey that should provide better information on the current size and levels of qualification of the Information and knowledge management professional community within the UK. The survey results should also be useful in assessing how future needs for information and knowledge managers could be met.

Industry

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

32. It is difficult to generalise about SMEs as they are so varied. However Lloyds Bank’s “Benchmarking the digital maturity of small and medium-sized organisations in the UK” (2014) found almost 1.7 million organisations have a very low level of digital understanding and capability – many make no use of the internet at all and do not have any web or social media presence.

33. CILIP sees a key role for public libraries in supporting SMEs and VCSEs gain the necessary confidence to use digital technology and also have exposure to new technologies such as 3D printing. Many public libraries are also part of the Online Centres network providing support for people wishing to gain online skills and, as part of the universal digital offer developed in England by the Society of Chief librarians, and supported by Arts Council England, each frontline member of library staff will be able to access online training modules on how to promote digital literacy. As mentioned in our answers to previous questions we believe a national investment programme is needed to properly equip public libraries for this task in the future.

34. One promising scheme is The Enterprising Libraries programme which is a partnership between Arts Council England, the British Library, DCLG and the Intellectual Property Office. It has established a network of Business and IP Centres in six major city libraries and in the BL itself focused on encouraging start-ups and supporting SMEs. The network is gradually being rolled out to more public library services in England. Enterprising libraries support local economic growth by turning libraries into spaces for the development of business ideas, providing coaching, advice, and IT support for local businesses and entrepreneurs. (Digitalskills.com)

35. On a more general point criticisms are often made about the lack of dialogue between employers, education providers and the professions about what is required in terms of skills and knowledge in the workplace. CILIP is certainly concerned that many employers do not
appreciate the role and value of information managers. Therefore we are starting a programme of engaging with employers and sharing our newly framed Professional Knowledge and Skills Base (PKSB) that includes information and knowledge management. We are also in the process of creating an Information Management Alliance with other professional bodies operating within the Knowledge Economy, which we see as an important advocacy platform for the value of information management and the need to promote information management as a profession, and one which is critical to the future economic success of all organisations and the UK.

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

36. Businesses can help equip the workforce with support for collaborative projects with schools and the academic sector. This way they will help to ensure that students leave with appropriate skills. This happens in certain parts of the country and school librarians have acted as the link between local businesses and a school but more could be done to facilitate this type of project.

Conclusion

37. CILIP welcomes the opportunity to submit evidence to the Lords Digital Skills Committee. The Inquiry is most timely. As digital skills and intellectual capital are not as fixed to geographic locality as the manufacturing plants of the past, it is vital that the UK remains ahead of the game in the skills of its population. CILIP has two ongoing projects in this area – an information literacy skills project focused on generalist levels of skill whether in the workplace or the home or as a learner, and an information management project focused on the higher level skills needed to manage the ever-expanding information resources available and helping turn that into intellectual assets of value. As the terms of reference of the Inquiry suggest both are essential in a knowledge-driven economy. We make no apologies in suggesting however that it is in the national interest to ensure that there are sufficient skilled information and knowledge managers to unlock the value of information within organisations (and also prevent some of the information disasters of the past it is all too easy to cite).

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5 September 2014
About CIM
1. The Chartered Institute of Marketing (CIM) is the leading international professional marketing body, with some 35,000 members worldwide (25,000 in the UK). First established in 1911 CIM has, for over a century, defined marketing standards and is the global champion of best marketing practice. CIM exists to develop the marketing profession, maintain professional standards and improve the skills of marketing practitioners, enabling them to deliver exceptional results for their organisations and for their economies. CIM does this by providing membership, qualifications and training to marketing professionals and businesses around the world and by delivering thought leadership reports and initiatives based on thorough and authoritative research and insights.

More detail can be found on our website at www.cim.co.uk.

CIM and skills
2. This evidence draws on our role and experience as the leading international provider of professional marketing qualifications and training and the only body able to accredit and award Chartered Marketer status. Digital skills form an essential component of the recently revised Professional Marketing Standards which we maintain as part of our charter purpose, and of the new qualifications and training portfolio they underpin. In designing and accrediting qualifications we work closely with both the private and public sector including bodies such as Ofqual and AQA. We have also worked closely with industry partners on digital apprenticeships in our key role as part of the government’s Trailblazers initiative.

3. Our evidence also draws on the extensive research and consultation we carry out both to maintain and develop our qualifications and to provide insight and thought leadership to the marketing profession. As well as working with individual marketers we also work with businesses and organisations of all sizes and across sectors. As such we have a unique perspective on marketing as a critical element of a business landscape which is being rapidly changed by continually evolving digital technology.

4. One theme of the Committee’s inquiry is whether education, businesses and other sectors are ready for the implications of a changing digital landscape, including the preparedness of the workforce to deal with an increasingly knowledge-driven economy. This is an area where the role and activity outlined above gives us considerable experience and insight and where we wish to provide evidence.

Digital Technology and Marketing
5. Marketing can be defined as "....the management process responsible for identifying, anticipating and satisfying customer requirements profitably." So marketing involves interacting with customers and potential customers, carrying out research and accumulating manipulating and interrogating data - often considerable amounts of it from sources inside and outside an organisation – in order to provide insights that will drive business strategy. This is an important definition to grasp, as it clarifies how marketing involves a broad range
of strategic and analytical activities undertaken prior to the functions the layman might most commonly associate with the profession: advertising and promotion.

6. The advent of digital technology has not only impacted on data collection and analysis, but also customer engagement, including through advertising and promotion. These changes, and the rise of social media in particular have disrupted the boundaries between these marketing activities. Platforms such as Facebook and Twitter are now simultaneously a way to advertise to customers, interact with them and collect data to inform strategy going forward.

**Digital Skills for Marketers**

7. As the picture painted above implies, the way in which businesses determine their strategic positions, and marketing as a core component of that activity, has faced considerable change as the digital landscape has rapidly evolved. So-called big data & the need to manipulate it smartly, rapidly evolving communication platforms such as social media, and the close relationships between these has resulted in convergence of formerly distinct business functions such as chief marketing officer and chief information officer. This is illustrative of the message we have picked up from the research highlighted below, that collaboration is the new currency in an environment where who leads and who supports is recognised as less important than ensuring the right capabilities come together to contribute to the outcome. But whoever is involved, or research and experience show that digital skills are important.

8. Working with respected pollsters YouGov, CIM undertook a major suite of research activity between autumn 2013 and spring 2014 to inform our future direction, particularly with regard to skills, education and training. It involved in excess of 2600 business professionals, both within and outside of marketing. As part of this work, senior marketers were asked to select from a list of 18 the capabilities which will be the most important contributors to the success of their organisations in five years’ time. Digital strategy came top, as the graph at Annex A shows.

9. In addition, 92% of senior marketers reported that marketing departments take a primary or contributing role in digital strategy within their organisations (Annex A).

**Digital Skill Gaps**

10. It can be seen from the evidence above that a range of digital-based marketing activities is absolutely critical to the success of UK business and, therefore, to the growth of the economy. It is essential that any associated digital skills issues are identified and addressed. For example, the recent report of the Commons Business Innovation and Skills Committee on the retail sector highlights digital skills issues regarding analysis, understanding and customer engagement (see pages 26 to 28). As highlighted above, these are core areas of marketing, although the report itself does not use that term.

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96 summarised in the report Back to Basics: Meeting the Needs of Today’s Marketer and Building Capability for Tomorrow. Not previously published, but available to the Committee on request.
11. Our experience has shown that young people coming into the marketing profession are much more at home with digital technology than the more senior people who recruit and manage them. Following from this there is an issue that employers often don’t understand the potential within their existing workforce and don’t know how to go about recruiting the best people to exploit the business potential of digital technology. Our feeling that there is a digital skills gap within the marketing profession at middle and senior management levels was borne out by our research, which found that more senior marketers were not comfortable with their capabilities in that area. As a result, we have incorporated a suitable digital skills module at level 6 (mid-year degree level) of our qualifications portfolio to allow more experienced and senior marketers to increase their skills.

Specific Questions

12. We would like to present the following evidence in response to some of the specific questions posed by the Committee.

Q 8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

13. In our experience few people set out from an early age to follow a career in marketing. They get into business, find they have an aptitude for communication and creativity combined with analytical skills and move into the type of job which uses their strengths. So while there are a range of typical marketing jobs with a digital focus, for example: digital marketer, digital marketing specialist and digital marketing manager, most holders of these positions will have begun with a business oriented qualification and worked their way towards these jobs by adding extra skills and experience.

14. The point here is that, in order to prepare young people for occupations which may not yet exist, we must first provide them with the building blocks for business success. Our experience is that the foundation lies in business focussed qualifications that also cover information technology, communications and analytics. These elements can then combine with others to give a flexible basis for enable an individual to develop their career into as yet unforeseen areas.

15. This has been borne out by our work as part of the government’s digital skills Trailblazer apprenticeships initiative. We found that the businesses we worked with to create the standard for the digital marketer apprenticeship were keen that it should include giving young people a grounding in business and marketing before moving on to the digital component. Employers regarded the business context as a vital foundation.

Q 13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

16. Our observation on this point draws on our finding about the lack of comfort with digital technology among more experienced marketers. Our experience is that there is scope for those running and working in SMEs to upskill to address this issue. We note above how modular, business oriented, qualifications can help people upskill, but there is also a place for institutions to offer carefully designed short courses which will help marketers and people in SMEs who carryout marketing activities to cost-effectively acquire new digital skills. CIM includes this as part of our training portfolio.
17. There is also significant, but relatively untapped, opportunity for SMEs to make more use of the innate digital skills of the so-called ‘millennials’ or ‘generation y’ – the young people who are entering the job market having grown up in the digital world. As already noted, they will need to learn about business to contextualise their abilities, but many small businesses may find that context relatively easy to provide.

**Digital skills and Ethics**

18. Finally we would like to draw attention to the ethical challenges created by doing business digitally, including the blurring of marketing activity with purely social interaction on social media such as Facebook and the resulting access to large amounts of personal data. These ethical issues create a particular digital skills challenge of their own.

19. Earlier this year CIM undertook a major piece of research together with YouGov entitled Keep Social Honest. This involved more than 4000 marketers and consumers and examined the interaction of businesses and consumers on social media, the ethical issues, and the attitudes of both groups. The report is available on a dedicated website.

20. A key finding of relevance to this report was that 43% of marketers found the range of guidelines and regulations governing the use of social media by business to be too complex and confusing. That reveals a significant digital-related skills issue within business when it comes to appropriate behaviour in this part of the digital world. Worryingly, we also found that business was not taking simple steps such as training staff and setting personal development targets in order to address the problem. Little wonder, perhaps, that we also found that only about 20% of consumers have high levels of confidence in what they see on social media.

**ANNEX - A**

**Future capability – views of senior marketers**

![Graph showing future capabilities of senior marketers](http://www.keepsocialhonest.com/wp-content/uploads/2014/06/Keep_Social_Honest_Report.pdf)
Role of marketing department – reported by senior marketers

For the following areas, please indicate whether you believe the marketing function has a primary accountability, a supporting role or no role.

Source: CIM capability survey - senior marketers

5 September 2014
Chartered Institute of Public Relations Social Media Panel – Written evidence (DSC0094)

Submission notes:
Please note that we have responded to the call for evidence in the context of the development of digital skills in the public relations and communications sector – and only answered questions where we feel we can offer an appropriate level of expertise.

We believe the committee should consider the development of ‘digital skills’ in a remit that is wider than that of the IT/telecoms/computing sectors. This issue has a much bigger impact than set out in the call for evidence.

The committee should consider developing and growing professional disciplines such as that of public relations and marketing, and how the development of digital skills sets are imperative to our professional futures.

We believe the committee should also offer greater consideration as to how ‘digital-by-default’ will become the norm for the workforce of the future.

About the CIPR Social Media Panel:
Founded in April 2010, the CIPR Social Media Panel (#CIPRSM) is made up of CIPR members who are some of the foremost social media thought leaders and contributors. The Panel input into the Institute’s policy guidance, education, training and digital media output. In July 2012, the Panel delivered the best-selling book, ‘Share This: The Social Media Handbook for PR Professionals,’ and, in 2013, delivered the follow-up book, ‘Share This Too,’ both published by Wiley, and collectively selling over 4,500 copies as of January 2014.

Since its formation, #CIPRSM has also developed industry-leading guidance including:
- Social Media Best Practice Guidance – updated in December 2013
- Social Media Measurement Guidance – published in April 2011
- Social Media Monitoring Guidance – published in July 2013

About the Chartered Institute of Public Relations:
Founded in 1948, the CIPR is the professional body for public relations practitioners in the UK. With 10,000 members involved in all aspects of PR, it is the largest body of its type in Europe. The CIPR advances the public relations profession in the UK by making its members accountable through a code of conduct, developing policies, representing its members and raising standards through education and training.
QUESTION 5
How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

Answered by:
Simon Collister MCIPR, member of the CIPR Social Media Panel

From experience of teaching undergraduates, postgraduates and professionals, it can be argued that there is still too much emphasis on classroom or lecture based teaching, taught to syllabi that are out-dated - or not necessarily reflective of emerging or transforming occupations - and are limited to rapid change or development due to bureaucracy within higher education or professional bodies.

Given the highly practical and technical as well as experimental nature of some elements of digital knowledge and skills it is important for students to gain hands-on experience of technology and its application in specific fields. This can be limited by the syllabi of courses and qualifications which tend to be taught by academics and professionals not familiar with new or emerging products or techniques as well as the facilities of education institutions which remain wedded to lecture theatre and classroom style teaching. The provision of 'wired' teaching spaces or computer-labs can be scant and, where it does exist, highly popular making it difficult to reserve and teach in.

As well as infrastructure limitations, education is also held back the scope of syllabi which remain unchanged and rooted in non-digital content. Part of this is linked to out-of-touch, established tutors as addressed above, but it is also partly to do with the laboriousness and time-taken to review and re-validate course content. The additional work and duration of this process is prohibitive to updating and adapting courses to new and emerging technologies, knowledge and skills.

QUESTION 7
How can the education system develop creativity and social skills more effectively?

Answered by:
Simon Collister MCIPR, member of the CIPR Social Media Panel

The answer provided to Q. 5 above provides part of the context and answer to this one as well. However, the issues that require addressing to help the nations education system develop creativity lie pre-higher education and within the approach schools take to teaching and learning. For example, many undergraduate and postgraduate students encountered through my experience are overly focused on learning the 'facts' required to pass assessments, rather than recognising the ability to think critically and creativity and value the 'process' of knowledge exploration and development. Anecdotal research among student cohorts across a number of years indicates that this approach to learning stems from GCSE and A-Levels where the goal is not to develop techniques for learning per se, but rather 'learn' the exam inputs required to pass. By extension such an approach to teaching may well stem from schools’ desire to achieve successful results in order to satisfy league tables.
Locked into this approach is a highly detrimental way of learning which overlooks the value in self-directed exploration, creative thinking, experimentation and a recognition that coming up with creative ideas, trying them out, failing and adapting them is an important skill set to possess in contemporary society.

I'm not sure the education system has a primary responsibility for developing social skills.

**QUESTION 8**

How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

**Answered by:**
Simon Collister MCIPR, member of the CIPR Social Media Panel

Education and other state systems can be notoriously process-driven and focused on outputs rather than critical and creative thinking. In some respects it may be worthwhile developing partnerships with credible third parties to help students identify, understand and pursue careers in the future workplace. Linked to my response to Q. 7, one of the emerging areas of the economic and employment landscape is the increasing rise of individual responsiveness and entrepreneurship. Driven by digital technology's empowerment if individuals and its fragmentation of existing industries this trend emphasises - at least presently - the opportunities for individuals to identify problems and develop solutions, either as start-up organisations (e.g. AirBnB, Uber, etc) or as individuals (e.g. the freelancing of traditional career paths and roles). Enabling students to think creatively, explore and test opportunities and even fail are key skills to be equipped with in such a broad, entrepreneurial economic environment.

**QUESTION 9**

How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

**Answered by:**
Simon Collister MCIPR, member of the CIPR Social Media Panel

In terms of the short and medium-term role for higher and professional/vocational education, more emphasis needs to be placed on understanding through research and embedding through teaching the key core knowledge and skills, e.g. techniques, ethical implications, successful applications, etc., of the major trends in the digital sector. These will be high-level insights and not necessarily available from existing workplaces or on course curricula. Extra funding for research and curriculum development will be key.

One potential limitation for education is the growth of commercialised involvement in elements of the digital sector. The once open field of the Internet and 'social media' is fast being consolidated, commercialised and hide away behind patents and copyright. While this is arguably inevitable in a market economy it means that teaching the application of popular or widely-used tools, technologies, platforms, etc. will require either partnerships with or licences for proprietary products. This is something that would potentially restrict education providers to limit student exposure to one or two key technologies given exclusivity clauses or often exorbitant costs.
11 September 2014
A submission by David Chassels CA as individual with knowledge and experience gained over 40 years working with Small and Medium Enterprises (SMEs) and understanding how people work. This includes as executive with ICFC/3i, Partner in Accountancy firm BDO and recently responsible for nurturing of Research & Development (R&D) companies on how next generation enterprise software can significantly improve support of people including delivery of “digital services”

Focus of this submission is to help position what “digital” actually is as both a user and creator and what skills are required. This is based upon knowledge of the future of Enterprise Software based upon R&D of over 20 years. Many make all things “IT” very complex but in reality business is simple. “Digital” being about people and their process is also “simple” once knowledge of what it really is in context. The purpose of my evidence is to pass on many years of learning as I unravelled the complexity surrounding ICT to deliver simplicity in understanding how software can support people in the new digital world.

Background

1. “Digital by default” has been a much hyped often confusing term used by Government to try place emphasis on the need to become both more efficient and allow the citizen to be involved in “self help”. The initial emphasis has been on building information web pages to both try and simplify information and create one source of access for the public use. This has largely achieved objectives as a basic “digital requirement”. However building “digital services” is a whole different game as it is actually about “business operations”. This requires the real time back office connectivity to ensure all relevant information is available to allow decision making as users interact.

2. It is important to understand how the supporting software markets works and where it will be heading. First ICT has as the basic level 3 main aspects Infrastructure includes the use of internet, Hardware in use both supporting infrastructure and the users and the Software which delivers required functionality. The infrastructure and Hardware have evolved to the point they are commodities with delivery of new devices in a competitive price driven market. The other relevant aspect of how the software industry has evolved and how it behaves. The big vendors have consolidated and have huge investment in acquired “components” that are integrated under a marketing banner yet are complex to actually see delivery of a software solution. However software needs to reach that point where it becomes “commoditised” yet delivers required flexibility by removal of technical coding skills in the build.

3. Software is the key to both build and use of digital. It is a harsh reality that despite business logic never changing we still need programming languages that are quite alien to users. As a result the “interpretation gap” between what users want and the technical programmers is as wide as ever. This problem has been recognised for decades and remains the biggest barrier to delivery of people friendly functionality. This was at the core of 20 years R&D and it was “discovered” that for business requirements (and that include government) the future does not require coding skills with the emphasis switching to
understanding the required people process to deliver the required outcome direct from this knowledge.

4. The whole ecosystem of vendors and their associates has thrived at customer expense (Government in particular) with software complexity. Very few business people never mind politicians will dare challenge this abuse as there has been no real alternative. Any move to simplicity is not welcome. It is called the “innovator’s dilemma” and with domination by big US vendors the required step change has “challenges” but will come. It is this move which will change the future of “how” software delivers with the focus on digital support for users. That is what 20 years of R&D have addressed. A R&D paper was published last year for those interested the summary here [http://www.igi-global.com/chapter/object-model-development-engineering/78620](http://www.igi-global.com/chapter/object-model-development-engineering/78620) It is the start of what could be called a 6th Generation Language (6GL). The build of applications currently rely on coders using such as Java and .net as 3GL. 6GL has been a vision for decades but not delivered...until now.

5. The relevance of such a change is significant looking to the very issues being addressed by House of Lords Digital Committee. “Digital” is actually a simple concept indeed it is what IT for business and Government should have been about decades ago. However the emphasis has been on large processing and record keeping systems resulting in people having to fit into this “inside-out” approach where direct interactions have been poor at best . The Labour party recently sought views on digital by asking some good questions. The Appendix contains relevant information in my responses which should help understanding, in particular answer to Question 5 referring to “inside out” v “outside–in”. But be aware such knowledge is a moving target and this also applies to skills.

**Digital skills for the future**

6. With understand as articulated about software “capabilities” the emphasis on skills required changes. Build of digital services will be in the hands of those that understand not just what is required but how it needs to work step by step supporting users internal or external. The tools that deliver such capability remove the need technical programming skills. Nothing is static and change will be driven by users with direct input with new ideas way of delivering a better service. This research gives a view [http://www.techproresearch.com/downloads/the-future-of-it-jobs-critical-skills-and-obsolescent-roles/](http://www.techproresearch.com/downloads/the-future-of-it-jobs-critical-skills-and-obsolescent-roles/) “However, it’s important to keep in mind that while business skills come in handy to establish relevance and prove one’s value, focusing on the right technologies is an even bigger part of the picture – it represents the foundation of the trade. Business skills are only useful when they are wedded to meaningful technology to capitalize upon them. Knowing which trends will take off, gain momentum and become common can future proof an IT career and ensure you stay on top of the game - and stay in demand.”

7. The coder / programmer. By removing need for mass coding of business applications these skills will sit at the very specialised level with focus on highly technical new ideas and products (business logic for “digital” is not in this category!). The term “geek” is often used but they are usually people of exceptional intelligence, often loners but have potential to build clever new capabilities. They are a small minority and have a passion which is self driven and they will find the route to acquire the skills.
8. The digital application builder. As indicated in the vision of how software will evolve and suggested by the Tech Pro Research is moving to business skills. A basic knowledge of database and spreadsheet type languages will be needed but these basic skills are being taught already but emphasis on having such basic skills can only be good. Those destined for programming hard coding world will be in the minority. In terms of “business” early indoctrination of the basics emphasising the importance of people being supported by “digital” information would be sensible. This can help and set knowledgeable expectations of what may lie ahead for individuals deciding their future. However fact is nothing beats business experience and interpersonal skills to start the creation of a digital service capability. It is important that the focus is to ensure easy use by “users” in effect the form adapts to that users specific needs and should of course support constant change.

9. The user. Much emphasis on this group has been made associated with “digital by default”. However this has different categories that need to be recognised.

- The current Government emphasis is on the “citizen” as a user and here the User Interface is a “public” form that needs good “design” yet also requires functionality that delivers required data/information and allows input of new information. All of this needs to be “intuitive” entry of new information only once and “friendly”. It must be assumed this user has had no training to use such a form.

- The “in-house” user and this in Government is the professional civil servant who often requires to interact with the public to deliver the service. They will also be the access point to help those unable to be a “public user”. Here “digital” functionality will rule and these users should be directly involved of creation of the digital solution. The user form should follow a logical format and is only part of the end to end process that will involve collaboration with colleagues across government and other agencies with all supporting back office functionality. This is where a well designed “digital” process can greatly improve efficiency and with real time feed back of who did what when, people can become “empowered” with change to the digital solution encouraged. The skill to build requires the “business knowledge of that operational need. It is not technology driven it will be a combination of experience and gaining the confidence of these users whose input is vital. Where there are complex needs unlike the “public user” in house training should be readily available.

- The “management” user needs to recognised where real time reports can be automatically created on both public and internal user activity. Views on activity that identify bottlenecks and problems that may need to be addressed. It should be noted that adopting modern digital software with all required supporting capabilities with that real time feed back will empower people at the frontline and reduce the need for a “heavy” layer of “management”. This booklet is worth of a read for those wishing to understand

http://www.transformationforum.org/PDFs/managing_transformation_means_transforming_management_sopk2.pdf  The title alone makes it clear what the real challenge is!

Education on modern management skills linked with experienced business skills will help deliver truly transformational digital services. It is NOT about technology as long as knowledge of capabilities exists. Without good research to establish the capabilities or with reliance only on “geeks” and the “user” form the optimisation of digital will not be achieved. So the final skill set lies with this knowledge of capability, the business understanding and
those that make strategic decisions. All should have basic knowledge and relative skills as described to deliver on digital requirements. It will be a continuous learning process from the basics at school level to the “boss” making the key strategic decisions to set up digital initiatives in the first instance.

Appendix to Submission to House of Lords Digital Committee

The call for evidence by Labour party Digital Government Review Team which ended on 30th May, asked Questions which have relevance for understanding

Q1. What are the characteristics of a good supplier market? Do we have one now?

A1 By nature “digital” is recognition of users, internal and external, who drive your “business operations” see recent commentary from Mckinsey http://www.mckinsey.com/insights/business_technology/reinventing_it_to_support_digitization basically IT needs to go business to address digital. Important to recognise all digital services will be custom builds and needs software that supports change. This is now being recognised as “adaptive” capability. The web interface is only one aspect you need the have the following attributes that will support delivery on users needs as far as digital software support is concerned

- Process engine – orchestrating as required to ensure all works to plan
- Rules engine - reflecting real world of complexity and compliance
- Calculation engine - automating system work
- State engine - real time feed back from any point
- Workflow / collaboration - everything connected in right order
- Audit trail, events, escalations - managed control and accountability
- Real time reporting - become predictive and support empowerment
- Roles and performers - people and machines identified
- Management hierarchy - see who does what and when reallocate work
- Orchestrating legacy - recognising valuable data in legacy
- User interface dynamically created dynamically populated with instance specific data - linking people, roles, task type and data via forms for specific instances recognising that user forms needs to be specific for that task in hand and with intelligent functionality should for engaging for users
- Process and task versioning control - recognising change is inevitable

A good technology vendor will have all such capability under one Platform and is recognised as a “BPM” approach using what is called an “outside-in” approach putting people first as noted in 5 below. Currently GDS have yet to grasp the business and supporting technology requirements other that the creation and design of information on a web page

Q2. Are current government frameworks and standards (such as G-Cloud, Contingent Labour One, etc) supporting the creation of the desired supplier market across all layers of government?

A2 NO You need to understand “GCloud” represents an “easy” way to cut down high up front payments in both infrastructure and the software delivering on the requirement. As such claimed savings need to be “scrutinised”? It can be a “lockin” that could prove
David Chassels – Written evidence (DSC0061)

expensive over time – very similar to the PFI concept with projects on a smaller scale but collectively could be significant. Government need to differentiate salient and non salient requirement the latter could be handled effectively under a GCloud but not for the important salient ones delivering a public service Unless there is in built provision to acquire access to the supporting software not just the data. (this is now possible) then it could prove to be very expensive.

Q3. What impact will increased use of co-production (or people-powered services) have on the procurement process and supplier market?

A3 It should make it easier recognising the “BPM” approach as described subject to 5 below

Q4. What needs to change in the procurement process? What else needs to change in the wider relationship before and during contract delivery?

A4 Procurement process needs to be recognised as involving all as described here

- The process starts with early **policy making** where decision makers should have a broad understanding of capabilities that are available to aid good decisions.
- As ideas move to **implementation** such knowledge should allow for a rapid assimilation of the requirements, likely costs and skills to deliver.
- As the **procurement** process is involved so specifications can be drawn up with detailed business outcomes and capabilities, but in knowledge such capabilities exist.
- Responses to requirements should both simpler and produce **accurate estimates** of man days required and thus accurate budgeted cost

Very important all in this “chain” are “intelligent” in understanding capabilities as covered in 5 below.

Q5. Are government buyers of ICT services 'intelligent buyers'? Are they well-informed both of the needs that they are buying for and of supplier capabilities and historical performance? If not what needs to change?

A5 Government has yet to achieve “intelligent buyer” status which starts with the absolute fundamental of understanding capabilities. The government shut down it research in 2003 and since then have had no effective resources to seek out proven new emerging capabilities. The Recent ICT Futures under the leadership of the GDS CTO has failed for reasons yet to be established. In terms of “needs” Government had wrongly focused on what is an “inside out” approach i.e. designing around existing legacy systems. A logical, easier and less costly way is to adopt the user centric “outside – in” approach. See this debate on this subject  [http://bpm.com/my-bpm/forums/is-inside-out-bpm-dead](http://bpm.com/my-bpm/forums/is-inside-out-bpm-dead). Benchmarking efficiency in both delivery on contracts and operational efficiency should be adopted to deal in facts not self interest “PR (internal and external!). Never underestimate the power of self preservation (see this interesting perspective  [http://philosophyofmetrics.com/2014/05/23/the-corrupt-primordial-class/](http://philosophyofmetrics.com/2014/05/23/the-corrupt-primordial-class/) )

Q6. Are government buyers supported in developing and communicating best practice standards? Or in understanding which best practice standards already exist? If not what needs to change?
A6 This is part of becoming the “intelligent buyer” and it is clear that has not happened resulting in out of date advice contained in the existing digital frameworks. As noted a centralised research unit is required to distribute knowledge on best VFM and capabilities expected.

Q7. Is G-Cloud working as a buyer-supplier market?

A7 It is very important to recognise what the “cloud” actually is. Very good debate here including my thoughts. http://bpm.com/my-bpm/forums/how-important-is-the-cloud-to-bpm Yes for “commodity” use but no for digital custom service and every department will be different! Cloud contracts could be very expensive looking at TCO over a longer period so need to have in built option to buy just like a lease purchase of any other asset.

Q8. Is there sufficient stability and clarity of requirements in the roadmaps for the current frameworks and standards?

A8 NO sadly the current approach has failed to understand all the requirements for “digital” and how they work together. Result is the Digital framework is quite deficient in giving good advice. There is too much emphasis on “open source” which does have its place as for “commodity use but build of services it could be very expensive. No research has been carried out on this very important aspect and needs to be addressed.

5 September 2014
Citizens Online – Written evidence (DSC0005)

Summary

Leading Digital Skills charity Citizens Online believes that a radical change is needed to the way the 6.8m offline adults in the UK are given skills training and support. In a recent White Paper released by the charity, they discuss how the UK is now a “digital nation”, with the majority of people having accessed the internet. However there is a minority of people who have not yet been online and it is these people who need the most support to become digitally included so that they can reap the benefits that being online can bring.

To ensure this happens, Citizens Online proposes a systemic approach to the development of a locally led, sustainable ‘digital ecosystem’. Citizens Online maintains that the current approach to digital inclusion is too fragmented and a joined up approach is needed.

The White Paper makes the case for combining resources and aligning approaches so that local communities will be able to identify the digitally excluded, draw on publically available training funds and ensure that every individual gets the training they need to go online and stay online in the long term.

Evidencing the need for a systemic approach to digital inclusion

1. The White Paper has been jointly published with channel shift experts, Trapeze Transformation. It is based on Citizens Online’s twelve years in the digital inclusion sector including, research experience, consultancy work, grass roots and cross sector working. Citizens Online is currently delivering the Get IT Together programme, a community development approach to digital inclusion, funded by BT through the Connected Society programme.

2. As part of the Get IT Together programme, a two year longitudinal study has been developed. More than 680 people are taking part in the research study and over 150 have been contacted so far at three months, six months and 12 months after training.

3. The results show that 80 per cent of learners are still online a year after training. For the 20 per cent no longer online, lack of device and lack of confidence were the most often cited reasons. Just under half of these learners had no access to ongoing support to help them use the internet.

4. As technology moves forward at an alarming pace some of those who have been helped to get online struggle to understand new devices and systems; Citizens Online’s longitudinal study shows that 20% give up and go back to the offline world within 12 months.

5. The White Paper suggests that statutory bodies in local communities, including the local council, Job Centre Plus and Housing Associations, will only succeed in tackling digital exclusion if they collaborate with voluntary sector organisations to build an evidenced based “digital ecosystem”

6. The White Paper highlights the critical importance of providing frontline staff with digital skills. Dr Gerald Power, an expert on digital channel shift, said: “The question that always
comes from the public sector is ‘We have built the online service, but how do we get the customers to use it?’ The White Paper represents the first serious attempt to answer that question. Citizens Online is creating a roadmap that enables everybody with an interest in this area to understand the issues in a more sophisticated way and then be able to develop a long term sustainable solution.”

7. One of the reasons for the lack of cohesion is the absence of statutory requirement, by any public body, to provide digital skills to adults. Funding for formal skills development tends to be held at a European and Skills Funding Agency level and money for informal digital skills programmes comes and goes. Because of a lack of clear policy vision for how basic digital skills should be funded, there is now a major local funding gap for vital core skills. Therefore, although money is being invested in programmes to transform local and national online services in support of digital by default, the funding streams to equip citizens to use these online services either do not exist or are not joined up.

8. The digital inclusion sector has tended to steer clear of more formal courses, believing that they wouldn’t appeal to a disengaged learner. This approach has merit, but leads to a fragmented offer in a community and a lack of formal evaluation of the content and quality of courses. Without a formal external body to approve a qualification it is easy for standards of content and delivery to slip. Organisations that are signposting (or in the case of JobCentre Plus mandating) people to courses have a role to play in making sure the training on offer is appropriate and of the right quality.

9. Citizens Online has conducted research with JobCentre Plus to demonstrate that in order to deliver value from digital skills training, those who commission it need to take a very proactive role in determining and evaluating training.

10. Citizens Online proposes a holistic approach to digital inclusion to keep people online, which ensures that learners have the opportunity to use their new IT skills, access funding and training opportunities and continue to be supported by local partners. This would include:

Funded training provision that is of high quality and matches both the needs and interests of learners and service providers in a local area.

Stable and appropriate community access points that are known about across a community and meet the needs of specific communities of interest.

Coaches that can give ongoing support to learners to develop existing skills, keep people online and potentially signpost learners to further formal training.

Citizens Online believes that this can all be achieved through:

- Local, multiple-partners strategies that join up key local service providers and tap into the resources that they individually control and potentially draws down national or EU funding.
- Using local evidence of needs and benefits to shape strategies make clear business cases for investing in digital inclusion locally.
Delivery that takes a holistic approach and has the potential to influence the beliefs and behaviours of whole communities, not just the individuals that engage directly with the programmes.


23 July 2014
City & Guilds – Written evidence (DSC0044)

Executive Summary
The City & Guilds Group is a global leader in skills development. Our purpose is to enable people and organisations to develop their skills for personal and economic growth. What we do is about more than skills, or qualifications, or jobs. Backed by a Royal Charter, we have more than 135 years of experience in making sure that people can contribute to successful businesses and thriving economies. Made up of City & Guilds, ILM and City & Guilds Kineo, we work with education providers, businesses and governments in over 80 countries, to provide work-relevant education and training in 26 industries.

City & Guilds recognises the challenges and opportunities presented by the digital agenda. This impacts on all industries and the majority of the work force. The theme of skills permeates the debate and this must be set in the context beyond the specialised technical skills of the IT developer / practitioner.

The Digital agenda has implications for the education and training community, not just what is taught but how and in turn affects how individuals learn effectively. We are supporting employers, colleges and learners with changes to teaching and learning facilitated by technology.

City & Guilds is also embracing that change as an organisation through methods of delivery of learning content, assessment and certification.

The changing technological landscape
1. What is the pace and change of the future digital technology landscape over the next five, 10, and 15 years? What are the leading innovations?

It may be a cliché but the pace of change is inevitably set to, not just continue but to accelerate. Extensive research work completed by e Skills has highlighted that there will be changes in many aspects of the technological landscape including hardware, software, design and installation of networks, Cloud and data management. As recognised in the Government’s Information Economy Strategy the treatment of “digital” as a discrete sector will become less and less relevant as digital becomes integrated with and integral to all sectors. Such is the pace of change that a realistic scan beyond 5 years is almost irrelevant. This in turn has implications for curriculum design and review cycles in areas that require qualifications.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

There will be challenges of investment in infrastructure, business support and cyber security but we would like to focus on the challenges presented by skills gaps. To maximise the
opportunities presented by a digital economy in the UK a skilled and digitally literate work force is crucial. We echo the view expressed in the Digital Skills Task force report100 “.... almost every job is a digital job “. This report also highlighted the rising demand from employers for those with digital skills and it presents the challenge of not just equipping entrants into the work place but also continued training and reskilling throughout working life. Our research101, Making Education Work found that 58% of employers believe their sector is facing a skills shortage and this is particularly acute in IT, Digital and Information Services. It will be important to separate out the majority who must be ‘digital confident’ in the use of devices, data and communication/presentation techniques, from those that are required to enable, support and protect that infrastructure. Even those that truly do not have a digital job will find they need a base layer of digital literacy to engage with services and social groups.

3. What is the employment impact on the UK’s labour market? What are the regional differences?

There are particular regions with a focus on digital industries, for example the South East, M4 corridor and Media City in Manchester. It may be inevitable that like minded organisations congregate together as was a feature of the Industrial Revolution in the 19th Century, however it is equally obvious that the factors that influenced such clustering such as location of natural resources do not exercise the same constraints on digital industries. The availability of a skilled work force, does however remain a critical factor.

Communications networks and quality of services may become the defining factors for location of the true digital industries. The broader underlying qualities impacting ‘digital workers’ will impact most of the labour market but even there we will see ‘spikey profiles’ of the capabilities they will need.

Future Workforce

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

The categories of digital citizen, digital worker and digital maker used in the Digital Task Force interim report102 are useful descriptors and distinctions for the different types of digital skills needed. It is estimated these definitions will cover 90% of the work force. Provision of digital skills in both formal education and on going learning during working life are important issues and should inform the structure, development and delivery of skills training and accreditation.

Despite predictions that IT user courses will no longer be required as “ digital natives “ become the norm our experience to date is that demand for such programmes and courses remains strong. We should nonetheless review our approach to how learners acquire these

100 Digital Skills Task force (July 2014) Digital Skills for Tomorrow's World
102 Ibid
skills as they become more akin to literacy and numeracy as basic essentials for all young people and adults to succeed in working life. Increasingly the “digital citizen” and “worker” require digital literacy. It is important to retain the place of this third basic competence as no child is born numerate, literate or digitally competent. Simply because they are immersed in a digital-rich environment does not mean they will automatically acquire the skills to function effectively, any more than they will learn to read, write and do arithmetic without some assistance.

Apprenticeships are an important feature of the skills landscape to deliver digital skills, be they for the “worker” or the “maker”. The combination offered of standards defined by employers and the balance of theory and work place learning must continue to be promoted as a credible alternative to the traditional higher education, university route. City & Guilds is a major provider of apprenticeships and works with a range of employers, including large companies such as Microsoft. This is a key feature to ensure currency of offer based on actual and emerging demand for knowledge and skills.

The Institute of Leadership and Management (ILM) has recently published research into what competencies managers and leaders will need in 2018 if they are to be effective. Managers and leaders believe that the core functions of management and leadership will be increasingly important and also harder to achieve; especially communicating effectively. The challenge increasingly will be to hold and continue conversations (with peers, stakeholders and customers) across a range of media and platforms. This trend also places more emphasis on effective face to face meetings (not least to build trust).

5. How are we teaching students in a way that inspires them and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

City & Guilds has published research into effective teaching in a digital context. This research recognised the opportunities for creativity and innovation within a learning environment. It found that there were particularly benefits in personalisation of learning, support for practical experience through simulations and in monitoring and assessment.

The pace of change of technology presents a challenge of for curriculum content provided by the institution and keeping completely up to date with the range of employment context and practices is unrealistic. A model of provision of the fundamentals of the industry the college, supplemented and complemented by work placements and tools such as Google Communities have proved effective.

Just as the means of teaching and learning needs to reflect change so does assessment and accreditation. City & Guilds is exploring how Mozilla’s Open Badges can be utilised to recognise achievements in flexible and innovative ways. Underlying this is a need to encourage learners to develop a desire to acquire new skills and knowledge. We cannot predict what new jobs will be but we can develop people to be more prepared for change.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

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103 [https://www.i-l-m.com/About-ILM/Research-programme/Research-reports/future-trends](https://www.i-l-m.com/About-ILM/Research-programme/Research-reports/future-trends)
City & Guilds is not directly involved in the delivery of the computing curriculum in schools however we believe that links with industry mentors and work experience will be essential components of the delivery.

7. How can the education system develop creativity and social skills more effectively? Feedback from employers has indicated that they think that the education system is too focused on academia and does not go far enough in preparing young people for work. We do not discount the importance of an academic curriculum for many learners but this needs to be balanced with skills such communication and problem solving. From 14 onwards the curriculum should offer learners the opportunity for applied learning, in preparation for more specialised technical and vocational routes at 16. There should also be space to recognise the importance of these peripheral ‘scaffold skills’ that transcend subject knowledge and can lead to more effective performance in HE and the workplace. Digital solutions have a part to play in this as the City & Guilds Techbac programme demonstrates.

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce that may not yet exist? How can this be improved?

Choice at 16 is a key stage in a young person’s career and with the raising of the participation age well informed careers advice about the options and routes available is essential. However as is presented by many reports it is currently lacking particularly for young people who do not wish to follow the well known path of A levels and university. Raising of the participation age provides an opportunity to broaden young people’s choices at 16. We are launching the City & Guilds TechBac® - a programme of study which blends technical qualifications with practical, real world learning developed and delivered in partnerships between education and employers. The TechBac® will provide an offer which makes digital skills integral to whatever vocational route chosen as well as providing an option of a specialising in digital industries.

Short and Medium term support for the digital sector

9. How can the digital sector be supported in the short and medium term? What is role for higher and vocational education, national colleges, industry and industrial policy?

Each of the components referred to has a role to play in supporting the digital sector; from identifying skills needs at all levels to industry and education working in conjunction to design and deliver programmes. And industrial policy taking account of infra structure requirements. Coordination and cohesion between these elements will often be a challenge but it is important that as well as addressing individual roles and responsibilities links between the different elements supporting the sector are identified and managed effectively.

City & Guilds has been pleased to be involved in the FELTAG work focusing on the role of Further Education and has welcomed its recommendations. Investment and innovation

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105 City & Guilds (October 2013) Making Education Work
106 Ofsted (March 2010) Moving through the system, Information Advice and Guidance
107 For example Barnardos (August 2013) Helping in Betweeners
cannot be left to any single player. We were very encouraged that others shared this view and actively supported the creation of a platform for best practice which has become the Think Out Loud Club109. This builds supportive communities to share the pleasure and pain of technology adoption.

10. Is there a need for increased high skills immigration in the short term? What are the implications of this?

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those disabilities and women, being engaged? How can this be improved?

City & Guilds does not train learners directly however we are very pleased to work with organisations such as the Trinder Organisation which specifically focus on the inclusion agenda.

12. What do the best local skills delivery models look like? What is the role for local government, Local Enterprise Partnerships (LEPs) and the third sector?

By definition local skills delivery models will vary and their success is, in part, determined by the interaction of the main participants. The work of LEPs is still in the relatively early stages for many however we have seen successful models emerging for example in the South West where there is meaningful engagement with employers and the respective roles and responsibilities of participants are clear and agreed to avoid unnecessary complications and duplications.

Industry

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

Skills shortages as we have discussed elsewhere are a probable barrier to SMEs which are exacerbated by the capacity to match salaries offered by larger employers.

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

As has been stated in response to previous questions meeting skills requirements is a major challenge. We believe that this can be assisted through effective partnerships between education and employers, both of whom have a role to play in ensuring that more structured learning meets business needs. Businesses should also consider approaches which include mentoring and coaching, working with providers to provide bespoke solutions for particular skill needs and invest in training for future as well as current demands. City & Guilds

109 http://thinkoutloudclub.com/
Kineo has experience of working with a number of clients to design and provide bespoke solutions for their business.\textsuperscript{110}

We have a number of examples of successful practice of employers working in partnership with education to equip the work force with new skills. Microsoft have upskilled teachers in schools across Wales in IT user skills and helping them by providing learning materials for them to use with their classes.

PD Solutions is working with their employers to offer truly tailored apprenticeships that are centre around the needs for the job and the individual – not an off the shelf solution for all (they work with Vodaphone, Telefonica, Cable and Wireless among others)

CTTS Broadband Distributor programme is aimed at developing the fibre cabling technicians – backed by BT and others with a clear aim of training those leaving military service

TechCity Stars set up by the employers of Tech City provides Apprenticeship programmes that meet their needs. They provide mentoring and input into the programmes being delivered.

15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

The knowledge-driven economy relies on an ‘always-on’, resilient and high quality data and communications network. This must cover the UK and allow seamless interaction on a global level. We are getting better but there is still room for improvement – all social meeting places should have free access, public transport should have high quality free access. A number of international studies exist to benchmark where we stand against other European countries, US and emerging economically strong nations.

5 September 2014

\textsuperscript{110} Examples are provided at https://www.kineo.com/case-studies/process-and-technical/
TUESDAY 11 NOVEMBER 2014

Members present

Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Lord Giddens
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Lucas
Lord Macdonald of Tradeston
Baroness O’Cathain

Examination of Witnesses

Chris Jones, Chief Executive Officer, City & Guilds, Martin Hottass, Manager, Skills & Siemens Professional Education, Siemens, and Sue Husband, Director, Apprenticeships and Delivery Service, Skills Funding Agency

The Chairman: Thank you very much indeed for joining us this morning. You are very welcome and we are looking forward to receiving your evidence.

There is a bit of housekeeping first. You have a list of interests that were declared orally by Committee members at previous sessions, and they can be found in the transcripts. This is a formal evidence-taking session of the Committee and a full note will be taken. This will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you will be able to revise any minor errors. This session is on the record. It is webcast live and will subsequently be accessible via the parliamentary website. Just before 11 o’clock I will suspend the meeting so that we can observe the two minutes’
silence. After that we will resume the session. You are very welcome to submit written supplementary evidence after the session. Indeed, we may specifically ask you to do so on some issues. I am reminded to ask everybody here to speak up nice and clearly. That is by way of an introduction.

I am going to ask you to introduce yourselves. If you wish to make any opening remarks you are very welcome to do so. If you do not want to, similarly that is fine. As we go through the questions, do not feel that you all have to contribute to every question. Some will obviously be more relevant to one or more of you and we will be very flexible as we go through. Let us kick off.

**Chris Jones**: I am Christopher Jones. I am chief executive officer of the City & Guilds group. City & Guilds is a leading vocational awarding organisation, but also an organisation that works extensively with companies across some 80 countries, focused very much around workforce and skills development.

**Martin Hottass**: Good morning. My name is Martin Hottass. I am the general manager of Siemens Professional Education in the UK and Ireland. Part of my remit is entry-level talent at Siemens and I am here in that capacity.

**Sue Husband**: I am Sue Husband. I am the director of Apprenticeships and Delivery Service at the Skills Funding Agency. We fund training and further education in England. We support over 1,000 colleges, private providers and training organisations, along with employers, with more than £4 billion of public funding each year.

Q232 **The Chairman**: Thank you very much indeed. I will kick off with a pretty broad question. We have had a lot of evidence from a range of people that in the future all jobs will have a digital component and there will be some much more highly specialist jobs. There is an increased need for high-level technical specialists, which we know is not being met satisfactorily currently. How do you think apprenticeships and careers guidance can best meet the needs of a future workforce? What needs to change in order for us to go up a gear? To what extent do you think there needs to be greater post-16 specialisation?

**Chris Jones**: Clearly this is an interesting area and when we contextualise it we look at the scale of the problem. The European Commission estimates that by 2020 there will be a shortage of some 900,000 ICT professionals, but alongside that the UK Commission for Employment and Skills also highlighted that by 2020 there will be a shortfall of close to 2 million in terms of the replacement and growth required for professional occupations. Fundamentally, ICT or digital literacy is going to be critical to almost every job that we see. One of the benefits that apprenticeships clearly have to offer this particular challenge is that it is a very flexible tool, unlike much of education, particularly if we look at GCSE, A-level or degrees. The ability to respond quickly to how technology is advancing within the workplace is limited to a large extent. Apprenticeships, and by their very nature the employer-driven agenda, should provide a far greater opportunity to be responsive to technology change, but also to how that technology is being used in the workplace. I think there is a great opportunity for apprenticeships to play a more important part in addressing the challenge of technical and digital-related skills.

In terms of careers advice and guidance, there might be an even bigger challenge. The more fundamental point for me is that we need to think more about careers education. We need
to open up young people’s minds to the breadth of jobs and careers that are available to them, but akin to that—I will come on to some research that we have undertaken recently—more emphasis needs to be placed on supporting the parents. Parents still play a fundamentally important role in supporting the decisions that their children make. The challenge for parents, and I see this with my two children, is that as they talk about jobs and careers that are going to depend increasingly on technology of any sort, I certainly am not best placed to be able to advise them.

We need to find a way to give parents more support, more confidence and more ideas as to where and how they direct their children to find information about careers. For me it is how we think about careers education in the broadest sense and that is clearly Government, employers, the education system itself, but increasingly and critically parents, too.

The Chairman: From your experience in City & Guilds, do you think that where people feel they have an understanding, certainly at school, do they understand how much all those jobs—say, in the construction industry—are becoming technically driven or demand a digital component?

Chris Jones: Not at all. If you talk about construction, probably to an average 14 year-old, in their mind they probably have a view that it is a building site, bricklaying or something like that. They have no concept of CAD/CAM or highly complex engineering programmes, like the Olympics for instance, and the complexity of the construction project. That is well beyond their understanding or appreciation and that is a challenge. How can you get more kids to go to see those sorts of investments or those sorts of environments where careers, in the context of construction or elsewhere, can be much better understood? My daughter is training to be a vet. The use of technology as a veterinary surgeon is changing rapidly. She has limited visibility of that at this moment in time, but she is acutely aware that technology will be a more important part of her skill and trade than it probably is today.

The Chairman: I am going to go to Ms Husband next and then come back to the Siemens case study, which will be helpful.

Sue Husband: Starting with apprenticeships and building on Chris’s point that they are employer-led now, I think the key way is to get employers to drive apprenticeships and the standards. It is easier for them to be more flexible and to adapt and individuals are obviously learning in the workplace, so they will always be learning using the latest technology. That is a key point that we will probably come back to. I think employers have a very big role to play in growing their own talent.

I should just touch on the National Careers Service, which sits under the Skills Funding Agency. We are there to provide impartial information and guidance to young people and adults, and that includes—and it is key to point these things out—provision of up-to-date labour market information that young people and parents can readily access through our website. We get that through a variety of sources: through the sectors and, importantly nowadays, through local enterprise partnerships and the Office for National Statistics. We liaise very closely with partner organisations and connect young people to other websites.

On the point about these roles changing so quickly, we realise that there is also a lot of other information, aside from the National Careers Service, on websites like Plotr, notgoingtouni and the Good Careers Guide. We are aware that it is not just the National Careers Service that can give that advice.
We have over 800 job profiles, which are being updated all the time. We work very closely with the sector to make sure that those job profiles are up to date. There is a wide range of IT-related careers, such as IT project manager, IT support technician and IT trainer. The National Careers Service also has a professionally trained workforce, and I think that is key in giving young people the right advice about where to look for more detailed information on the careers that they should be pursuing.

**The Chairman:** Can I push you a little, not on careers at the moment but back to apprenticeships? Are you confident that enough priority is being given to digital and IT career paths within apprenticeships?

**Sue Husband:** I would say that it is growing. The key area that is growing through is Trailblazers. That is where we are getting sectors, particularly industries, to come together and help to design the standards for apprenticeships. We have very keen involvement from the IT sector on that. I think that is where we will see the impact: the sector driving that change, with the Government supporting them to do that.

**Baroness O’Cathain:** You said that employers have to be really involved in this and there is a need to make sure that they realise that every job is going to have a technology thing in it, but who is going to teach the employers? The heads of these big businesses rely on myriad people. If they do not understand it themselves, do they know that they are going in the right direction? It is a board responsibility to make sure that they do. Is there any suggestion that there should be one IT person at the top of the organisation dealing specifically with turnover of staff—not HR as such but training skills and talent? They do not have these board positions now. A number of people in the top 100 FTSE companies that I know—the chairmen—would not even know how to open a computer. They really would not. They have minions to do it and they will come unstuck.

**The Chairman:** Mr Hottass, we are not talking about Siemens.

**Martin Hottass:** My CEO can open his computer. He is probably a lot better than me at that. Maybe I can offer a different perspective, because it is obviously a very broad question. In our experience, we have been engaging in this field for a very long time as a German business. In Germany it is normal that you give something back to the local community that you work in, and that ethos is prevalent in any country in which Siemens operates. Our local business units will have engagement with schools.

I sit in talent acquisitions, so I am the kind of person you are describing. When we embarked on this journey more formally we realised that the ageing population will lead to a huge demographic change, because the supply of young people to the marketplace from 800,000 young people currently who are turning 18 will drop to 690,000 by 2020. Coupled with baby-boomer generations retiring, that gives you a big problem with regard to attracting the right level of talent.

When we started this journey it was purely driven by economics. We were saying, “We need to grow our business. We want to grow our business. Do we have the right skills?”. Surprise, surprise, they were not in the marketplace, so the only way you can do that then is to engage wholesale. We are running our own national training contract through the Skills Funding Agency and we currently have 500 apprentices in engineering.

We also realised, once we got relatively good at that, that the only way to have a sustainable supply chain is to make sure that kids at school learn the right things. We got engaged with
STEMnet and STEM ambassadors and so on, and we engage from primary school onwards. At primary school our engagement is typically through parent governors. Most of our employees have children and ultimately it is a question of: forget about the company, just think about your social responsibility as a parent. Most of our parents are proud to work for us and they want to give something back to their local schools.

We have created free resources on the web that are available for anybody to make sure that there is inclusion and that we do not create a cast of people who can and a cast of people who cannot, which is obviously an issue. In early years education, this is about experiential learning. It is about kids seeing that building something can be fun. We get them to build a wind turbine. You put a hairdryer on it, and the house has a buzzer on it, and if it spins the buzzer goes off or something. It does not really matter. What matters is that they learn experientially and they see that engineering is exciting.

In our experience, the drop-off point is at the age of 10 when youngsters leave primary school and go into either middle school or high school, because the style of learning then changes to academically-driven content and the subject matter is taught in an abstract way. At that point we typically lose most girls. Also in the curriculum we have some unintended bias where examples are more geared towards young men, so we should use the example of a failing hairdryer rather than a car breaking down. It is about accessibility and making sure that people understand that whatever skill you learn you can apply. We support the curriculum in England and in Scotland. Again, this is free of charge and it has the whole syllabus and the lesson plans from primary school to key stage 4. For us, as a business, that is very cost intensive but it is our contribution to combating youth unemployment.

At 16 you have some big decisions to make: either you stay in education or you go into an apprenticeship. The apprenticeship offering in the UK has improved considerably over the last 10 years. We support Trailblazers. In our view, the employer needs to own the content, the skills landscape. What employers are ill equipped to do, though, is to formulate it and maintain it. That is difficult and that cannot become our job because we are not equipped to do that.

The Chairman: Do you mean the structure of it?

Martin Hottass: Yes. If you asked everybody in the industry sector what good looks like, you would probably get the same answer and that should be the standard. How you translate that into a fair and consistent framework and maintain that framework should not be the employer’s job. That is my view.

Q233 Lord Giddens: Can I ask Martin a question about the energy sector, because we have hardly discussed it in our group? It is such an important sector and it is obviously being penetrated by digital technology all the way through with smart grids and smart meters and in wind power to control intermittency, which I see you have worked on. Is there material that we should feed into our report that is relevant to the energy sector and preparation of people for working in energy industries? This is going to happen across the board, as far as I can see, to the traditional fossil fuel industries as well.

Martin Hottass: It is there already. We were talking about this outside. Siemens is in the smart grid market. We do not install meters or anything like that, but we measure the energy consumption of our customers. If you go back five years, there was an analogue process and you would get a bill that told you what you had consumed, but by the time you
got the bill it was too late; you could not do anything about your consumption, it was just a factual statement. Now we measure energy consumption every minute because of the amount of—

Lord Giddens: There is going to be a huge demand for digital skills in the energy industries.

Martin Hottass: In any industry. The answer for me is exactly as Chris said: we will all need to be computer literate to a much higher level. It will be in any framework. It does not matter whether you are a baker, a bricklayer or a business administration person. It does not matter at all. There will be a huge growth in the number of people who need to be digital makers, the people who create content or new cyberware or whatever, but the use of IT across any industry sector will increase. We call this Industry 4.0, where factories are now completely digitalised, so you can run a whole assembly line using a computer program and you can try it all out before you put it in. Computers are so powerful now that you can simulate whole assembly lines before you invest. We worked with Jaguar Land Rover and BMW Oxford, just to give some examples, to do that. That means that people coming out of school will have to be a lot more IT savvy. Having said all that, my grandchildren are probably more IT savvy than me, and they are only nine, because they grew up in a life where you have instantaneous access to information. When I was at school it was a book and that was it.

Lord Aberdare: I want to take up the point about maintaining apprentice frameworks. I have heard from a number of different employers, “Okay, we get involved in defining the framework, but how does it get maintained?” Is that something that the apprenticeships service or the SFA is going to be responsible for? How will that happen?

Sue Husband: We have had that feedback, too, and we do see ourselves as a service. As we have gone through this new approach with Trailblazers, we have had the feedback from employers that they feel it is probably too onerous for them to take full responsibility for updating them. However, there has to be that employer involvement all the way through. It is for them to guide and advise on what the standards look like and how they change and are amended, but as a service we should support them in keeping those standards up to date.

The Chairman: When you say “we should support”, does that mean you are planning to support?

Sue Husband: One of the things that we are doing currently with the Skills Funding Agency—you will know that we have been through a reform programme recently—is looking at the structure and how we best support employer-led apprenticeships going forward. Over the last 24 months we have seen such a big change in the way apprenticeships are led by employers that we realise that we have to adapt as an agency to support that appropriately.

Q234 Lord Haskel: We have heard about what good employers, do but what about the bad employers? What about the employer who says, “Why should I bother having apprentices. I will just poach people as other firms train them.”?

Sue Husband: It is an interesting point. What we are finding from employers is that the more transferable skills they give people the more loyal those individuals are. Whenever I meet apprentices I ask them a few questions about why they chose an apprenticeship, where they got the information from and how they feel about the organisation they work for. Time after time young people tell me that they really appreciate the opportunity they have been given and that they feel extremely loyal to that organisation. I think those organisations that do
not see growing their own talent as a future will find out in the long term that that is to their demise as opposed to the benefit of trying to poach from other employers, because those young people will not want to leave.

Q235  Lord Macdonald of Tradeston: You say in your biography that the role of the Skills Funding Agency is to deliver the Government’s skills priorities with a particular focus on English and maths, which is understandable, but should it be English, maths and digital skills? Is it not that important?

Sue Husband: That is a fair point and in our business plan this year, following on from our funding letter, we will include that. One of the things that all our employers are doing, especially through Trailblazers, is embedding ICT into their apprenticeships more and more. It has always been an ask of apprenticeships that ICT is considered. The really successful apprenticeships now have a blended learning approach whereby they expect their learners to use IT where appropriate for learning. But absolutely, I think it will be literacy, numeracy and IT literacy in the future.

The Chairman: Mr Jones, did you want to come in?

Chris Jones: Just on that point, obviously across functional skills we have English, maths and ICT, so there is already recognition that you have to have a core aspect of ICT as part of an apprenticeship framework.

I would like to come back to the number of apprenticeship starts. In the last year in ICT, less than 3% of the total number of apprenticeship starts were ICT apprenticeships. There is clearly a substantive amount of work that we have to do collectively to raise the profile and awareness that there are ICT apprenticeships. They range from not only those that are involved in programming but right the way through to what Google do now, which is social media. The diversity of apprenticeships is clearly one issue. There are many of them, but we do need to raise the profile. A question for us is: what sort of stimulus do we need to provide to ensure that more people recognise that those apprenticeship frameworks exist and that they lead to good, strong careers and, clearly, further educational progression?

The Chairman: Do you think we need to rename it? Do you think ICT sounds like the skills of a previous age?

Chris Jones: That just happens to be the way we capture that in the BIS returns. If we look at the detail, they are given slightly different descriptors in the programmes.

I think a broader point that we need to look at is how you connect the future industrial strategies that we as a country have to have. How do we look at that? How does that ladder back into the curriculum from primary through secondary into college or university? How does it blend into careers education? I am not clear. I have not seen enough evidence that when we develop our industrial strategies and talk to our important areas—energy is a good example—we see the connection and think about how we embed the skills pathways and build the pipeline so that the challenge of skill-shortage vacancies is reduced over time but deliberately so. That, for me, is a big gap.

We hear a lot about industrial strategy, but we do not understand the connection between that and the educational system and careers education and how those play a core part in successful delivery of the strategy.
The Chairman: Thank you very much. Mr Hottass, you will have to keep it short because otherwise we will not get through the questions.

Martin Hottass: Yes, sure. The Skills Funding Agency, in my understanding, obviously cannot be the guardian of how standards are developed or maintained. That is not your role. The Skills Funding Agency’s role is to make sure that public funds are used in the most cost-effective way. The demise of the Sector Skills Councils has left a bit of a void in this area, so I think the jury is out there. A number of sectors, like the energy sector, have founded their own assessment service, which is employer-led and owned by employers. That could be a blueprint, but it could also lead to a lot of complexities.

The Chairman: I know we said we would move on, but I am going to let you because this is an area for you.

Chris Jones: I will just make a general statement. One of the challenges around Trailblazers is that, while it is great to see the degree to which we are seeing employer-led frameworks coming through, one of the consequences of a Trailblazer strategy is that across industries you have different Trailblazers adopting different approaches to how you deploy an apprenticeship framework. At one level, assessment and how assessment is managed in one sector could be fundamentally different from that of another. If we are looking at that in terms of a transferable skill, technology, digital literacy, what does that then mean? We arguably will not have a standard that everyone recognises across industry, and that is a challenge that I do not think we as a sector have quite worked our way through yet.

The Chairman: That is very helpful, because we have the Ministers next week. That is a helpful pointer to us of an issue of concern that we have heard from other people as well.

Q236 Lord Holmes of Richmond: Good morning. We have been told that careers guidance in its current form is not fit for purpose. Do we need to rethink careers advice altogether?

Martin Hottass: Yes, I would say so. That is an unqualified yes. I think we should go to what Chris calls careers education, where you accompany a child during their development to bring them closer to the world of work, and that is a joint effort by the state, parents, and by employers. Ultimately, most kids have no idea what the world of work looks like, me included. I passed my A-levels and I had no idea what I wanted to do. I think that is mirrored now, and the changes in government policy where you can buy a system leads to very patchy provision and depends on what the school purchases. It also depends on what is on offer. This idea that the market regulates itself does not really work, in my view.

I would appreciate it if we had career guidance that started at primary school and was more about experiential learning and education, and as you progress through the different key stages it becomes more focused towards careers. The biggest problem for me has always been in this field; the careers adviser or the teacher is not equipped to tell a child what a job looks like because they have never worked in that industry. This is where industry comes in and plays their part.

Chris Jones: To expect a teacher in a school of 14 year-olds to give good, high-quality careers advice and guidance is probably the job from hell. It is not what I expect them to do, so that is one of the problems. More broadly, one of the issues that I have is that there does not appear to be any clear sense of accountability or consistency in careers advice and guidance today. There is also a huge amount of different choices. This week in Birmingham we have the Skills Show. We will have 100,000 young people coming to Birmingham to experience
what is effectively a careers fair. They will have a chance to engage with people like Siemens and others, but there is no provision at that Skills Show for teachers to go and learn about industry or careers. We have the Big Bang. We have Careers Lab, which has been launched by National Grid and Business in the Community. These are all great initiatives, but there does not appear to be any point of connectivity between them to ensure that what we deliver is something that we can collectively measure. That is a challenge.

We need to try to find a way to build some degree of consistency into what is delivered. We all do a careers aptitude test. I will cite my daughter. She is training to be a vet. Her careers aptitude test said that she should be an undertaker or a taxidermist. There is a vague connection, but that did not help her to understand what choices she had to make or what she would need to do. That is one of the issues. What advice do you give a 14 year-old or an 11 year-old who has an interest in something, a job or a career, because of what they might see? How do we stimulate them to want to learn more, to understand more? What education will they need to pursue?

Connected to that is the challenge that when we start to introduce a choice at 14, a further choice at 16 and a further choice at 18, those choices will inevitably limit the career that you potentially will be able to take because you have not studied what you should have studied at 16 or 18. Before you know it, that is a block and a barrier to the next progression route. I think that a system of having breaks at 14, 16 and 18 works against young people.

Baroness O’Cathain: In just one sentence, we have programmes to teach people how to teach, but is it included in the teaching colleges or in degrees and diplomas in teaching? Is careers advice one of the things? If it is not, surely we ought to think outside the box and ensure that there is some way in which there is going to be a big emphasis on taking people and training them as careers advisers and giving them a diploma or a degree or something, because it is so fundamentally important to every school person in this country.

Chris Jones: I do not disagree with that. I also would like to see a very clear programme, particularly for teachers and tutors who are very close to particular types of disciplines, with an absolute requirement for them to go back into industry for the most possible time that they can afford in the balance of everything else. Not enough spend time back in industry as a mandatory part of their own CPD.

The Chairman: Let us go on to Lord Aberdare, and then I will ask questions as well, but they carry on from this.

Q237 Lord Aberdare: My question is about how schools and industry can be supported to work together to inform career choices. What are the most effective practical mechanisms and things that they can do? Above all, what is the role of government, and therefore this Committee, in things that government can do to facilitate the process? If I can add one more phrase that I am sure we will come back to, SMEs need to be part of that as well.

Martin Hottass: For me as an employer this is a tricky subject, because a lot of the initiatives that Chris alluded to we support, but we probably get 50 to 60 requests a week to support yet another initiative. I think this is probably where the problem lies. In my view, employers play a vital role and we should host teachers or further education lecturers to have a week or maybe five days a year or whatever—it does not really matter—in industry so that they understand what young people or any employee who works in that industry does. That is a role that employers can play.
The other role that employers should play is, as I said, to engage with the local community and say, “This is where your career could be”. That just makes common sense, because ultimately we need people in order to execute our orders and it does not matter whether you are an SME or whether you are a big multinational, so that would be that.

The role of government in all this is to facilitate it. To the best of my knowledge, there is no careers guidance qualification in the syllabus for a teacher. You typically study the subject and then you go to teacher training for a year to do a postgraduate certificate in education, and that is it. As part of that, you get taught the didactics and the pedagogy of teaching but not how to give careers advice. That has always been a separate role and does not exist any more in schools.

**The Chairman:** It is often a PE teacher who had run out of steam on the playing field, I think, in my experience.

**Martin Hottass:** I could not possibly comment on that.

**Sue Husband:** If I may, I will go back to the National Careers Service, because I think it has been in place for the last couple of years. For the people who do use it, it is highly regarded. The challenge is that there are not enough young people engaging with it, and that is something that we have very high on our radar now to address.

Educating teachers about careers advice is such a difficult, complex subject. Through the Careers Service young people can get access to trained careers advisers, and I suppose a key role for teachers is probably equipping young people, or inspiring them I should say, to know where to go and find out that information. I think the people best placed to educate young people about the careers out there today are employers. One of our roles is to facilitate those relationships between employers and schools and local enterprise partnerships. That is where we would see that we would operate.

One other point about teachers relates to the Education and Training Foundation. One of their roles is about looking at the skills that teachers will need in the future. I think we should look to them to address that issue.

**Baroness O’Cathain:** On careers advice?

**Sue Husband:** Yes. Finally, as the Minister is here next week, perhaps we should talk about how BIS is currently working with the Department for Education to look at us possibly opening up to having an all-age careers service, because we think that is one of the challenges. There are too many compartments.

**The Chairman:** Too bitty, yes. Okay, let us move on to delivery.

Q238 **Baroness O’Cathain:** What is the quality of further education provision? Does provision meet the needs of business? If not, how can this be changed?

**The Chairman:** Who would like to kick off on that?

**Baroness O’Cathain:** It is all part of the same thing.

**Martin Hottass:** I am happy to as an end user on this. Siemens has a national training grant, which means that we contract with the Skills Funding Agency directly. We are in receipt of an apprenticeship grant for every learner we put on our books. In return for that, we also become “Ofstedable”, if that is a word, and indeed have been inspected.
We only have engineering apprentices and we only contract with eight colleges in the UK, because the majority of colleges are not equipped to deal with what we need. Now, it is easy to go on to college bashing, but this is not the purpose. The purpose is to say that a college finds it very difficult to find a lecturer who is any good. If you have local industry thriving and you have a skill set that is rare, you can earn a lot more working in industry than you could working in a college. Subsequently, as our apprenticeships become more and more demanding, the lecturer also needs to be more and more skilled, and that is going to be a big problem.

In some areas where you have industrial heartlands, college provision by and large, and this is a generalisation, is adequate or good. In places like London, I only have one college that can deliver the electrical training that I need. I bus all my learners from Croydon to north London every day and that college can only attract lecturers to that extent because of its association with us and because we sponsor equipment and make it more attractive for a lecturer to work in it. Ultimately, I think government can help by improving the provision of lecturers’ pay and making it attractive to work in that sector. Most of our lecturers are in their fifties, so in 10 years’ time you will have none left.

Chris Jones: It is a very broad issue and it goes to the heart of the structure of the education system as much as anything else. To pick up Martin’s point, if we look across broadly FE, although we can take this across education generally, the infrastructure of the educational institution, the demographics it pulls its student cohort from, the degree to which it has a high level of industry concentration around it or is it rural, the level of funding that it currently receives, and its overall broad sense of financial stability are all issues that are going to impact on the quality of provision. If you take Martin’s point, the capital intensity for an FE college, if it wants to deliver engineering, is vast. Yes, employers have a responsibility to support that, but I do not expect an employer to have to cough up all the kit required for a college to deliver the learning. That inevitably is going to create real challenges.

My chairman, when visiting in another role he has, was told that within one particular borough of London there were 15 different schools that a child could choose to go to. Now, that is not different schools, that is different types of school, all for 11 through to 16. We had a UTC, a careers college, an FE college, a state secondary, a grammar school, a free school, an academy school, and a private school.

The Chairman: A faith school.

Chris Jones: A faith school. Now, how do you connect those? How can we be sure that the system is going to deliver something where ultimately the product is someone who has skills, knowledge, curiosity, a desire to learn and a desire to work? That is a problem. I applaud the fact that we are having career colleges now. It was a move by Lord Baker off the back of UTCs. It is engaging industry with colleges in a new and different way to think about education from 14 onwards, but it is another choice. I think that is one of the issues that we have to wrestle with collectively. It makes it hard for Martin to recognise whether someone coming from a careers college is going to be fundamentally better equipped to work in Siemens than someone who has come through an FE college or a university. The challenge for Sue and her agency is how we fund these organisations. What is that going to mean for us?
These are quite systemic and deep structural issues that I think will challenge not just digital skills but our ability to deliver for the skill gaps more broadly across industry. That is something that the Government have to wrestle with and industry has to wrestle with. I certainly do not have a solution to suggest, unfortunately, at this moment.

The Chairman: I have one supplementary question, probably to Mr Hottass. I am keeping an eye on the clock. I was interested in what you were talking about: having to bus people and all the rest of it. Take engineering and thinking about the capital that is needed, should we not have a lot more specialism in our colleges? In a sense, that is what you are talking about with UTCs and careers colleges. Why do we assume, therefore, that post-16 FE colleges should deliver everything from hairdressing to engineering in every place? To what extent do we need quite a radical rethink of our post-16 colleges? I am going to pause. I am going to come back to you for replies in a minute, because it is 10.59 am. Rather than have half a sentence, I will pause and we will stand while the bell rings.

Sitting suspended for two minutes’ silence.

The Chairman: Do we have to shake up post-16, Mr Hottass?

Martin Hottass: While I obviously fully understand what you are saying—that we should not expect every college to deliver everything—and I would support that, I think that for a conurbation of the size of London, which is approaching 10 million people, to have only one college that can deliver that is probably inappropriate. Just to give you an example, we also contract in Scotland. The colleges there have basically “carved up” the market, so you have specialisms in specific colleges, which is more funding-efficient for them but also means that it is a lot more expensive for an employer, because there is no free marketplace for the provision of skills. The current Administration’s endeavours to give the ownership of skills to employers and make sure that there is a free marketplace where employers can procure what they need to procure at the best possible price, because it is obviously our money, makes it a difficult proposition.

I cannot give you the answer. What I do know is that we need to incentivise people to go into further education colleges in a different way because, the way I understand the pay scales, you can earn a lot more now as a secondary teacher than you can in further education, which ultimately means that you get the law of diminishing returns. You get people who may not have made it in industry or are not good enough then teaching, and since this is the biggest investment in our future this is probably not the best way forward.

Chris Jones: I am the governor of a college group through Oxfordshire down into the Thames Valley. We have a mixed economy. We are providing everything from 14 right the way through to higher education. As a governor, I am quite concerned. I think we are trying to do too much on too many different fronts and fundamentally, my more cynical side would suggest, we are simply an organisation chasing funding; we are not an organisation that is thinking deeply about what the provision that is the most necessary for industry to be successful is.

If we look at the area in which we operate—science, technology and engineering are key areas—we are beginning to think about how we increasingly refocus our institution into an organisation that can meet the demand that the Thames Valley up through to Oxfordshire requires. That is a problem. Over time, colleges have become very diverse, and that is a challenge because it is not clear what they are there to do. I personally think that the more
we can begin to specialise post-16 the better, but it does need careful thought and consideration to ensure that doing that does not prevent a student then moving between the pathways. I think that flexible pathways where you can move between the institution and the type of learning are incredibly important.

Sue Husband: I would just say that it is a very challenging time for colleges at the moment, but on the other side we are seeing some great examples of best practice where colleges are working very well with the local employers and the local enterprise partnership and adapting. I think that is the key thing in these times. They have to adapt and deliver the most appropriate provision.

Q239 Lord Macdonald of Tradeston: In business it is often said that you need a good crisis to drive change through rather reactionary organisations. It looks as though you are heading for a crisis in further education with the further cuts that must be coming after the next election. Will that force economies of scale and a more radical approach to how they are run in future?

Chris Jones: I think so, yes, but the evidence is that the merger of two failing colleges does not create a successful college. The expectation that a good, successful college group should have to take on the burden of a failing college is not necessarily the answer either, I agree. Those are some of the structural challenges that we face, but I would say that across the education system per se there is probably too much poor provision, and we need to look at that and work out how we narrow that down so that we drive quality up.

The recent reports looking across university provision and the number of universities that were formerly colleges that became universities because they were able to show that the degree to which they deliver high-quality higher education leading into employability is remarkably low. That is one of the problems that we have. You have a system that has chased funding, sometimes for the right reason because they have had to survive, but consequently that has meant we have ended up with a very diluted system with no real sense of what good looks like generally.

Martin Hottass: To answer your question about economies of scale, I think you will find that more niche provision will probably be even harder to come by. When the first round of savings were announced and the Skills Funding Agency was forced to contract only directly with training providers that needed a fund of £1 million—I think that was the cut-off rate—that meant automatically that smaller niche providers in small niche industries could not contract any more and that went out of the window. I think that will continue to be the case. You will probably have, as Chris said, a more diluted—

The Chairman: You are suggesting that far from creating radical change and a shake-up, it will produce weaker, more generalist provision?

Martin Hottass: Yes.

Chris Jones: Our college group is multisite, multidiscipline, and if we look at that one would say that we should get economies of scale. Actually, it is even harder for the leadership team to deliver a consistent quality of provision with the scale. In effect, we are seeing diseconomies of scale because moving staff around, leveraging funding and leveraging student attendance is harder. The leadership team are doing a great job but are challenged. They are not used to running the complexity of the business that they now have. For college education in general, these people are running businesses that are increasingly more
complex and we need to find a way to support them in that. They are not doing it with any sense of delivering a poor service. They are working incredibly hard to deliver the best possible service to the community and to the learner, but they are under intense pressure of diminishing resources in many respects.

**Q240 Lord Haskel:** This continues the discussion. You have told us about FE colleges and technical colleges. How is the infrastructure of skills delivery working across the whole of skills delivery? Should it change? You have told us about change in FE. What about other sectors of skills delivery?

**Sue Husband:** I think we know that skills delivery is constantly changing. You will have heard the announcement last week about Manchester. That is a key thing. It is changing. Local enterprise partnerships are having more and more say. Anything that can be done to champion the importance of skills and apprenticeships to drive economic growth is important and obviously welcomed by the agency.

One of the other things is the way we fund provision. It is growing with the providers, colleges and businesses that are delivering the skills that we want them to. One of the things that came out of FELTAG, the Further Education Learning Technology Action Group, was looking at the way we fund programmes that are delivered more and more online. I guess one of the things that we are doing as an agency is making sure that the funding is encouraging exactly the growth in the areas where we need it.

**Chris Jones:** I would come back to my comment about how we embed skills across the broader industrial strategy agenda. If we look at some of the major infrastructure programmes going on today, at what point do the infrastructure reviews begin to look at skills as being a critical part of the solution? What do we need to build into the system from day one to ensure that the infrastructure initiatives and the capabilities that we will require are at least in line with how education can best support that longer-term investment and return? That is an absolutely critical aspect of what government in any independent reviews of industrial strategies needs to lead to. Where do skills play their part, and how do we think about skills as a core ingredient and enabler to a successful delivery of that strategy? That is critical.

**Lord Haskel:** What about targeting skills? We know that we need more people in science and technology and engineering and we have far too many people doing hair and beauty. Is there any way in which it can be targeted so that we can try to get the balance right?

**Chris Jones:** I think there is an interesting challenge there. Do you stimulate the market, and are those incentives going to be as much for the learner as they are for any other participant in the system? Equally, are we at a point where we are saying, “These are the careers that we are only going to fund and if you want to do something different you will have to fund it yourself?” Hair and beauty is an interesting one. Yes, we arguably say we have far too many hairdressers coming out of college. A lot of those go into the care sector, because the skills they acquire for hair and beauty and the aspect of customer care are what the care sector requires, because the care sector cannot recruit and fulfil its skill requirements. I think we have to be a little bit careful, and it comes back a bit to the core skills—whether they are technical, professional or transferable—that we want to embed, so that we at least give ourselves slightly more bets on the table, I suppose, that we will succeed in the long term.
You cannot deny that for a 2-million engineering replacement requirement or a demand for ICT, a stimulant—whether that is funding or otherwise—should clearly be one measure that we consider. Whether it is the right measure and should be used in extremis I do not know, so I think we have to be a little bit cautious.

The Chairman: When we talk about diminishing finances and you are clear, not so much from your City & Guilds experience but your experience as a governor, that FE colleges inevitably chase the money—

Chris Jones: As others do.

The Chairman: —is there not a case for saying that we have to direct the money to the skills and training that we need more of?

Martin Hottass: I think we should go back further. This starts at school. We are asking a child to make a decision about their future at the age of 12. Invariably, it is the parent who will make that decision. This obviously mirrors your point about educating parents more. For me, STEM is an enabler for any career and we should have STEM as the backbone of our curriculum going through. You need maths in order to do ICT as well, so it is not as if they are divorced at all.

The other bit is a reputational issue, which we are starting to overcome, that apprenticeships were seen as a second-class career. Now that we have apprenticeships that go up to degree level, they offer a viable alternative. The replacement needs of businesses are typically not necessarily at graduate level. Of course, we always need graduates. Please do not get me wrong: we always need people with master’s degrees and we need people with bachelor degrees, but the bulk of your workforce sits typically one space level below that.

These are the people who would come through a higher apprenticeship or people who leave school or college at 18 and decide that an academic career is not for them. If you can demonstrate that you can have as rewarding a career following that path as you would having a university career, then you are on to a winner. In our business, we have 28 managing directors of 28 business units. Fourteen of those are former apprentices. That is not something that we typically promote, but that is quite powerful because ultimately in industry it does not matter whether you have a degree from Cambridge or not; it depends on whether you can do the job or not.

The Chairman: Do you think that is culturally because you are a German company?

Martin Hottass: Probably, ironically not. I think it is probably because the UK as a society is much better at giving people opportunities. I am German by birth. I do have a degree, I have to say.

The Chairman: No, I am not criticising you personally. It is just that we are always told that the culture is more open to apprenticeships.

Martin Hottass: To apprenticeships, yes, but Germany is very much a rules-based society. The career trajectory of an apprentice in Germany is not as good as it is in the UK.

The Chairman: Right, that is interesting.

Q241 Lord Macdonald of Tradeston: This is obviously a very revolutionary time with all these disruptive technologies hitting people, and it creates a sense of chaos, which in some
ways can be creative, but on the other hand people are very bewildered by it. I am sure that applies to politicians as much as school leavers. If we are looking for ways through that, either to make things more efficient or to give people more direction, how much weight should we give to apprenticeships? You now have 500,000 a year coming through, a third of whom are over 25, a third probably school leavers, a third 19 to 24. Given the support that it has attracted in recent times, should it become the main branding for this new thrust to try to incorporate these skills? Even looking at degrees for the over-25s, that is almost your degree as a qualification for getting a good apprenticeship at Siemens or whatever.

**Martin Hottass:** In my view, we should put apprenticeships on an equal footing, but they are not the panacea. You need a broad society and you need a broad skill set across the board. For me, the embedding of ICT and practical skills in apprenticeships is an obvious thing to do because it is about vocation. It is about being able to do something, but also increasingly in our degree courses we train the mechanical undergraduates of a well known north-eastern university in a town whose accent I speak with enhanced skills because they do not have a clue. They study mechanical engineering but they have only ever been exposed to theory, so they cannot apply what they have learnt. A Rankine cycle, which is a steam cycle that you would use for a steam turbine, for an average student is not accessible any more.

**Lord Macdonald of Tradeston:** How could we refine and strengthen the present apprenticeship system with our recommendations to government? I cannot think of a Mr or Mrs Digital in government who is looking after all this. My memory goes back to e-envoys and cyber tsars and so on, but it looks as though this has again, through the chaos, spread across departments, which may or may not be a good thing. I think the instinct is to try to get a greater central importance and focus on this. Can you think of a way in which apprenticeships could be better directed from government and perhaps through a central ministry?

**Sue Husband:** I would say at the moment that apprenticeships are well directed. We know that we have cross-party support for apprenticeships. The great news is that they have built momentum over the last few years and they are here to stay, I hope. I would say that they already have ICT embedded in them. That will continue to grow. I think that the momentum is there with apprenticeships. They are well placed. I agree with Martin’s point that apprenticeships should be seen as a viable option for young people to go to either university or an apprenticeship. Again, when I talk to apprentices, I always ask them whether it is a conscious choice or whether it is something that they slipped into. More and more I am hearing that individuals are making a very conscious choice to do an apprenticeship for several reasons, one of them being not having debt, but another one, interestingly, is that they see it as an opportunity to get into a business early on so that they know that they have a job and that they can grow with that employer.

**Lord Macdonald of Tradeston:** The Prime Minister says he is looking for 500,000 a year and maybe 2 million by the end of this Parliament. You are looking forward with your money, presumably, Sue. How many apprenticeships do you project for 2020? Will it be a million a year then?

**Sue Husband:** Most important is the quality, so that is what I would say first. We saw a slight drop-off last year. I think it was around 10,000 less, which is a small number in comparison to the overall delivery. The key thing for all of us is to drive the quality of apprenticeships. I do believe that they will grow, but that will take time. Through Trailblazers it has taken some
time to get those settled in. All our Trailblazer pilots are starting with small numbers to make sure that what we are doing is right: right for the individual, right for the business. Yes, I see them continuing to grow, but first and foremost it is about the quality of the apprenticeships that we are delivering.

Q242 Lord Lucas: I would like to pick up on something that Karen Price of e-Skills said to us when she was here talking about how to get people who want to return to work or change careers into the apprenticeship and training system. She was saying that what she wanted was courses that are totally up to date and short so that someone can take them and know at the end of it that they have the talent and that it was worth training for and something that they could show an employer to show equally that it was worth the employer taking them on as a trainee. Now, are there such courses? If there are, where would you put them? Perhaps not in FE, but where would you go to find them?

Martin Hottass: This goes back to the European Union initiative, which has a strange name. It is called MOOCs: massive open online courses. This is in the budget for the next seven years. I think that is probably an interesting project: try before you buy, in essence. The question with that is obviously how you make sure that the person you at the end take on is the person who sat the test. As with all these things, it is open to massive abuse. In the IT world, because it has moved so quickly, it is probably quite attractive to that industry sector.

The Chairman: In general are there enough short courses for returners? We have had quite a bit of evidence from employers in front of us saying that the present system does not deliver the skill set that they necessarily need and they would like to see more short courses that people could go to at various points in their career. Where in the system does that exist at the moment, or where could it exist?

Chris Jones: The model that was developed through the qualifications and credit framework was designed to support a flexible model. We would say that the reality is that the QCF has never delivered on its promise for a variety of reasons. I do think the fact that the agenda is increasingly about employer-led provision provides real scope for more high-quality short courses to be delivered. The question then becomes whether those short courses are going to be publicly funded or funded through some other form of provision. The 24-plus loans for apprenticeships were obviously not as successful as we would have wanted.

If we are looking at people who are looking to reskill or retrain, whether they are in work but looking to move industry or out of work looking to come back into employment, we do need to think a bit about the short-course provision that the employer is particularly going to be looking for. If it is technology, is it more about attitude and aptitude than being able to demonstrate that you have a strong capability to deliver engineering? That needs some fairly careful thought and consideration.

By and large, I think the notion of short courses is absolutely right. That sense of continuous learning, bite-sized learning or learning what you need when you need it is one that employers readily recognise, but that is not a model that a traditional college would find easy to deliver. A training provider might, but again there are challenges to their economic model as to how they would respond to the demand for that.

Martin Hottass: You virtually gave my answer. That is fantastic.

The Chairman: That is fine.
**Martin Hottass:** The point, though, is that it depends. That is the answer. If you want an accredited outcome, there is probably not enough provision because most government-funded provision has a minimum amount of guided learning hours in it. If you talk about technical training—giving somebody a specific skill to do a specific job—there is a market out there, but as Chris said that is very restrictive, and it becomes more expensive to deliver that course.

If you look at the railway industry, we are currently building a new national railway college to enable industry to train on a train that you can dismantle and mess up. At the moment, you train people on train maintenance when the train is in the depot. If you cannot get that train back out on time, you have a bunch of commuters stood somewhere and nobody picks them up. Subsequently, we have a skills provision that is not as good as it could be. We invest as an industry in this. We need more investment to allow people to learn more, but this should not be certified, in my view. This is a technical skill.

**The Chairman:** Lord Courtown, let us go on to qualifications.

Q243 **Earl of Courtown:** I was quite interested in what you were saying about major infrastructure projects and the digital skills required when entering into this and perhaps the lag time. We should be looking at what is required at an earlier stage in planning these projects. This leads on to looking at these qualification apprenticeship frameworks. We have digital skills galloping ahead and our education is trying to play catch-up all the time. Can we be confident that the qualifications and frameworks that we offer to our apprenticeships enable them to understand the content as well as to keep up with the change?

Just one other point. We mentioned digital skills generally earlier, and we talked about skills for example on a building site. As somebody who has employed people on construction sites, I think that a lot of these people out on the building site have the digital skills anyway, whether it is in loads and levels, a large plant or whatever. We have to make employers and apprentices realise that they have these skills anyway. It is just a question of developing this a bit further.

**Sue Husband:** Yes, we can be confident that apprenticeships will be fit for purpose. I think that through Trailblazers, having businesses design those standards means that they are fit for purpose because it is the employers who are designing them for employees in their workplace. The other beauty of that is that obviously in a workplace they will keep their technology up to date because they have to. There is a business need to do that. Young people, because they are in that workplace, will be benefiting from that day to day. Yes, I think we can be confident in that.

**The Chairman:** We have heard quite a lot in previous sessions about the qualification regime not being adequate at the moment.

**Chris Jones:** I think there is a difference between the qualification regimes. An apprenticeship is by its nature fundamentally different from that of an A-level or a GCSE. Clearly, one of its benefits is that it is increasingly employer-led, but that framework can be adapted and changed to reflect, relatively quickly, the changing needs of industry or a particular type of job role or job skill.

If we look at a GCSE or an A-level, and one might say even a degree, for an A-level or a GCSE the amount of lead time to develop the curriculum, the amount of lead time to put that
curriculum into a school and to train the school to deliver to the curriculum and the degree to which that qualification will need to have regulatory approval means that you are then into a two-year delivery programme. Technology changes. Do you stop delivering the programme and adjust it for the new technology, or do you accept that you are going to complete a two-year educational programme and recognise that the technology has already moved on, so that cohort is qualified in the GCSE or A-level but technology has moved on?

That is why, in areas where we have high degrees of innovation, an apprenticeship model, whether intermediate or advanced, is absolutely right. The flexibility to meet the demand is far higher and I think it is a great opportunity for apprenticeships to take that lead.

**Q244 The Chairman:** You have talked about GCSEs and A-levels and you have talked about apprenticeships. You have not commented on the huge number of vocational qualifications that, for instance, a lot of FE colleges are turning people out with. You are saying that apprenticeships get a tick from your point of view. You have commented on the more academic end of the game, if you like. What about the stuff in the middle?

**Chris Jones:** There has been a high degree of reform already in the number of vocational qualifications available, but we also need to be clear about what we are looking to those qualifications to do. Many qualifications are vocational in their orientation, but one might say that they are still fundamentally part of an educational journey that may well lead you into higher education. They are not fundamentally focused on delivering an individual ready for the world of work. Then there are vocational qualifications that are not just simply about knowledge but about whether you can demonstrate that through the application of skill. There are subtleties, and when we talk about NVQs or vocational qualifications we are talking about a very broad spread of qualifications, many of which are simply designed to enhance knowledge and understanding and a number of which are focused on whether you can apply that skill at the level required in order to go into work. There are differences there, and those that are designed to support a pathway into higher education are fantastic if that is what the learner is looking to do.

**The Chairman:** Do people understand those? Do employers understand the qualifications? Do the young people themselves understand? Everybody broadly knows what they think a GCSE is, but where do people understand the subtlety that you are describing in the other qualifications?

**Chris Jones:** Research that we have done would suggest that employers do not understand the degree to which there is variability across that qualification framework.

**Martin Hottass:** Yes, I would agree with that. Not many SMEs will employ somebody like me whose job it is to understand that. You could have an applicant with a diploma in engineering who could be from a UTC, and it could be the old engineering diploma that was 14 to 16 or 16 to 18, but now we have also renamed our national certificates and higher national certificates into diplomas and advanced diplomas, so you could have two completely different kettles of fish with the same name. Most people would just look at it and be completely confused.

**Chris Jones:** One of the challenges here—and I come back to the qualifications and credit framework—is the right idea. How do you design a framework to enable a learner of any age to be able to enter into learning and to try to map out the sort of learning they want to be able to have? It is a great principle, but one of the downsides of the qualifications and credit
framework has been that in the last six years the number of awarding organisations has grown. Now there are probably close to about 145 awarding organisations. When I joined City & Guilds there were around about 101 awarding organisations, everything from large scale, GCSE, high stakes, to organisations like City & Guilds, right the way down to small niche providers. A lot of those have been able to enter a market, utilise the IP created by others and effectively offer a cheaper alternative, not always of the quality that is required. We have created a marketplace to enable an explosion of qualifications, which has led to a degree of confusion. I think it has led to a degree of variability in quality, and that is another challenge that we have to work with. People will recognise BTEC. They will recognise OCR or AQA and, yes, because we have been around for 137 years they recognise City & Guilds. There are a variety of others and they will say, “I do not know who that is or what it is. It is an NVQ. Oh, okay, it must be all right”. That opens up a lot of variability.

Q245 Lord Janvrin: I want to come back to a theme that has been coming out constantly. It is the flexibility in the apprenticeship area because it is employer-led and this being particularly useful in the rapidly changing, innovative, industrial world that we live in. How do we make sure that we engage employers in this process? In particular, talking about innovation, how do we engage the SME sector in the world of producing the apprenticeship framework and so on? What can government do in this area?

Sue Husband: Our role is to support SMEs to start with. We work with the Federation of Small Businesses and the British Chambers of Commerce to help facilitate that and help encourage their members to come in. We have seen some great examples of large businesses leading Trailblazers but encouraging SMEs to come in. For some SMEs, if they wanted to take part in a meeting to look at the standards, they might have to shut their business down for that day because there may only be one or two of them. Being very conscious of that, the big businesses have stepped up and offered support to enable SMEs to be involved.

We have an ambassadors network for apprentices, and that has helped because a key number of those are SMEs themselves. There are business people who can talk to other business people about their own experiences. We have found that one of the key triggers for a business to get involved in apprenticeships is to hear from another employer like them about the pros and cons and the challenges, thereby connecting up people who run SMEs with other businesses that have gone through that process. The National Apprenticeship Service offers a service to support businesses with advice and guidance and share case studies with them and so on.

Finally, there is a financial incentive. We have an incentive for small businesses in particular whereby we give them additional funding to take on board apprentices.

Lord Janvrin: Is there evidence that SMEs are getting more engaged?

Sue Husband: Yes, but I would say that there is more work to do. We definitely have more work to do because we know that is where we need to target now. There are so many big businesses on board. We need to crack the SMEs, but it takes time because it is a big decision for a business, especially a very small one, to take on just one apprentice, let alone a few.

Lord Janvrin: Are the financial incentives well known, do you think, or is that still work in progress?
Sue Husband: Again, like all things, you need to keep communicating. When you think that everybody knows what you are communicating, they probably have not even started to hear it. We need to keep communicating that and I think the ambassadors network will help us do that because it is a local thing for small businesses. The ambassadors are probably the key point for us.

Martin Hottass: It is a difficult subject. A lot of our local supply channels are SMEs and in our policy as a business we want our local supply chain to be first local and then as strong as possible. We extend our apprenticeship offering to our supply chain, and we have done this obviously with the blessing of the Skills Funding Agency and through a number of pilot programmes such as the Employer Ownership of Skills programme. That is a game changer, because an SME does not necessarily understand what best in class looks like, but if they do it with a known brand that helps.

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I would say that the grant, which is £1,500 that you can access only once for the first time, is probably one of the best kept secrets. That is not the Skills Funding Agency’s fault necessarily. If you run an SME, you deal with everything, because until you get to the critical mass where you can employ somebody to become an expert in something else, you are the FD, you are the CEO, you are the HR person. The last thing on your mind is how to get £1,500 out of the Skills Funding Agency, which is not easy by the way.

Sue Husband: Yes, £1,500 is a lot of money for a small business, but that is not why they do it. I think that comes through time and time again when we talk to our ambassadors. The small businesses that take on apprentices do it for absolutely the right reason: because they believe it is the right thing for their business. I do not think that £1,500 would necessarily convince somebody who was not going to do it anyway for the right reasons.

Q246 Lord Aberdare: You have very much begun to tackle this question, which Lord Janvrin asked as a follow-up, which is: is it working? Let me drill that down a bit more. It seems to me that there are a lot of good things in place and it is working where there are big companies that can partner with small companies. I am not sure that we are getting to the sort of magnitude that we will need in SMEs employing apprentices. I am thinking particularly of certain sectors that are dominated by small firms like creative and media, or hospitality. It seems to me that maybe some specific mechanisms are needed to tackle those, whether it is the ATAs, the GTAs, or those kinds of things. Are you focusing as well on some specific mechanisms so that we get the volume across the SME piece?

Sue Husband: I am very glad you picked up on the creative industries, because that is something that Minister Boles had asked us to look at very recently. I think there is some side work going on with particular industries where we know that they are predominantly run by SMEs. There are particular projects going on to look at specifics and the creative industries are one of those at the moment.

Chris Jones: SMEs make up about 54% of all apprenticeships, so they are doing a pretty good job. The real heavy lifting needs to come from the big companies. Siemens is a great example, but the failure here is arguably larger-sized multinationals engaging and supporting their industries and their sectors. I think that SMEs on their own are probably doing quite a bit of the heavy lifting.

Lord Lucas: I am frankly optimistic about FE colleges. I saw a very nice example in South Shields where the local FE college had teamed up with Ford Aerospace, which is a local SME,
and had produced an apprenticeship scheme that was then shared with other local SMEs. That focused on the strengths that the FE college could bring to this in their breadth. Is this something that could be done more generally to support SMEs?

**Chris Jones**: I think it is happening. There are lots of examples where FE colleges are partnering incredibly well. Preston’s College partners brilliantly with BAE. Martin will cite the colleges that partner there. The benefit typically seems to be when you have the blend of a college that is forward thinking and has a very clear employer engagement strategy and a large employer who can support the college in the delivery. It is not easy for another college in a more rural area to probably deliver what it might be that that college can do with Ford.

**Lord Lucas**: It is Ford Aerospace. It is a little company, an SME.

**Martin Hottass**: I happen to know this example very well because I am part of the skills group in the north-east. It came through the Engineering Employers’ Federation. Where there are mechanisms to get employers together and engage there is a real appetite, and I see that across the country. It helps to have a lead employer, a strong brand name, for a number of reasons. We typically train at a much higher level than the apprenticeship framework requires, simply because our business is more complex. That means that if you send your apprentice alongside mine, they get a much higher level of education. They also get a different experience because typically all my training is done in a bespoke class. That works in ATAS and GTAs as well, by the way. It is a horses for courses argument.

The ultimate thing is also that you attract better candidates, because the biggest problem for an SME is that they do not have a brand name. When you look at my stats on the National Apprenticeship Service website, we attract 6,000 applications a year for 150 to 160 jobs. That is difficult to get in, but when you then look at, let us say, a tier-2 supplier with 10 employees, they probably only get three or four. I think that is the area where we have some challenges. We are trying to work with the Skills Funding Agency and NAS to allow us to share data of candidates who have not been successful at Siemens, for whatever reason, with our supply chain, but that gives you data protection issues and obviously you are duty bound to not do it.

In a way that is a lost opportunity, because we write to every person who has made it through to interview but unfortunately has not been successful, and we say to them, “Would you give us permission to pass your CV on?” There could be a better brokerage service.

**Q247 Lord Giddens**: We are very concerned as a Committee about the huge gender divide that exists around digital technology and computer science in particular. Only a tiny proportion of girls take computer science to any sort of level, at A-level or university. What kinds of strategies should we be advocating to try to handle this issue, because it is obviously very deep-rooted? Chris, you mentioned parents right at the beginning. I presume parents will have a significant role in this, but it seems a very deeply embedded issue. Anything you have to offer through the educational system or whatever that would help the Committee with this would be very useful, I think.

**Martin Hottass**: We struggle with this as a corporation. We know that 54% of the population is female and we do not have anything like that figure in engineering. We try to get round the unconscious bias in case studies. For example, when you look at our apprenticeship literature or graduate literature, you have a lady wearing hi-vis and a hard hat. For a man, that looks like, “Yes, it is safe and this lady is very attractive. Fantastic”. According to my
partner, what it signals to a lady is, “Oh, I have to wear a hard hat all the time”. This is obviously done with the best intentions, and when you are on site you have to wear a hard hat, which I think everybody accepts, but I think a much better way might be to show that even in engineering, if you work at a certain level in the organisation probably 80% of your time is spent doing something completely different.

We should showcase people in their place of work and show the variety of the career. When it comes to role models, as I said, rather than using a car as an example, which is clearly geared towards boys, we should maybe use something that is a lot more accessible for ladies and that makes it more attractive.

*Sue Husband:* I think Martin needs to come and meet some of the ladies I work with.

*Martin Hottass:* I have met some.

*Sue Husband:* I think it is about role models, in all seriousness, and as an agency we do that when we give awards to young people. I met some great ones the other day in the south-east awards, very strong young women who are going into schools. Their businesses are using them and I think that is happening more and more now. Businesses see that there is half their talent pool that they are not accessing, to put it simply. They are using female role models to take into schools and speak to young girls and boys about the career that they are following. That is the big thing, but there are also things like programmes on TV. I watched the Crossrail documentary recently and there were some female engineers on there. It is interesting and it surprises people, so I think we just have to be conscious about where we use those role models and what opportunities we have as a nation to do more there.

*Baroness O’Cathain:* An awful lot more women are now going to take engineering courses. Among my chattering-class scene, my own goddaughter is in Girton in her third year of engineering. It is terrific. She is very enthusiastic about it and she is talking about the great opportunities that this course has given her. Particularly being a woman, she will shine, yes.

*Sue Husband:* Yes.

*Lord Lucas:* I was just fascinated by what Martin Hottass said about the gender signalling that is going on. I saw a wonderful example of it yesterday with someone giving a presentation about engineering in the food industry. It was only about the boys’ aspects and right at the end he said, “And we get to talk to some real people about how they use our product and feed that back into the engineering”. I am sure they are all the way through our education system, these little signals. How do we start to address that?

*Martin Hottass:* When we started our journey to create our education portal, which is, as I said, free for anybody, we stumbled across that by accident. This is fascinating. All our literature up to a certain point always reinforces that bias, but it is simply because of the author and their perception of reality. Once you get your head around that, then we have changed things. Our healthcare module, which is for primary schools, basically shows a skeleton. You can play around with it and it makes all kinds of funny noises and things, but it is completely gender neutral and it does not stereotype. I think you will find in most educational publications that there is an unconscious bias.

*Chris Jones:* I think it is interesting. We have a programme that we run called Apprentice Connect, where City & Guilds’ own apprentices go out into schools to talk about apprenticeships. They do that for 14 to 16 year-olds. In the last two schools they have been to, the teachers said when they have introduced it, “Okay, boys, now pay attention. This is
for you”. It comes back again to this broader point: how do we ensure that the people who are most influential are not consistently reinforcing the dominant logic? That dominant logic, though, plays out across society in general. Why are most primary school teachers women? Why are most people who go into the care profession women?

When you sit and talk to those industries, they are looking for and desperately keen to get more gender balance. Role models and celebrating the success of individuals in industries that are seen either as predominantly male or predominantly women are part of what we have to do, but it comes back to careers education. Women/girls have to realise that engineering is not about boiler suits and oil. ICT is not about being geeky and late nights and eating pizza and beer, writing some code.

The Chairman: It is for some people.

Chris Jones: It is for some people, yes, that is true. There is a broad diversity and we need to be able to support them and understand why they can make a real contribution. The good thing is that if you take America, Facebook and Yahoo both have female chief executives or chief operating officers. The chairman of Capgemini here in the UK is Christine Hodgson. We need more people who can be role models and inspirational.

Q248 Lord Haskel: This is about inclusion, about society. We have been told that the changes to technology will increase inequality, in no small part because of the lack of awareness of what is going on in the digital world. How can digital technology be used to reduce inequality?

Martin Hottass: The advantage of digital technology is obviously that it is relatively inexpensive. When you look at how schools are equipped with ICT equipment these days, even primary schools, if you use it responsibly I think you will give people more opportunities. It only becomes prohibitive if you make it a club and charge a fee. Obviously ours is free for that reason. The European community initiative I alluded to earlier with these massive open access courses is designed to do that. I think that could overcome barriers quite effectively.

Sue Husband: I would agree. I think it is an exciting time. It gives us the opportunity to make learning more accessible, more engaging and probably personalised, particularly for harderto-reach audiences. We have seen that with online literacy and numeracy learning. For people who struggled in a classroom and could not face going into a library or somewhere like that to learn, doing it in the privacy of their own home has allowed them to learn at their own pace in their own way. I see it as a positive thing that can open up learning to more.

Chris Jones: May I offer a slightly contrary view? I worry that as we see businesses and government moving more towards using technology, there is a danger that those who cannot access it easily are going to be further marginalised. I was down in Cornwall quite recently visiting Ginsters, the pie people—very good it was, too—and they talked quite a lot about the challenges they face with the LEP and Cornwall College in supporting what is fundamentally quite a challenging environment. It is very rural. It is very hard to connect people, and surprisingly the access to technology is nowhere near where it needs to be. They were genuinely concerned that not only young people but people of all ages would find it harder to engage with society and with work because they could not access or be able to go somewhere to access technology. That was a real concern for them in that particular part of
the world. Yes, it does provide a huge amount of benefits. Equally, I think it could have a
negative impact. It could marginalise people even more than it has done to date.

**Lord Haskel:** Do you think we should be making a special effort to make people aware of this, or should we be making special efforts to try to overcome this?

**Chris Jones:** Absolutely. I live in a village in Oxfordshire. Some of our local community used to be able to access computers in a room associated with the church. That is no longer there because they could not fund it any more. The library has shut. The mobile library does not have any technology associated with it. People who used to go to the library to access a computer cannot do that any more and we cannot assume that they will be able to access technology through their iPhone or their iPad, because despite living in the Prime Minister’s community we do not have a very good broadband service.

**Lord MacDonald of Tradeston:** Could the school not replace the library?

**Chris Jones:** I think that is a very interesting idea. Absolutely it could do.

Q249 **The Chairman:** I am going to move us on to the final question, which we are asking of all our witnesses who have been in front of us. We would like you to come up with one key suggestion. I know that is always difficult. We are going to make recommendations to government. We want you to focus, if you would, on what your top priority would be for change that we should recommend in order to improve UK competitiveness in the digital world. How would you make that happen and how can we afford it? Easy, really.

**Sue Husband:** You get what you pay for, in the sense that we would fund whatever the priorities are through local enterprise partnerships, seeing where the skills need is and putting the funding to address where the real need is, and so paying for what the economy needs.

**The Chairman:** Priorities?

**Sue Husband:** Yes.

**Martin Hottass:** I would welcome the opportunity to tailor learning more to how the learner wants to learn. That sounds like a woolly answer, so let me explain. I learnt through books, as I assume all of you did, and the blackboard. A young learner these days learns through the iPhone or through social media. If we can use those channels to disseminate knowledge and engender appetite, that would be inexpensive because it is obviously an open-access platform. It would also give people knowledge they do not have and obviously better knowledge of careers. That would be the bit that I would incentivise.

**Chris Jones:** I suppose I come at it from a slightly different perspective. There have been 61 Secretaries of State in the last 30 years responsible for skills. I would call for stability and I would call for greater independence of the skills policy from government.

**The Chairman:** Thank you. That is a very good statistic on which to finish. Thank you very much indeed. That was a very good session. Thank you.
Introduction

1. The City is a global hub for international finance and business services which depend on the provision of high quality digital infrastructure. More widely, the business activity in the City provides the market drivers for many of the firms which have chosen to locate in ‘TechCity’, which touches the edge of the Square Mile. It is vital therefore, that the digital infrastructure which supports these services in the Square Mile is world class and future-proofed.

2. The following paragraphs set out the main challenges to growth of the digital economy, as the City Corporation sees them.

Broadband

3. The City is home to many businesses that rely heavily on technology, from large corporate companies with trading operations, to small technology companies developing cutting-edge systems and products, used by the financial sector and others. Access to affordable, reliable, high-speed broadband is therefore essential. Significant gaps in digital infrastructure in the City remain, however, putting some businesses at a serious disadvantage.

4. There is deep concern that the attractiveness of the City is increasingly disadvantaged by the lack of fast broadband connectivity at an affordable level. Leased lines are prohibitively expensive for many small companies, leaving them struggling on copper ADSL lines with slow speeds and unreliable connectivity (over 9,000 businesses run on relatively slow ADSL copper broadband). There are as yet no firm plans to roll out the infrastructure necessary for providing SMEs or residents with affordable superfast broadband. City Corporation officials have held several meetings with providers at senior levels over the past few months but only limited progress has been made. In the long run, this stance could damage the offer that London’s position as a leading edge global city and could have an immediate, deleterious effect on high tech SMEs which operate in and around the Square Mile.

5. The Government’s Connectivity Vouchers Scheme has been launched in 22 cities, to help SMEs access faster and better broadband. The City Corporation has so far had approximately 120 applications for vouchers. Consideration should be given to extending the scheme beyond March 2015 for, say, 6-12 months, now that SMEs are starting to have greater awareness of it, and relationships between suppliers and boroughs are strengthening. It would be a lost opportunity not to capitalise on the momentum now being created.

6. The City provides a free Wi-Fi network covering approximately 85% of the Square Mile’s public areas. In July 2014, over 200,000 enabled-devices connected to the network. Usage is increasing by 11% per month at present, illustrating the importance of free Wi-Fi to workers, residents and visitors to the City.

7. Over the next few years, a greater number of operations will be transferred to ‘the cloud’ (voice, data, TV broadcasting). Both wired and wireless infrastructure is, therefore, absolutely crucial. The poor speeds in the City mean that SMEs that already rely on the cloud
have encountered difficulties in gaining the level of access required for business operations. The City Corporation is trying to bring about easier and quicker access to buildings to accommodate 4G and eventually 5G antennae, in line with the Mayor’s plans for 5G in London by 2020. Although the pace of this is fairly rapid, and probably on a par with that of other global centres, if this is not done correctly, there could be further negative impacts to connectivity in the City.

Office Accommodation

8. Many start-ups and businesses with high growth potential find it difficult to sign up to long-term leases for e.g. serviced offices. One flexible solution, at the early stages, is co-working spaces, such as the Innovation Warehouse at Smithfield, which the City Corporation helped found. A recent study conducted for the London Enterprise Panel of co-working spaces in London also points to the wider benefits of developing such spaces for knowledge-intensive businesses.

Access to Finance

9. Access to finance – especially at the growth stage – is a major issue in the UK. There are signs that early-stage growth finance is becoming more plentiful (e.g. through business angel investors, an area the City Corporation supports and champions through its Angels in the City initiative). Notwithstanding the increased efforts of the British Business Bank and the founding of the High Growth Segment of the London Stock Exchange, there remains a dearth of follow-on funding. Indeed, there is anecdotal evidence of growing businesses securing so-called ‘Series A’ funding (the first injection of venture capital) elsewhere, typically in the US.

Skills

10. There is concern amongst City firms over the lack of digital skills of prospective workers with estimates of a minimum 745,000 additional workers with digital skills over the 2013-2017 period. Businesses need some comfort that the skills system – including apprenticeships – will provide the skills to meet this gap. Strengthening education and business links is one way of facilitating closer involvement of businesses in the delivery of the curriculum. For example, the City Corporation is involved in the Tower Hamlets Education Business Partnership and Inspire! – the Education Business Partnership for Hackney, helping to set up the latter alongside UBS and other City businesses. Both enjoy good relationships with businesses and schools.

11. The City Corporation is lead sponsor of Tech London Advocates, an 800-strong network of individuals in London’s tech sector. Through a working group on education, they are able to establish what tech businesses can offer and, through existing intermediaries such as education business partnerships or organisations such as Founders for Schools, they can then help teachers to enable students to develop relevant skills.

12. By also working with higher education institutions, businesses can help their workforces keep skills up to date. Innovate/Finance, for instance, a new industry organisation for the ‘FinTech’ (financial technology) sector, of which the City Corporation is lead sponsor, is

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111 The Future Digital Skills Needs of the UK Economy, O2/Development Economics (September 2013)
developing a partnership with the Open University to deliver training specific to the needs of the FinTech sector – a fast-developing sub-sector of tech.

13. There is potential for more to be done to link businesses, and their close understanding of current and future skills needs, to schools and other education and training providers. The City Corporation already supports a number of initiatives in doing this:

- ‘TeenTech’ brings together more than 500 young people in a focused, interactive event showcasing careers using STEM subjects (science, technology, engineering and maths).
- The Centre for London’s ‘Connecting Tech City’ programme, which is building an online platform to link young people in London’s core ‘TechCity’ area on the City’s fringes with businesses keen to engage with them in some way through e.g. supporting the curriculum, hosting work placements, or talking to groups of students.
- Hosting a STEM-focused careers fair in summer 2014, giving in the region of 500 young people the opportunity to interact with businesses requiring STEM skills and exposing them to volunteers representing more than 100 career opportunities in these areas.

14. While, in the longer term, the new computing curriculum should help to ensure programming and coding assume a central position in education, there are already a number of initiatives which usefully introduce young people to coding. One such initiative, focused on young women, is ‘Code First: Girls’, delivered by graduate accelerator programme ‘Entrepreneur First’ (of which the City Corporation is a core sponsor) to help young women from non-technical backgrounds develop the coding skills needed to compete more effectively for a place on the main Entrepreneur First programme.

10 September 2014
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

TUESDAY 29 JULY 2014

Members present

Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Baroness Garden of Frognal
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Macdonald of Tradeston
Baroness O’Cathain

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Examination of Witnesses

Guy Levin, Executive Director, Coalition for a Digital Economy, David Pollard, Chairman for Education, Skills and Business Support, Federation of Small Businesses, and Antony Walker, Deputy Chief Executive Officer, techUK

The Chairman: Thank you very much indeed for joining us this morning. You have a list of interests that have been declared by the Committee members in front of you. They were declared orally by members at the previous sessions on 8 and 22 July and they can be found in the transcripts. This is a formal evidence-taking session of the Committee and a full note will be taken. This will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you will be able to revise any minor errors. This session is on the record. It is being webcast live and will be subsequently accessible via the parliamentary website. You are welcome to submit written supplementary evidence after the session. If there is anything else you want to add or clarify, that is great. Witnesses and Members are reminded to speak up. I think the acoustics are quite good in this room, so it is not a bad one but speaking up always helps.
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

I suggest first that I ask each of you to introduce yourselves and if you want to make any short opening remarks you are welcome to do so. If you do not want to, we will go straight into the questions. It is entirely up to you.

**Antony Walker**: Good morning. My name is Antony Walker. I am representing techUK. techUK is a trade association representing about 850 companies right across the digital technology space. It is a mix of small, medium, large, domestic and foreign owned, all of them pretty much at the cutting edge of digital technology. Collectively, they employ 500,000 people here in the UK. Skills are an absolute top priority for all those companies. Many of them have active programmes where they try to contribute to the skills base in the UK. Several of them are running apprenticeship schemes, which we may talk about later, and most of them are involved in the new skills tech partnership that has recently been announced. techUK is on the board of e-skills. We are closely involved in the Information Economy Council and we are on the board of the independent Digital Skills Taskforce, which produced its interim report this week.

**David Pollard**: David Pollard. I am a member of the Federation of Small Businesses, which is a member-led organisation, and I chair their policy group on education, skills and business support. We have about 200,000-odd members who are micro and small businesses. Our spectrum of membership covers the whole gamut of the British economy, everything from the seaside cafe or the gift shop at a tourist spot to university professors running consultancy businesses, people in IT and high-tech manufacturing, and quite a number of farmers and small construction companies—the whole spectrum.

**Guy Levin**: I am Guy Levin. I am the executive director of Coadec, the Coalition for a Digital Economy. We are a non-profit organisation that campaigns for policies to support digital start-ups in the UK, so we are at the smaller end of the spectrum, and our members not small businesses but start-ups specifically, so they are companies that have high growth potential.

**Q53 The Chairman**: Great, thank you very much indeed. Can we start with a pretty general question? Can you describe for us which technology trends you think will have the highest impact on UK businesses and how? Just give us a flavour of the breadth and size of the change and what you think the impacts of that will be.

**Antony Walker**: The first thing I would do is quote Tim Berners-Lee, “The future is still so much bigger than the past”. An important point to make is that we are still at the very beginnings of this digital revolution and there is a huge amount to play for in opportunities for jobs, growth and productivity improvements across UK firms. We are at the start of something. I think sometimes there is a sense that it has all been invented, it has all been created, but that is absolutely not the case.

In terms of the big trends, I would highlight e-commerce, mobility and cloud, data and analytics, the Internet of Things, machine-to-machine learning, automation and, importantly, security and privacy as areas of real importance. I can explain each of those more, but those are the technologies that the companies we work with daily are thinking about in how they drive their own businesses and how they develop products and services that can drive other businesses, such as the members of the Federation of Small Businesses.

**David Pollard**: I asked this question of my two sons on Sunday because they are both computer scientists.
The Chairman: They will be well placed, then.

David Pollard: Their first response was, “What is the timeframe?”, because what is going to be big in the next five years will be totally different probably to what is going to be big beyond that. I think the two gentlemen either side of me will give you a lot more detail on the technical side of it. From my perspective, cloud is a very useful and important thing. I am a one man band these days and I do a lot of my work and all my back-ups and everything through cloud systems. I keep records of all my work doing that. That is a big tool for small businesses. Anywhere they can get access to the internet they can use cloud-based tools to access digital technology that is exactly the same as that of a large company. That is one big impact.

Another is that mobile is going to have a big impact on an awful lot of businesses over the next five years and beyond. We have seen the way people use the internet to do a lot of their online shopping, and that tends to be a fairly structured, planned sort of thing, “I need some more bits and pieces for my IT set-up. I will go online and search where I can get the best price”. You take your time over it. “I want a good holiday but I want a cheap holiday”, and you spend days researching where the best place is and so on. Mobile has the potential to make it a very local and reactive sort of thing. You can be out in town and meet a few friends and say, “Why do we not all go out and have a meal? Where are we going to go? Oh, it is a bit of a hot day. There will be a lot of people out there trying to get into pubs”. You can check on a mobile device and find a restaurant that you like that has space for six of you, book a table, get in and turn up, where 20 minutes before you were not even thinking of going for a meal. It has that ability to provide an awful lot of very immediate response to things.

The Chairman: Before I come to Mr Levin, can I ask you a supplementary on that? You described what you do yourself, so cloud is really important to you. How did you learn and access that and how do your members do so? How do small businesses know what the useful tools are for them going forward? Where do they get access to it? How do they get training in it?

David Pollard: I think that is a key issue. In my case, I am a technical guy by background. My original degree was aeronautical engineering and management. That was taken a long time ago, but I got into it. I had a little involvement with programmable calculators and what have you. I had to learn a lot about the electronics and mathematics that underpin computing. Then when I did my MBA at Cranfield, the digital economy was coming—it was seen even then, back in 1978-79—so one of the things we had to start learning was programming. I started to learn to program in Basic on a Commodore, first on a terminal on a mainframe and then on a Commodore PET. Shortly after that, I worked for Plessey as a corporate planner and the Apple II turned up with VisiCalc. When I first saw VisiCalc it was absolutely magic: you could put all the numbers in and it would add them up, calculate the percentages and do all those things. We take it for granted now. You do your expense forms that way, but we were doing business planning with that. When I went to running small businesses, I started—

The Chairman: This is you. You are a technical man and it clearly comes to you naturally. You are inquisitive, that is what you do, but there are a fair number of people running businesses who are not like you. In fact, there are many people running businesses who are not like
you. How do they get the skills, in your experience, talking to your membership? What lessons are there about making sure that they have access to those?

David Pollard: Speaking about what I have seen in action in Hampshire, for instance, when the internet started to take off for businesses of all sorts of sizes, I went to some events about using the internet. There were a lot of people from small businesses there. The event was run by a guy who has become quite a good friend of mine, who was paid by local councils to run these events. They used to take over space in council offices for large presentations. He could talk to 30 or 40 people and do a presentation and take them through what a website was and how you put it together.

The Chairman: So that was local authority-directed?

David Pollard: They were taking a lot of the initiative in that area and getting people in as part of their support to local businesses. He was giving them an understanding of what it was and making the difference between the technical side of it and the marketing.

The Chairman: Does that still happen, in your experience?

David Pollard: No, I do not see much of it these days.

The Chairman: Okay. Thank you. Mr Levin?

Guy Levin: I would first highlight the huge pace of change. It was only seven years ago when the first iPhone came out, basically inventing a whole new platform for things. The app economy did not exist until 2008 when the next update came out. Over recent years, digital barriers to entry have plummeted. If you wanted to run a digital business or a web-based business 10 years ago, you needed rooms full of servers and incredibly expensive equipment and skilled people costing tens of thousands of pounds, if not hundreds of thousands of pounds. Now you can do that for free, pretty much, as a new starter. That has been an incredibly powerful trend that has meant that a huge number of new innovative technologies have sprung up.

With the emergence of new platforms and the sharing economy, barriers to entry have fallen not just for the digital start-ups, the sort of firms I represent, but for consumers and individuals. Putting the sharing economy to one side, platforms like Shopify or Etsy mean that you as an individual could set up an online shop-front to sell your wares for free tomorrow in very little time. There has been a democratisation of technology and I think it is a powerful trend that will continue. It is part of what Marc Andreessen, the VC, termed software eating the world. In recent decades we have seen Netflix beating Blockbuster and Spotify and iTunes beating HMV. There is a shift of things moving on to software, and that lowers barriers to entry and makes things more open and democratic.

I think Antony was right to pick up on greater connectivity and the proliferation of smartphones in the UK and across the world, and that is only going to continue as we get greater connectivity with the Internet of Things and the rise of wearables. I do not want to predict the future, but it is easy to conceive of the number of connected devices soaring in the coming years.

Q54 The Chairman: We will come to this in some of our later questions, but how do we make sure that that does not become used by a relatively small part of the population and that a larger part of the population are left behind even more than arguably they are now?
Guy Levin: I think partly market forces will help do that.

The Chairman: I think that is a bit optimistic, if you do not mind me saying so.

Guy Levin: What I mean by that is that using a computer today is infinitely easier than it was when you had to use a mainframe terminal. Most good start-ups and most good larger tech companies put a huge amount of effort into user experience and design to make things as simple and easy as possible. I know there are still challenges and that digital skills are incredibly important—that is why we are here—but I am reasonably optimistic that this is going to get better, not worse.

Antony Walker: I support Guy on that, because I think he is absolutely right. We are seeing this massive democratisation and all the pressures of the market are to reach as many customers as possible. The challenge is not going to be that a majority is left behind. It is going to be a minority, and there are very serious issues there that we do need to come to, but I think most people will be included.

Your question does draw out one very important point in relation to SMEs in particular. We know that at least half of UK SMEs do not have a website and that only 17% of SMEs transact online. There is a big issue, which you very rightly draw upon, which is one of awareness for a lot of small companies. That should be a major area of concern, because there are huge opportunities to digitise and therefore drive the productivity of those small companies.

Baroness O’Cathain: That is all very interesting. I am sure we could spend all day talking about that. Can I make a point following the last minor discussion? All of you are in senior positions and you need to know what the future looks like, and none of us can predict that. Do you spend enough time thinking about the minorities? It is very glib to say that it is a decreasing minority who will not be involved in computers. How do we know that? What sort of research do we have? All the information that I seem to hear and read, both from the chattering classes and the stuff that I read, is that people get to a certain age or stage, maybe 60, maybe early retirement, and they are getting more and more isolated because of all the new things. Mr Levin, you have just painted a fantastic, buzzing future and fireworks in the sky and all the rest of it, but the fact remains that more and more of these people are going to become more and more dependent on the state or on people to look after them. How can they get involved in this?

There seems to be a huge gulf between young people and the people who are, I do not know, maybe 40% of the population, or maybe you are dealing with 60% of the population. Have you any idea what the divide is? I do not. We are always talking about the digital divide, and I think it is important that we have this in our minds because, do not forget, we are looking at the whole digital situation, not just at competitiveness but at people’s ability, the infrastructure, and all that comes into it.

Antony Walker: Go ON UK is a body that brings together industry and government to look at these precise issues.

The Chairman: Yes, we are taking evidence from them.

Antony Walker: Lots of our members are active in that. They produced a very good report recently setting out a strategy for how you address the digital inclusion issue. There are real concerns about the extent to which broadly 10% of the population can really be included. There is a strong correlation. They tend to be people who are socially excluded anyway, so they are hard to reach by any means. There is a proportion of the elderly who have no real
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

experience of the technology. There is also a strong correlation with levels of education. You need to think about all those three things: social exclusion, education and age groups that have been isolated from the digital revolution. Go ON UK, together with the Tinder Foundation, has put together a very good potential road map for how you address that and they have also costed that. I think it was about £875 million to get everybody to a basic level of digital skills by 2020. My concern at the moment is that there are absolutely none of those resources available. We have great plans in place, but what we have not had is significant funding.

The Chairman: That is really helpful. I am going to stop you there because we have them coming to give evidence. It is good news because we have the right people coming.

Baroness O’Cathain: It is, yes. That is right.

The Chairman: Do you want to go on to your other question?

Q55 Baroness O’Cathain: Yes. My real question was: how is the scale-up of medium-sized enterprises best achieved? You have all these great people firing on all cylinders and then they come to the block in SMEs. How much do they have to invest? Who is going to help them through it? Who is going to suggest that they look at cloud even more than they are at the moment and have it explained to them?

The Chairman: It is absolutely crucial, is it not? Who wants to start? Mr Pollard.

David Pollard: That is a massive agenda to try to address. There are so many different factors in there. If you have small businesses and they begin to grow, how do you keep them growing? There is the old story of crossing the chasm, going from being a niche provider into behaving like a major company and being able to sell and market to a much broader audience. An awful lot of that, of course, is about marketing and selling skills, but then there is the technology as well.

We have a problem, which is a subset for business owners of the one you mentioned earlier, which is that an awful lot of people do not have the basic educational qualifications for the modern world. We have an education system that is geared to producing an elite who will go to university. We now live in an economy where everybody has to have a fairly reasonable level of literacy, numeracy, personal skills, and so on. If our education system is not geared to getting everybody to that level so that they have the basic competencies for the 21st century, we are always going to have this big chunk of people who will not be able to participate in the digital economy.

Trying to address the problem of the over-60s who have not been on the internet is difficult. There will be some you will never get on to the internet. On the other hand, there are an awful lot who, once you start to get them involved, take to it like a duck to water. One of the big things that seems to be getting a lot of 60-plus people into the internet is grandchildren. All of a sudden the grandchildren are in Australia and we do not get to see them very often, but with FaceTime on an iPad you can chat to them and see them at the same time. That is an incentive for somebody to pick up that technology.

We have to try to find other issues like that that we can present to businesses, which give them the understanding that, “Yes, I have seen that. That is fantastic. I have to start putting that into my business”.

319
The Chairman: With your Federation of Small Businesses hat on, are the Government doing enough to help small businesses overcome the barriers at the moment? You said earlier that you knew that local authorities used to do some stuff that they are probably not doing now. Are you aware of that? Do you want to send a supplementary note on it? One of the things we are keen to do is make recommendations to government about supporting those things.

David Pollard: I think that government programmes always go for the sexy, high-profile ones like finding the companies that are going to grow by 20% or 30% per annum and trying to get them to grow or finding the ones that are driven by other political initiatives. What we do not have is local ones saying, “What are the local problems? What is going to make a quick benefit locally? What can we do?” The LEPs are beginning to get more involved in skills and business support, and they are the natural people to work with their local authorities and put together programmes of this nature that can help businesses pick up those things.

Antony Walker: It is useful to draw some distinctions here between different types of companies. We have talked about start-ups, SMEs and scale-ups. They are all fundamentally different groups. Start-ups tend to be born digital. As Guy very correctly said, they are the individuals who are using all these amazing tools, a lot of which are now available free, to create whole new businesses, scale-up from scratch and be able to quickly trade and work online to collaborate and bring people together. There are 340,000 new start-ups already this year, according to StartUp Britain. All that change is being enabled by digital technologies, so I think that is a huge tick for the growth and jobs agenda for the UK driven by technology.

The SMEs are a much more mixed picture. Some get it and are harnessing technology well, but a huge amount are not. Here I think the problem is primarily one of awareness. The first steps of getting on the ladder of being digital are not particularly difficult and the skills are available for getting a web presence, starting to transact online, and so on. A good example is a company called Annie Barr Associates, which we work with, which is based in rural Northumberland. It has five employees. They had a website but it was not generating much business for them. It trains healthcare and social care professionals across the UK and internationally. They said, “What can we do about it?” They talked to a local web developer in the town a few miles away who said, “You need to look at your search engine optimisation”. “Oh, what is that? We did not know about that”. He helped them with that and he also said, “These are a few things that you need to do to help raise your profile up the search engine rankings. You need to start blogging a little, tweeting and so on”. They spent about £10,000 on upgrading their website and implementing SEO, as it is called—search engine optimisation. They started to change their behaviour. In a year, they have doubled their revenues simply by having a much greater web profile. It was simple and easy; the skills were available and the local people were available to support them. All they needed was that awareness. I think we need to focus on the awareness issue for SMEs.

The Chairman: Just to pin you down, because that is a really helpful example, how did they know who to go to get that initial advice?

Antony Walker: They talked to their business cohort. They talked to people like us and others and asked, “What should we be doing differently?”. They used their network. Again, it comes back to the powers in this technology because, as Guy will attest to, we are now seeing these clusters and networks appearing all over the UK. That is a fantastic self-learning mechanism for businesses, but there is a massive job to do here; do not underestimate it. If
we can digitise the other 50% of SMEs, we can drive the productivity of the UK economy, and that leads to a real increase in the standard of living for us all. It is a massive prize.

The other issue is scale-ups. I wanted to come back to that because this is where we think there is a huge opportunity. Almost all net new job creation in Europe in the last 10 years has come from high-growth companies. These are the companies that can contribute most to the economy in a short period and yet, while we have focused on start-ups and SMEs, we have not really focused on what it takes to get more scale-up companies to scale but also to get them to stay in the UK and not move to the US or other markets. We are working with the Information Economy Council at the moment on a project led by Sherry Coutu, who has a venture capital background, and we are expecting to publish a high-profile report in the autumn that I think will come forward with some very good and strong recommendations. I will not go into all of those now. We will come back to you on that.

The Chairman: Great. Make sure you send us that, please.

Antony Walker: We absolutely will.

The Chairman: That will still be within our timescale, so that is very useful.

Guy Levin: I completely endorse everything Antony has just said. It is important when thinking about digital skills to segment the population and talk about what sort of skills and people you are talking about—the digital inclusion issues that we touched upon earlier. I think that basic digital literacy for everybody is very important. I quite liked the segmentation that was in the Maggie Philbin report out last week: the digital muggles, people who are excluded; digital citizens, the basic level of digital literacy; digital workers, who have slightly more advanced skills; and digital makers, who have the advanced technical skills. From my point of view, from Coadec’s point of view, it is mainly that last category, the digital makers, who we are most concerned about, because they are the high-tech, highly skilled employees who our start-ups need to grow into scale.

I completely agree that there are massive inclusion issues at the higher levels and that they are important for start-ups and organisations like ours. The more digitally savvy consumers and the more digital businesses there are, the better for everyone. They all depend on network effects and larger markets.

Q56 Lord Aberdare: I wanted to focus specifically on one barrier, which I notice was mentioned in the FSB written submission. Antony Walker also referred to it, and that was cybercrime. There were some quite remarkable statistics about the number of small businesses that are suffering from fraud and cybercrime. I suppose the question is: what might we do about it? What are the sorts of actions that we might be able to recommend as a group to help minimise cybercrime as a barrier to the otherwise glorious uplands of digital success?

Antony Walker: You are absolutely right to raise this. It is a crucial issue. If you want to be a world-leading tech economy you have to be two things: the most connected economy and the most secure economy. Those two things should be high in everybody’s mind. We think a lot about broadband; we should probably think as much about how we make sure that we minimise opportunities for cybercrime, keep our businesses, consumers and citizens safe and secure online, and ensure that they have full trust in services.
Awareness is a critical issue for many businesses. Far too many companies are simply not aware of the relatively simple steps that they can take to protect themselves. I think there is more that government, working with industry, could do to try to address those issues. There is some work being done but I do not think it is enough. That is what a lot of our members would say. An area of considerable concern is how we raise awareness about cybercrime issues. A lot can be done relatively simply. It is just a matter of awareness and education.

However, there is more that the technology industry can do itself to design out opportunities for cybercrime. We are engaged in the Cybercrime Reduction Partnership, which is looking at exactly that issue: how do you minimise opportunities? A simple one, for example, is iPhone thefts. The fact that you can now remotely kill your iPhone is reducing the amount of street crime in relation to iPhones. It is things like that. It is identifying where there is an opportunity for a crime to exist and then thinking about how you improve the technology to take away that opportunity. Then at the high-risk, high-threat end there is all the work that we need to do to ensure that our national critical infrastructure is secure and that the UK as a whole is cybersecure. UK industry is at the forefront of working on some of those issues as well.

The Chairman: When you talked about government, presumably you were talking about BIS as the lead department, were you?

Antony Walker: Yes, particularly in terms of SMEs. In other areas we work with different parts of government, but business awareness is a BIS issue.

Q57 Lord Macdonald of Tradeston: How do you come up with the figures? I think there is mention of £4,000 per business being lost. Is one of the problems here that businesses do not tell you what has been lost, especially banks? A lot of this is very speculative. We really do not know who is stealing what because people do not want to tell us, because once they tell us we will not trust them either.

David Pollard: That is the case with banks. Banks want to cover up their losses because they do not want to be seen to be insecure, otherwise we would not put our money in them.

Lord Macdonald of Tradeston: How do we know what we are talking about?

David Pollard: The £4,000 came from us, and that is from surveying members and asking them how much they have lost.

Lord Macdonald of Tradeston: Is that somebody losing £4 million rather than an average of £4,000 over every small shop and business?

David Pollard: It is not £4 million but it is probably a certain number of people losing maybe £5,000, £10,000. It could also be a lot of people who lose a few hundred pounds at a time. What we have to be careful about when we talk about cybercrime and the losses from it and cybersecurity is that they are not necessarily the same thing. If somebody stays at your guest house, runs up a bill, pays with a stolen credit card, and you do not realise it is stolen until afterwards, that is no different from the old days when they turned up with a cheque and a guarantee card and the cheque bounced. That is not cyber-related crime; it is just simple fraud. These days, because it is so easy to commit fraud over the internet in that way, there is an awful lot of bog standard fraud going on that is coming up under the head of cybersecurity.
Q58 Baroness Garden of Frognal: Can you give examples of UK companies faced with the decision as to whether to automate or to offshore work tasks? What are the key considerations there? Mr Walker, you already mentioned the desirability of trying to keep work within the UK if possible. Do you have some examples of companies?

Antony Walker: The desirability is to keep work in the UK from the perspective of the UK economy. In terms of individual business decisions, individual businesses need to work out how best to do what they do in a way that drives efficiencies, drives down costs and increases their productivity, so those companies need to make business-based decisions. Offshoring is one avenue that companies can look at. It depends very much on the nature of their business, the activity that they are considering offshoring and so on. It is a rather complicated set of questions that a company needs to go through.

Here I would make a distinction between a number of things. Automation, outsourcing and offshoring are three different things. They are all about driving productivity but they are about driving it in different ways. With outsourcing in particular we see more and more IT going into the cloud, so software is a service and so-called platforms are a service. What we are seeing now—and this is a fantastic thing for small businesses in particular—is a democratisation of business IT provided as a cloud resource rather than something that a company has to build, operate and staff internally. It not only reduces costs but massively increases functionality for small businesses. It allows them to do things that were previously only possible by large companies. That is a massive enabling trend and it will only continue. More and more small businesses will be using the cloud in the same way start-ups do automatically; they would not even consider buying servers and hiring IT staff and so on.

As I said, offshoring is a different thing. It is more complex. Automation is another major trend, both in things like manufacturing but also in business processes. We are increasingly seeing firms looking at standard business processes that are perhaps done manually to see how they can automate those. Again, there are lots of opportunities to do that that will have real productivity benefits. As you rightly imply by your line of questioning, it will have implications for the labour market, and we need to think about what those implications are.

The Chairman: Thank you very much. Who else would like to come in on this?

Guy Levin: Just to reinforce Antony’s point about the benefits of cloud, particularly for start-ups, cloud really does allow start-ups to pay for what they use rather than having to purchase redundant machinery, and it allows rapid scale-in. If you launch an app or a service and it gets featured on the front of a BBC website or something, you get 10 million hits instantly overnight. Using Amazon web services or something to host it means that they can instantly just scale it up, and if that passes they can bring it back down and only pay for what they use. It is a remarkably efficient way of doing things.

In terms of offshoring, most of the capacity that start-ups need is developers, whether that is web developers or app developers. I would say there is a skills shortage there, or maybe there is no shortage but there is a shortage in the prices that start-ups can afford to pay and that often leads to offshore contracting. I know start-ups that have teams or hire in subcontractors from Latin America, South Asia, Eastern Europe and former Soviet countries, because that is the only way they can afford it.

Antony Walker: We are seeing wage prices increasing in some of these other markets, so already in areas of manufacturing we are starting to see some reshoring, where the
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

Technological potential to automate the manufacturing means that the labour costs become less significant. There are potentially lots of good reasons why you want to do that activity closer to home, because you want to do things more quickly or you want to protect your IP and things like that. The same will be true of IT skills as wages increase in other countries. We will see reshoring as well as offshoring.

David Pollard: I was given an interesting perspective on reshoring by Doug Richard, the ex-Dragon, who was in conversation with Lord Adonis at an event a while back, and he is investing in a young woman’s company in a textile business producing designer jeans. She wanted to make the brand focus on its Britishness, so she was very keen on having them all built in Britain. Doug overruled her on that, on the basis that it was not something that they could do at that stage of the business. They are having them made in Turkey, but the interesting point he made was that there is going to be no difference in cost between making them in Turkey and making them in the UK because the factory in Turkey is fully automated and is a state of the art textile factory. The issue was that there was no capacity, there were no businesses, in Britain doing this sort of textile manufacturing because, of course, we got out of textiles in the 1960s.

On the point Doug is making, a start-up business cannot raise an extra few million to build a factory with all the technology and recruit and train the staff to do it. They are dependent upon there being somebody in the market who is providing those services. There are opportunities for new companies with this new technology in the UK, provided that we can find the mechanisms, the venture capitalists, to fund the businesses to support a whole range of start-ups so that some of them—

The Chairman: And identify the needs as well, yes. That is very helpful. Thank you.

Q59 Lord Kirkwood of Kirkhope: Could I take you back to the question of inclusion and inequality that we touched on earlier? I think it was Mr Walker who suggested that a best guess would be something like 10% as the residual minority that you might have to embrace and try to support in some way. The problem about the 10% is that that is 6.3 million people, and if you think about universal credit going to 7.7 million households it is probably the same group that you are talking about, because they are, generally speaking, households with low education, high disability, all the usual indicators for poverty. Do you think that the kind of organisations that you represent feel a responsibility for dealing with that, or do you think this is something that the Government need to shape up to?

Antony Walker: Private companies can certainly play their part with both ideas and mechanisms for reaching out to those people. You mentioned the potential saving in the cost of service delivery for getting to that last 10%, which would come directly back to the UK Exchequer. There is no doubt about it. If that estimate—£875 million—is anything close to being right, if that allowed you to fully automate at least one of the major public services that tends to be used, particularly by that socially excluded group, you will have made huge cost savings. That is exactly why we think now is the time to start thinking about properly funding a programme of digital inclusion, because we think that the savings for the UK Government will be so significant that they can properly transform their service to the right places.

Lord Kirkwood of Kirkhope: That is a helpful answer. Do you think that if you decided it was worth doing—and it is for all sorts of social justice reasons, apart from the efficiency point
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

that you importantly made—it is best left to groups in Northumberland who know the local communities perhaps better than people in Whitehall and the DWP, and try to stimulate hubs and clusters that provide the support network rather than a big government programme?

**Antony Walker**: I do not think it is an either/or. You want to localise the delivery as much as possible, because people trust people that they know. They do not necessarily trust a remote government service or whatever it is, so you want to harness local delivery but you want to create a national framework to support that delivery. It is a combination of both. At the very local level there is certainly a need to think about local authority level, but there is also a need for something national as well, not least because if you want the private sector to engage and large companies to engage, in order for them to do it cost effectively they need to engage at a national level and not just at a local or micro level.

**Lord Kirkwood of Kirkhope**: If you could do everything you can do and everything that you did went right, what would be the residual rump, which is an unfortunate way of describing it? If it is 10% now, with a determined effort what could you break that figure down to?

**Antony Walker**: Some have estimated that that 10% is that residual rump—and I agree it is unfortunate terminology—but a significant number of people will have to be assisted digital rather than fully digital citizens. Some people will always need some form of support.

**Lord Kirkwood of Kirkhope**: That is a good idea; assisted digital.

**Antony Walker**: We need to think about what the mechanisms are to do that. Is it through things like local libraries? Is it through the network of post offices? We need to think about how we can support them.

**Guy Levin**: I was just going to come on to that. I looked it up, and according to the ONS 13% of adults have not used the internet in the last year, which is 6.5 million people. That correlates very closely to age. Less than 40% of the over-75s have used the internet in the last year. There is clearly a large group of people who are excluded.

There has been some interesting research done—I am by no means an expert on this and strongly suggest that you get in the people who are—looking at the reasons for that. I was reading through some of it. The Government Digital Service did some research on this as part of their work about digitising government services and found that the number one largest reason was not a lack of access or lack of skills; it was just lack of interest. I think over 60% said that they were not interested. “It is not for me”. “It is not for people like me”. That is a harder barrier to overcome. I am citing this piece of research, but if that is true that is harder to overcome.

**The Chairman**: I think we should move on from this only because we are doing a complete session on it, so we should probably focus more on the labour market today.

**Q60 Lord Janvrin**: Can I come back to the labour market—Mr Walker, you mentioned it just now—some of the trends that we have been discussing, and how they are affecting the labour market? What is the employment impact, particularly in the SME scale-up area? Could you expand a little on the longer-term, wider impact?

**Antony Walker**: I said at the beginning of the session that we are at the early stages of the digital revolution. Whilst that is true in terms of the changes ahead, we should not forget that this digital revolution has in fact been going for about 25, 30 years, so it is not an
immediate shock. It has happened over a sustained period. We are seeing the progressive
digitalisation of the global economy. That means a couple of things for the labour market.
First, it means that digital technologies are being used to drive efficiencies in the way
businesses work and organisations operate, and they have the potential to significantly drive
productivity of businesses.

If you look across business sectors, the business sector with the highest levels of total
factor productivity is the technology sector. That is precisely because it is very good at using its
own technology to drive productivity benefits. Unfortunately we do not see anything like
those levels of productivity in other sectors of the economy, so there is a huge opportunity
still to drive productivity across the whole of the UK economy.

What does that mean for skills in the labour market? It means that some tasks will be made
redundant through a process of automation, outsourcing and so on, but it also means that
those resources can be redeployed to do more productive things. One thing I highlight is that
there are more jobs in the UK economy today than there have ever been, and that is after 25
years of the digitalisation process. We certainly do not believe that there is a correlation
between digital revolution and a reduction in the total number of jobs. It is just that those
jobs change and become different.

That means that you need a flexible and skilled labour force and labour market. The UK
Digital Skills Taskforce report that Guy referred to makes a very useful distinction about
those who need basic digital literacy. They estimate that 90% of the workforce needs basic
literacy; that about 50% will be digital workers, a higher level of skill; and that 10% will be
digital makers. That gives you a broad idea. If we want to grow the UK economy we need to
increase that number of digital makers, because in a global digital economy you want to be a
net producer rather than a net consumer, so let us double that number of digital makers.
That would be a good thing for the UK to do.

The Chairman: That was a very helpful summary. Only add if you need to at this stage,
because that encapsulated it very clearly.

David Pollard: Just one brief point. I heard Andreas Schleicher from OECD present the first
skills survey. What was quite startling was the high number of people who do not have basic
digital skills—something like 30% of the population—but that seemed to be replicated in
younger people as well. One of the messages that we have been giving when we are trying
to get small businesses to recruit young people is that they understand social media, they
understand what is happening out there in the digital world, and they can help you get up to
speed with it, but there is a whole chunk of these young people who are not like that.

I have a colleague who was hired by DWP to train unemployed people to use Universal
Jobmatch. He was expecting to teach them how to use Universal Jobmatch when he got
there but none of them had e-mail addresses and did not know how to use e-mail or the
internet. He had to be able to set them up with Hotmail and Gmail accounts and everything
and start to educate them all on that. We have to take on board this idea that we have a
problem now with a rump of people who are not digitally literate, but we also have to work
to make sure that the education system is not adding to it as we spend a lot of money at the
top taking them off. The education system has to be preparing people to live in a digital
world.

The Chairman: Yes, absolutely. We have heard that a lot.
Guy Levin: Just to add a couple of points, I reinforce Antony’s optimism here. I am resolutely optimistic about the digital revolution. It will have an impact on the labour market, but now with the smartphone you have access for the first time in human history to almost the complete sum of human knowledge and international markets that you did not previously, whether that is through selling something on eBay, which is slightly old now as technologies go, or through the sharing economy: if you have a spare room you can rent it out on Airbnb.

One of the things this has led to is an increased need for flexibility in the labour market that Antony alluded to, and the digital technologies have allowed better matching of people who have something and people who want something. Where that is labour, that may mean new opportunities if you have a skill to teach and being matched with somebody who wants it or anything else you have to offer. Even if that is just walking a dog or cleaning a house, there are now far easier and more efficient ways of being matched with somebody who desires that, so that may need a more flexible labour market.

I would also note that it is particularly good for people like stay-at-home mothers. Google has done quite a lot of work with Campus for Mums, for example, trying to get mums to go into tech. Start-ups are quite good in the sense that they can be flexible. You can run an online store in your spare time around your other commitments, so there are these upsides to technology.

Q61 Lord Macdonald of Tradeston: We have heard a lot about the need for hard skills, soft skills, developing the talent pipeline and so on, but if this is, as you say, a truly profound revolutionary change, one does not immediately get the impression that it is seen that way by politicians, teachers, universities. Certainly all these disciplines and interests are being affected in the margins probably organically by what people are doing piecemeal, but should there not be a stronger thrust from the centre? In schools, for instance, it is good to hear that coding is finally coming in, you say 25 years into the digital revolution, but they seem more preoccupied with English literature, the history curriculum or various foreign languages. Surely this should be the main thrust of what is going on in schools, colleges, universities and vocational training for apprenticeships. We say very glibly that people need a lot more social skills. A lot of people would like to know exactly where that is taught.

Antony Walker: In terms of the skills requirement either for the sector or for the economy as a whole, first, as you have just said, we need to raise the general level of digital skills and we need to have more people going through to the very high end and very specific skills that are needed by the digital makers. There is a big challenge there. There is an enormous challenge with schools. As an industry, we are pleased with the new computing curriculum, but we are concerned about the lack of resource dedicated to teaching that curriculum. We are missing a whole generation of teachers who are equipped to teach computing at schools while also ploughing ahead with the implementation of this curriculum. We must take that issue incredibly seriously and rethink how we are going to address it.

The Digital Skills Taskforce report suggests that there is a funding gap of about £20 million to address the teaching provision for computing, and we absolutely endorse that. We think that is an urgent issue. Industry can play its part there and in fact is playing its part. We work very closely with an organisation called Code Club, which has been actively using people from the industry to run after-school coding clubs in schools, which is all about inspiring kids and showing them how creative and fun coding can be. But that organisation also does
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

something called Code Club Pro, which is about using people from the industry to teach the teachers, which is the long-term solution.

As an industry we are concerned that we properly resource computing in schools. It needs to be given the same level of attention as other science subjects. It needs to be part of the rich mix of good and solid education that young people will need if they are going to succeed and thrive in this digital economy.

Lord Macdonald of Tradeston: Would your concern for schools and teachers also extend to universities and further education colleges and the lecturers there?

Antony Walker: Absolutely. All the way through the educational pipeline there are jobs that need to be done in both colleges and universities. The industry can and is stepping up to the plate in recognising that it needs to be much better at articulating its needs and working with colleges and universities to help structure education at those kinds of levels. We also recognise that a lot of work is required in relation to apprenticeships being recognised as an alternative and good route into the sector, and that means private companies working together to create a more common approach to developing apprenticeships. That is starting to happen now through the new tech partnership that was recently announced. I think industry is trying to do a lot, but there is a lot more to do.

In teaching in particular, we think there is a real problem. I do not think we should be shy of looking to bring teachers from overseas. There is an absolutely critical gap at the moment. We did not train a whole generation of teachers in these skills.

Q62 Lord Macdonald of Tradeston: Mr Levin, you have been an adviser to the Treasury and to other government departments. The sums that we hear talked of seem pretty puny; £20 million here and there. Do you see any evidence that the Government are taking this as a first order issue as befits something that is such a revolutionary change? Are we getting the money pumped in?

Guy Levin: It is incredibly positive that the Government have made the changes to the curriculum that they have. I agree with Antony; I would like to see more money spent on the CPD for teachers to enable them to have the skills to deliver on it. Since I left government I have spoken to people at the Department for Education who are privately concerned, and I am not surprised that they are. I think Antony is right that if we want to deliver the digital makers of the future, at all stages of the education system there needs to be greater effort, emphasis and investment, and I would include universities in that. If you look overseas, in the US there are far better links between universities such as Stanford and MIT with local digital clusters. You have that in the UK too with UCL and Cambridge with their local tech cluster, but that could be massively improved upon.

In the UK now there are private sector organisations such as General Assembly and MakersAcademy that exist to allow people to change career. If you want to be a web developer you can do a three-month immersive course with them and they will teach you all the skills you need to be a junior web developer at a start-up or at a larger tech company. The only problem is that it costs you £8,000, which is not something that most people have lying around, so it might be worth a public policy response of some sort to make it easier for people who want to change career or upskill in that way.

The Chairman: I am going to give you notice that the final thing we want you to do is give us one recommendation that would move all this on. The thing that we have heard from all of
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

you very clearly today, and that we have heard in previous sessions, is that there are lots of quite small-scale great initiatives happening. Our concern is how the whole thing moves up a gear. If I can just warn you that in 10 minutes we are going to ask for a recommendation from you. Teaching may be the one, but something that is the most pivotal thing to shift the whole thing up a gear is what we are starting to be concerned about. There is lots of good stuff but it is bits here and there.

Q63 Lord Holmes of Richmond: Good morning. We have touched on a number of elements I wanted to bring out on this question, so feel free to list some specific examples. How can the digital sector be supported in the short and medium term? I am interested in what you think could and should be done as we prepare individuals and businesses for the shock, not least to labour markets, occupations and so on.

David Pollard: These two guys will give you the real digital industry perspective on it. What I would say, taking an overall perspective when we try to prepare people, is that we have to educate them for the future for a technological society. We have a culture where it is not just okay but quite cool to be no good at maths or technology. We have to change that culture and have an education system that says that our core function is to churn out 99.9% of all those who do not have documented learning difficulties with at least all the core communication skills, the numeracy, the understanding of technology and the ability to think in structured and logical ways that are needed to cope with the 21st century.

Lord Macdonald asked about all the English and so on that is being taught and whether they are teaching the right things. I had an interesting discussion recently about education with a friend of ours who is an ex-deputy head of a large comprehensive. He gave the example of talking to an Oxbridge cohort about work experience and when it was coming up, and suggested to them that they should think of a company or sector they would like to be in, get some companies, write to or phone these people and ask about opportunities for work experience. They did not know where to start. They considered that they were capable of writing an essay for an admissions tutor at Oxbridge but they did not know how to start on the basic communication skills, and everybody needs that. If we can get people to have a basic understanding of all the maths, how to communicate and so on, we can pick out the bright ones, who are going to be the Oxbridge candidates after that, but at least we know that everybody has a chance of functioning in the 21st century and getting and holding a job.

Guy Levin: From the start-up perspective, the biggest thing that could be done for skills in the short term is immigration reform. The changes to the curriculum are fantastic, but it will be a decade before any of those people work in a start-up—and start-ups are not known for their long lifespans; probably 90% of them fail. A start-up today, sitting in the Google campus up in Manchester or wherever it is, cares about being able to hire a good developer tomorrow who has the skills it needs to build its product. That is mercenary and capitalist, I suppose, but it is what we need for the economy and for growth and innovation.

The visa reforms since 2010 have been quite detrimental to that. Scrapping post-study visas means that some of our best STEM graduates and computer science graduates from the US, India or wherever are forced to leave when they could be delivering massive contributions not just for start-ups but in any section of the economy. In the short term I would say that immigration reform is definitely the number one ask on the skills side of things from us.
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

I would also say there are a couple of things on the labour market to make it more flexible. Non-compete clauses are quite common in the tech industry and can be detrimental to efficiency. Signing a contract saying that you are not allowed to work for a competitor makes it much harder for someone to get hired. I think that banning non-compete clauses would be a positive step.

Lots of tech third sector initiatives are good at trying to encourage more people to become digital makers, such as the CoderDojos—the code clubs that Antony has already alluded to. There is an organisation called Geekettes that is trying to get more women into digital things, because there is a massive gender divide, particularly when it comes to the digital-maker end of things.

**The Chairman:** We can tell that. We are struggling to get female witnesses in any of our sessions, and it is not through lack of effort.

**Guy Levin:** Those are third sector initiatives. They are not necessarily for the Government to do but they should be encouraged and flag-posted.

**The Chairman:** Anything to add, Mr Walker?

**Antony Walker:** It is my turn to agree with what Guy was saying. I draw a point from that, which is that start-ups in big established companies broadly agree on these issues. They have the same concerns, they see the future of the digital world in a very similar way, and they are all part of one big ecosystem. I think that is a point worth making.

The migration point is incredibly important. If you want the UK to be a global hub for tech you have to be a global hub for talent. Silicon Valley is built on its ability to attract the best global talent from around the world. One in seven new firms in the UK is created by foreign entrepreneurs. We need to keep the UK open to global talent, and that means having a smart migration policy, which is entirely achievable if it is focused on bringing in and attracting wealth creators. In that category I would put entrepreneurs and researchers, because our universities are the anchor point in the information economy. To keep our universities at the forefront of global universities they need to be able to attract the best researchers from around the world. We need to be encouraging them to come.

When those researchers have completed their studies, when they have developed their ideas, we need to be encouraging them to stay in the UK and build businesses and wealth here. I met a professor at Cambridge a couple of weeks ago who said about the work that they are doing on high-end manufacturing, “I am worried that we are training our competitors to out-compete us”. This is a fundamental issue. There is a whole set of specialist skills that we need, that Guy’s members and my member companies need right now in order to continue to succeed here in the UK. My last point is that we need to bring in educators and teachers. A smart immigration policy is absolutely fundamental.

The second big ask for me would be to properly fund the teaching of computing, not just focus on the curriculum.

The third is important for techUK and our members: addressing the fact that only 16% of the IT workforce is female. This is an important issue that we have to address. That requires targeted interventions all the way from the classroom to the boardroom, so techUK has a programme of work. We are working with all our members, focusing on issues like interventions at primary school level such as code clubs, where 40% of participants in code clubs are girls, which is a great thing. Let us continue them all the way through. We have a
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

programme called Walking Tall, which is about encouraging women to return to the workplace after a career break to have families, and encouraging them to have the confidence to come back into the tech sector and not to feel that their skills are out of date. We have a Challenging Industry programme, which is focusing on cultural issues within technology companies that do not have the right gender balance, and we have a Women on Boards programme. You have to look at all those stages. That is industry activity, and government can support that too.

The Chairman: I am going to ask, if you do not mind, for question 8 on inclusion, which we have broadly covered. We have just covered the final part on gender, and if anybody wants to send in extra supplementary evidence on that, that would be helpful. Similarly, it would be helpful if you could send in any written evidence on disadvantaged parts of the UK, because we are out of time. I do want Lord Aberdare to be able to ask quickly about infrastructure. Please just headline answers, and again further written evidence would be great because this is an area that we have not covered today at all and is a concern to us.

Q64 Lord Aberdare: The question is: how can the UK’s infrastructure be improved to support a knowledge-driven economy. There has been a lot of focus on broadband, but what are the other aspects of that? There is connectivity, for example, but also perhaps softer things. We talked a bit about security, which is perhaps part of the infrastructure, as of course are skills. Are there infrastructural things that we need to be bearing in mind?

The Chairman: Mr Levin, are there any from your point of view? If there are none it does not matter, if you think that is not the key issue at the moment.

Guy Levin: Broadband is the most important one — access to high speed, fibre — but that has been covered elsewhere.

The Chairman: Yes, high-speed broadband.

David Pollard: One thing about broadband is that we all tend to think of it on a consumer basis, where it is about very fast downloads so that you can watch the TV through the internet and slow uploads because you are just sending e-mails, but if you are in business you need fast upload speeds. If you have done digital glazing and you want to send the product to your customer, you do not want to sit there and watch the computer for the next four hours while it uploads the film.

Antony Walker: If you want to address the infrastructure issues that are critical to businesses growing in a digital economy, the thing you need most is the ability to think and plan for the long term. We have struggled to get broadband to our rural businesses quickly enough because we were not planning ahead. It is the same with mobile coverage, and we all know the same is true with transport. The biggest fundamental challenge to the infrastructure issue is the ability of government, together with industry, to think and plan long term.

Q65 The Chairman: Thank you very much indeed. Just before you escape — that was a long session, I know — I have taken very clearly from all of you that teaching and smart immigration are very strong issues that you have raised with us today. Do you have any other recommendation that you would like us to hear very clearly?

David Pollard: One thing on the business of teaching is that back in the 1980s when I ran a technical consultancy, we used to do work experience for teachers and they would come in
Coalition for a Digital Economy, Federation of Small Businesses and techUK – Oral evidence (QQ 53-65)

during the Easter holidays and see what the business was like. I suggested to Elizabeth Truss, on the reform of the computing curriculum, that one of the problems is that so many teachers go from school to university, to teacher training and back to school, and they do not understand how important the digital economy is in business. So my other recommendation would be work experience where teachers can go to companies and see just how much the computer is an integral part of everybody’s job, not just the software guys or the designers but the people in logistics, the people loading up the trucks for delivery and so on.

**Antony Walker:** My one ask would be that you don’t focus just on finding the ‘one thing’.

**The Chairman:** I was giving you one thing each. It is not that we want only one thing.

**Antony Walker:** The one thing I would ask for is an approach that looks at interventions for the short, medium and long term—a comprehensive view of the pipeline. If you deliver that, that is the one thing that will be really successful.

**The Chairman:** That is easy then. Thank you very much indeed for coming today. That was helpful.
Code Club, Age UK, TalkTalk and UCanDoIT – Oral evidence (QQ 129-142)

Transcript to be found under Age UK
1. The Communications Consumer Panel (the Panel) and the Advisory Committee on Older and Disabled People (ACOD) welcome this opportunity to respond to the House of Lords Digital Skills Committee’s call for evidence in relation to Digital Skills in the UK. The Panel works to protect and promote people’s interests in the communications sector. We are an independent body set up under the Communications Act 2003. The Panel carries out research, provides advice and encourages Ofcom, government, the EU, industry and others to look at issues through the eyes of consumers, citizens and microbusinesses.

2. The Panel pays particular attention to the needs of older people and people with disabilities, the needs of people in rural areas and people on low incomes, and the needs of micro businesses, which have many of the same problems as individual consumers. Through its Members, the Panel represents the interests of consumers in Scotland, Wales, Northern Ireland and England. Following the alignment of ACOD with the Panel, the Panel is more alert than ever to the interests of older and disabled consumers and citizens.

Levels of Digital Engagement

3. While the advantages of online connectivity apply to all groups in the community, they are especially relevant to disabled people, those on a low income and older people - many of whom may be less mobile than younger people. And yet we know that the take-up and participation in the digital world is unequal and levels of use of the internet vary significantly across the population. Older and disabled people, and those in low-income households, are much less likely to use the internet at home.

4. Ofcom’s 2014 Communications Market Report[^12] highlighted that while home internet access among UK adults stood at 82% in Q1 2014, take-up varied across age, gender and socio-economic group. The biggest differences were between the youngest and eldest age groups: 94% of those aged 16-24 had access to the internet compared to only 32% of those aged over 75. However, internet take-up among this latter age group has risen by five percentage points between 2012 and 2014, the largest rise of any of the age groups. There were also differences in internet take-up by socio-economic group. AB households were the most likely to have an internet connection (93%) while DE households were the least likely (67%).

5. Ofcom’s 2013 research on disabled consumers’ ownership of communications services found that for older (65+) less affluent disabled people, internet access levels are at their lowest (23%) which is significantly lower than among non-disabled people of the same age and socio-economic group (37%)[^13].

[^12]: http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr14/UK_4.pdf
6. Whilst solutions may be complex, the issue itself is straightforward: approximately 21% of the UK population lack basic digital literacy skills (source: BBC/Go ON UK survey\textsuperscript{114}).

**Why digital engagement matters**

7. We now live in an era in which we are seeing many Government services become “digital by default” and where being online is becoming more and more a necessity of life and less and less of an optional extra. An increasing number of commercial services are only available online - or delivered offline in a way that effectively penalises users, through high cost or lower quality. Those people still functionally offline will be at an increasing disadvantage and risk being left behind in terms of ease, convenience, inclusion, speed and cost.

8. While the Panel is currently working with the Government Digital Service to support the development of the assisted digital offer, it is our belief that unless fundamental action is taken, the digital divide risks becoming an ever greater digital gulf as the distance increases between those who are online and those who remain firmly anchored in the offline world. The potential consequences of this exclusion are serious: for individuals, especially those who are more vulnerable; for society; for business; and for the UK economy. Digital literacy, especially on security matters, is going to be critical.

**Consumer Framework for Digital Participation and Bridging the Gap: Sustaining Online Engagement**

9. In 2010, to help government and others increase the number of people using the internet, the Panel developed the Consumer Framework for Digital Participation\textsuperscript{115}. The Framework sets out the citizen and consumer needs that underpin digital participation. It starts with the consumer experience and breaks down the journey that people make in getting online and then enjoying the benefits. It specifically addresses the issue of what consumers themselves have said they need to get online. Targeted at government and industry, the Framework brings together all the different elements that are needed to provide the help and support for people to get online and get the most benefit from the internet.

\textsuperscript{114} http://www.bbc.co.uk/learning/overview/assets/bbcmedialiteracy_20130930.pdf
\textsuperscript{115} http://www.communicationsconsumerpanel.org.uk/downloads/what-we-do/previous-projects/access-and-inclusion/FINAL%20DP%20SUMMARY.pdf
10. The Framework was a key element of the National Plan for Digital Participation and was used by the Digital Participation Consortium to help target and prioritise its work. The intention was that, by putting consumers first, the Framework would enable policymakers and service deliverers to:

- **Highlight the particular needs of different groups**: different groups of people need different things to help them get online and get the most out of the internet.
- **Identify gaps and overlaps in current provision**: there are lots of different digital participation projects and initiatives being delivered by many different organisations across the country.
- **Target new provision**: identifying the particular needs of different groups and gaps in current provision, to enable new activity to be targeted in a way that achieves the maximum impact with the available resources.
- **Assess progress**: the Framework can be used to assess progress and evaluate activity and initiatives against how well they meet consumers’ needs.

11. Subsequent research by the Panel in 2011/12, Bridging the Gap: Sustaining Online Engagement\(^\text{116}\), consolidated stakeholders’ experiences and learning in supporting online participation among people who are less digitally engaged, and gathered information about supporting people to take the next steps online. The study confirmed that some people’s online journeys are long and complex. Starting the journey does not, in itself, guarantee that people will become confident internet users, able to function and interact with services.

online. Some will continue to need support to overcome challenges and go on to maximise the benefits of being online.

12. The elements of the Framework categorised as ‘to make it work’ and ‘to enjoy the benefits’ appeared to represent the tipping point for many of those we spoke to in our research. But these elements currently appear to attract less attention and resource than the initial push to get people online. If a user’s journey is not supported adequately, so that it is sustained and developed, the initial investment in training may go to waste. The Panel has encouraged Government and providers to continue to use the Consumer Framework for Digital Participation to assess progress made and address gaps.

13. Building on both the Consumer Framework and informed by our ‘Bridging the Gap: Sustaining Online Engagement’ research, the Panel identified a number of areas for strategic focus and made a series of recommendations for government, policy makers and those delivering on the ground. In the Panel’s view:

- the challenge to increase participation is underestimated;
- meeting the challenge is underfunded; and
- people who remain unable to access online services will suffer increasing detriment if the challenge isn't met.

Digital Engagement support

14. In terms of digital engagement support, we would encourage Government to investigate the opportunity to further consolidate and extend the availability of support at points of need, for example by strengthening the relationship between Job Centres and Benefits Offices and the providers of expert help e.g. UK Online Centres - so that those most in need, and potentially those who are currently most digitally unengaged and hard to reach, can (a) get assistance with what they’re there for; and (b) receive encouragement to learn skills to help them in future, so that they can better "do it themselves", resulting in greater confidence and steps on the path to overcoming general digital reluctance.

15. Ofcom’s 2014 Communications Market Report\(^\text{117}\) highlights how, as a result of growing up in the digital age, 12-15 year olds are developing fundamentally different communication habits than older generations. It is vital that educationalists are aware of, and engaged with, this trend and what it means for how children are taught. However it is also important to bear in mind that a) being able to use devices technically does not always equate to having an appropriate level of cognitive skill to safely, securely and successfully manage online engagement in all its forms and b) it is likely that not all young people will remain fully digitally engaged throughout their lives.

16. We would also strongly support the establishment and/or consolidation of comprehensive digital help and free access at locations people might regularly use, e.g. schools and colleges open to local citizens after school hours, post offices and libraries under a unified programme of Government digital help for citizens. We believe, too, that there

should be a free helpline for users of Government digital services to provide technical as well as specific service support.

17. We believe that libraries have a vital role to play, in conjunction with other locally based agencies as noted above, in supporting and encouraging people who are not fully digitally engaged. They have the potential to deliver a well-supported, safe and sustained learning environment that excludes no-one. Commercial organisations, including banks and communications providers, also have a role to play – as in the Go ON UK model. As society changes, this is more important than ever before, so that we ensure that more vulnerable consumers and citizens are empowered and are not left behind.

**Businesses and digital support**

18. The Panel is currently undertaking qualitative research across the UK to explore:

- which communications technologies and services micro-businesses use and to what extent; and their importance to the business
- the experiences of micro-business of the communications sectors and services – including fixed line, mobile phones, fixed broadband (including superfast) and mobile broadband.
- the barriers/challenges and the opportunities
- what – if anything – should/could be done to improve communications experiences to contribute to greater growth?

We intend to publish the research in early Autumn and will, of course, be delighted to share and discuss our findings with you in due course.

**Infrastructure**

19. The Panel has previously called for digital engagement and usage to be on an equal footing with broadband roll out and speed in respect of policy and funding. Access to good quality services remains vital and in relation to this, in the Panel’s view, sub-optimal delivery of communications services as a result of inadequate infrastructure – be it a lack of fast broadband or the absence of mobile voice and/or data coverage - has long since ceased to be a matter of simple irritation for consumers and micro-businesses, and is now an issue of real detriment.

20. Along with the Mobile Infrastructure Project, the Panel has welcomed the 4G coverage obligation of 98% indoor coverage UK wide, and 95% in each Nation by the end of 2017 as tools to increase rural broadband and mobile voice/data coverage. We have encouraged close monitoring of their roll out and efficiency. However there is still some way to go and it is vital that consumers and citizens in the widest sense should not be left behind, left out or left wanting.

21. Consumers, citizens and micro-businesses are increasingly reliant on mobile devices. Excellent network coverage and call quality combined with the provision of better information will help people make better choices – and make greater use of the functions and applications that they want, which in turn we believe will drive up service levels and ensure a thriving competitive market.
22. The needs of consumers and citizens must be central to policy making, so delivery of a high quality service experience is consistently achieved and consumers and citizens are not excluded or deterred from effectively participating in the digital world. It is vital that citizen interests are taken into account in relation to both the provision of infrastructure and quality of experience. Ofcom’s May 2013 Broadband Speeds research\(^{118}\) states that the average download speed in rural locations is 9.9mbps - but this is an average and there are many examples of much poorer performance. Unsurprisingly, Ofcom’s Consumer Experience report published in January 2014\(^{119}\) reports the level of dissatisfaction with broadband speeds amongst consumers in rural areas is almost double the average – 32% v 18%.

23. There are other related factors too – by June 2013, 73% of UK premises were in a postcode served by next generation access networks enabling superfast (30 Mbps or higher). We’ve welcomed the UK Government’s undertaking to extend superfast so that 95% of UK premises will have it by 2017 and to explore with industry solutions to reach 99% of premises by 2018. But 2018 is still four years away and how will citizens and micro-businesses in the last 5% (i.e. those who are not included in the undertaking to extend superfast to 95% of UK premises by 2017) - be affected? We are concerned by the risk that they will, for a long time, remain disadvantaged – and while the percentages may seem relatively low, the absolute numbers are high.

24. We hope that the actions outlined in the recently published Government Digital Inclusion Strategy will help as awareness and understanding of the respective organisations’ roles increases. However, whilst it is important that Government supports other organisations, Government must first ensure that its own work embodies best practice; and it should make funding available so that policy statements translate into tangible outcomes. The Social Value Act 2012 provides a basis to encourage investment/shared investment into schemes to make them sustainable and links should also be established to the work of local democracy groups. The transformation of the UK into a leading digital nation with digitally able citizens cannot be achieved without serious commitment – and investment to support it.

25. We would also encourage the much greater availability of free public Wi-Fi, together with appropriate advice about relevant security. We understand that the Schools for the Future programme had hoped to extend free Wi-Fi to parents and local citizens but was unable to fulfil this ambition for funding reasons. This appears to us to be an interesting initiative worthy of further investigation.

26. Finally, we would encourage greater co-ordination, collaboration and transparency of existing government and industry initiatives.

2 September 2014

\[^{118}\]http://stakeholders.ofcom.org.uk/market-data-research/other/telecoms-research/broadband-speeds/broadband-speeds-may2013/

CompTIA – Written evidence (DSC0082)

About CompTIA
1. CompTIA is a non-profit, international trade association representing over 10,000 members, from large multinationals to small and medium enterprises, across the ICT industry. Through our experience, expertise and network we can provide independent advice to Government on identifying and responding to emerging trends in the sector.

2. We promote competence and standards, offering computing certifications for IT professionals, from entry level to expert with over 1.5 million individuals certified globally. As a vendor neutral organisation CompTIA speaks with independent authority on the challenges and opportunities facing large organisations in ensuring their workforce is properly ICT certified.

3. CompTIA is vendor neutral and does not support any one particular certification product; it is trusted by business and as an authentic voice of the ICT industry. Having operated internationally for over three decades, CompTIA has strong relationships with both computer software manufacturers and the businesses that use this technology.

Executive Summary
4. The digital sector is one of the most productive in the UK economy and employment has grown 5.5 per cent between 2009 and 2012, more than three times that recorded within the wider economy. Globally the IT Market is worth $3.6 trillion, with the UK share worth $163 billion.

5. As companies adopt new technology, they will be doing so in a more strategic fashion than ever before. Rather than treat ICT as pure infrastructure for running operations, companies will view ICT as a way to drive business objectives and competitive differentiation. In a 2013 study conducted by CompTIA, 79% of UK firms viewed technology as important or very important to the future success of their business over the next two years.

6. These shifts in technology and shifts in strategy will drive a need for new skills. Most companies are experiencing some level of skills gap—in the same 2013 study, 48% of UK firms stated that their IT skills were only moderately close to where they wanted to be (or worse). These IT skills include traditional items (such as networks, servers, and security) along with emerging fields (such as non-relational databases, cloud APIs, and mobile operating systems).

7. Ensuring the new computing curriculum can produce enough future workers with the fundamental understanding and skills of information technology is vital if the United Kingdom is retain a leading position in a competitive international market.

8. Government can play a leading role by taking a positive attitude to ensuring workers in the public sector are able to achieve the necessary ICT skills to perform their duties and improve individual and team productivity. According to its own assessment central
Government has remained “over dependent from the private sector and high cost interim managers”\footnote{HM Government: ICT Capability Strategy Implementation Workstreams} due to a failure to train and develop enough of its own staff for required roles.

9. Research by CompTIA indicates that the private sector is beginning to realise that IT skills must be brought in line with corporate objectives. Global Knowledge reports that the number of companies planning to send staff to IT training jumped from 63% in 2011 to 80% in 2012.

10. All organisations, whether public or private sector, cannot afford to fall behind in ICT skills and training. In this regard, skills certification can provide a key tool to ensure that workers and teams have the appropriate skills and capability to deploy them in the delivery of projects and services. Evidence\footnote{CompTIA’s 2nd Annual IT Career Insights study} also shows that certification will also improve employee retention and recruitment, as well as improved network performance and data security.

**The changing technological landscape**

**Question 1: What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?**

11. The Information and Communications Technology (ICT) industry is in a period of massive change. The last seven years has witnessed one of the most innovative periods in the history of the industry. This period included the introduction and broad adoption of broadly capable touch-based smart phones and tablets, solid state storage as a default feature, two new generations of wireless standards, social media, cloud infrastructure and other developments which are significantly changing the way in which society interacts and makes use of information technology.

12. While some view technology change as progressive steps along a spectrum, many industry observers including CompTIA recognize that certain trends produce more dramatic shifts in the ways that businesses use technology and the skills that are needed for continued progress. CompTIA believes that the trends of cloud computing and mobility have ushered in a new era of ICT, following the era of the mainframe computer and the era of PC/Internet.

13. We are likely to see an even bigger explosion of innovation around robotics, telematics and transportation, 3D printing, virtual reality and ever increasing broadband capacity pushed by machine to machine and the Internet of Things. We’ll see continued advances in new computing paradigms (optical, biologic) and big data sorting computers powering healthcare and diagnostics.

14. Over the next five years, companies and individuals will continue to build the foundational knowledge they need in these new trends. In the following 10-20 years, companies will execute new business models based on this knowledge.

15. As companies adopt new technology, they will be doing so in a more strategic fashion than previously. Rather than treating ICT as pure infrastructure for running operations, companies will view ICT as a way to drive business objectives and competitive
differentiation. In a 2013 study conducted by CompTIA, 79% of UK firms viewed technology as important or very important to the future success of their business over the next two years.¹²²

16. These shifts in technology and shifts in strategy will drive a need for new skills. Most companies are experiencing some level of skills gap—in the same 2013 study, 48% of UK firms stated that their IT skills were only moderately close to where they wanted to be (or worse). These IT skills include traditional items (such as networks, servers, and security) along with emerging fields (such as non-relational databases, cloud APIs, and mobile operating systems). IT skills are only part of the picture, though. Increasingly, there is a need to mix technical skills with skills in business operations and customer behavior, as all lines of business in an organization utilize technology differently and seek to reach new customers who are digital natives.

**Question 2: What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?**

17. One of the main challenges will be ensuring a smooth transfer of knowledge from the baby boom generation to millennials and generation Z. Boomers have to come to grips with the new generation of workers and embrace the education and mentorship roles they have and millennials have to be willing to learn. Educators will have to quicken the pace and make room for faster experiential learning models. The days of needing to spend four years in university to be capable of doing a job are coming to an end. Individuals are looking for quicker and more economical pathways to their careers.

18. Many new careers will emerge through the transition like data analytics in health and marketing, and other fields like IT security will see huge spikes in demand as incumbent workers retire. Success in a career will be more determined by a person’s ability to exploit the technological tools at their disposal and to quickly incorporate newer and better versions of those tools than the knowledge they’ve accumulated.

**Future Workforce**

**Question 4: What skills do future workers need in order for the UK to be globally competitive?**

19. The key challenge and future demand for digital skills, for our workforce and for individuals of all levels and backgrounds is the ability to transfer skills learned on one system to another and adopt a flexible mindset. With cloud, open source, mashup and other technologies, industry, commerce and the workforce need to be able to harness the way different technologies can be interconnected to enable productivity.

20. We will reach a world where networks run as services at device level and hardware skills will continue to evolve to include mashup-tech-transfer skills. This applies to ‘user skills’ as well as professional engineering and software systems development. There will be impact in terms of ongoing cyber security demands, which should be a significant theme in any future digital skills development programme.

¹²² CompTIA’s International Technology Adoption and Workforce Issues Report, 2013
21. From CompTIA’s IT Skills Gaps Study 2012 the following is a rating of the importance of IT skills and the concern of the skills gap faced in the UK. Data from the study was collected from 250 UK Business Managers:

<table>
<thead>
<tr>
<th>Infrastructure / End-points</th>
<th>Skill Somewhat Important</th>
<th>Skill Very Important</th>
<th>NET Importance of Skill</th>
<th>Skills Gap Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networks / Infrastructure (LANs, WANs, etc.)</td>
<td>33%</td>
<td>67%</td>
<td>100%</td>
<td>44%</td>
</tr>
<tr>
<td>Server / data center management</td>
<td>34%</td>
<td>59%</td>
<td>93%</td>
<td>40%</td>
</tr>
<tr>
<td>Storage / data back-up</td>
<td>40%</td>
<td>55%</td>
<td>95%</td>
<td>29%</td>
</tr>
<tr>
<td>Help Desk / IT support</td>
<td>38%</td>
<td>54%</td>
<td>92%</td>
<td>27%</td>
</tr>
<tr>
<td>Telecommunications - VoIP, UC, etc.</td>
<td>46%</td>
<td>38%</td>
<td>84%</td>
<td>29%</td>
</tr>
<tr>
<td>Printers, copiers, multifunction devices</td>
<td>51%</td>
<td>28%</td>
<td>79%</td>
<td>14%</td>
</tr>
<tr>
<td>Mobile phones / smartphones</td>
<td>49%</td>
<td>21%</td>
<td>70%</td>
<td>19%</td>
</tr>
<tr>
<td>A/V - projectors, digital displays, etc.</td>
<td>38%</td>
<td>19%</td>
<td>57%</td>
<td>7%</td>
</tr>
<tr>
<td>Tablets</td>
<td>36%</td>
<td>12%</td>
<td>48%</td>
<td>16%</td>
</tr>
</tbody>
</table>

| Information |
|----------------|----------------|----------------|------------------|----------------|
| Security / Cybersecurity | 40% | 54% | 94% | 39% |
| Database / Information management | 37% | 54% | 91% | 38% |
| Data analytics / Business intelligence | 46% | 37% | 83% | 32% |
| Customer relationship management (CRM) | 42% | 40% | 82% | 27% |
| Enterprise resource planning (ERP) | 42% | 30% | 72% | 23% |
| "Big data" (Hadoop, NoSQL, etc.) | 40% | 15% | 55% | 16% |

| Applications / Internet |
|-------------------------|----------------|----------------|------------------|----------------|
| Web design / development | 38% | 39% | 77% | 27% |
| SQL | 48% | 38% | 86% | 13% |
| HTML | 50% | 28% | 78% | 10% |
| Web infrastructure | 44% | 35% | 79% | 26% |
| Virtualization | 42% | 39% | 81% | 30% |
| Application development / programming | 34% | 44% | 78% | 20% |
22. To remain globally competitive it is important to address those skills gaps identified by industry as areas of concern. If we can narrow these gaps, develop more cutting edge skills and build infrastructure to support continued skills development then we will put ourselves in the best position to be - and stay - competitive on the world stage.

23. There are number of leading factors which contribute to IT Skills Gaps as found in the CompTIA International Technology Adoption and Workforce Issues Study 2012 (which will be updated in autumn 2014). Fast changing technology makes it difficult for IT workers to stay current with skills. There is also lack of resources for IT skills development and often available IT education/training fails to sufficiently translate in terms of improved workforce performance. These factors, combined with IT pay being too low in some areas, will see industry struggling as their workforces lack the skills to compete in the global economy.

**Question 4b: How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?**

24. Clearly the workforce at large will not require the same level/same skills as those in defined technical roles. However, the delivery of computing in schools has long equated to teaching our young people how to word process and use spreadsheets. That has not been good enough for some considerable time. One only has to look at the levels of computing and engineering skills being delivered in East Asian education to see the gap.

25. IT teachers in schools have often been non-specialists and hence the ability to deliver quality digital education has not existed in depth. The move to make Computer Science GCSE a core subject, the investment in teacher training and Computing at Schools’ Barefoot project are steps in the right direction. However we need to audit teacher skills – it is suspected more investment will be required to attract the right talent and upskill current teachers to raise standards to the appropriate level.

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124 CompTIA White Paper – The Value of Certification - 2013
26. As stated, the move to change the focus to coding and programming in schools is welcomed. However, the workforce of tomorrow will require technical skills across a much wider range of technologies and topics including networking, data, security and reforms to education programmes would be galvanised by inclusion of these modules

27. Over time, the level of technical skill in the general population will rise as technology evolves. Technology will continue to play an increasingly pivotal role in terms of competitive advantage; it is vital that the United Kingdom addresses gaps in key IT skills or suffer the consequence of become a digital laggard in the global economy.

Question 5: How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

28. In addition to our comments on education in question 4 there are supply chain issues and we are yet to witness widespread delivery of cutting edge technical skills.

29. We need to:

(a) Encourage technology specialists into the teaching profession

(b) Develop the skills of existing, talented technology teachers

(c) Deliver a broader foundation in computing which enables talent to access the very diverse range of technology careers available.

(d) Teach with a view to the future – for example, right now it’s all about the Internet of Things, interconnectivity, general concepts in systems/system design and open source technologies

(e) Continue to encourage educational organisations to forge links with industry

(f) Some computing qualifications are available for up to ten years - this is far too long. Enforcing Awarding Organisations to ensure their qualifications are in line with what industry requires is a recent good move. They should also be obliged to update their offerings in fast moving areas, such as computing and technology every three/four years.

(g) Embrace industry learning/certification. This tends to be more cutting edge and resources are made available to support delivery. Further Education organisations have long been offering this alongside traditional qualifications to enhance employability. Industry recognised certifications are also being used to boost the skills of our World Skills candidates in the IT Network Systems Administration Competition and they are starting to really compete with candidates from the likes of Singapore, Japan and China who repeatedly come out ahead of the UK competitors.

Question 6: How are schools preparing to deliver the new computing curriculum in an innovative way?

30. We currently see schools struggling with the pace of change and developing the technical skills required to teach the new computing curriculum. We also need to look at
whether schools are resourced to deliver the technical skills required. For example, do they have the requisite hardware and software to support the teaching of basic networking?

31. The Computing at Schools initiative is a great support and it is hoped that the Barefoot project – whereby individuals from industry visit primary schools to help them get started with delivery – will have impact.

32. Industry certainly has a part to play in helping educators deliver relevant teaching and to bring the concepts to life. If we are to be successful, we need to emulate in computing delivery what Professor Brian Cox has done for Physics it making it more readily understood and accessible for children and the general public alike.

33. There are so many ways to bring the computing curriculum alive; some leading projects which could be emulated include:

- Bletchley Park: Make an Enigma machine out of an empty potato crisps tube
- Lego Mindstorms – students can build robots and use software to plan, test and modify sequences of instructions from a variety of real life robotic behaviours. This brings science, engineering, technology and maths together.

34. In addition the curriculum can be supported by the use of factual news stories and free online tools to teach Security. We need to create an education system that can start to deliver best in class technical education and this should include lots of practical assignments. Although knowledge is important, computing is inherently practical!

**Question 7: How can the education system develop creativity and social skills more effectively?**

35. Teacher skill sets and practical work are important but a great way to foster social skills and develop creativity is for learners to engage in projects.

36. Projects allow learners a fair amount of latitude to express themselves, to engage in teamwork and to work on real world problems/scenarios. Close cooperation from industry would help provide context and relevancy. A project represents an incredibly useful vehicle in the development of a range of skills and hence why we are starting to see them feature more and more for example in the new TechBacc qualifications.

**Question 8: How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?**

37. See response to questions 4 and 5. We need to deliver cutting edge skills and teach nascent as well as established technologies and concepts e.g. Software Defined Networking, Cloud, Mobility, Interconnectivity. Further Education Colleges are fostering good links with industry and adopting industry certifications such as seen in the UK Apprenticeship trailblazer programme, but an investment in teacher training is again required to enable organisations to deliver cutting edge skills.
Short- and medium-term support to the digital sector

**Question 9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?**

38. Our current educational infrastructure aims to support the needs of the digital sector but there is blockage in some channels where there may need to be more incentives for organisations to raise the bar in terms of the industry relevancy and level of their computing provision.

39. The workforce needs worldwide industry skills, using, integrating and commissioning latest technologies. Ever closer links between education and industry will be an important catalyst in the raising of the digital skills level in the UK. The benefits are clear: exposure to the world of work brings theory to life and learners emerge from education job-ready, whilst industry is better able to influence the calibre and type of skills they need to advance.

40. For organisations, skills are vital to meeting both current and future business demands. To be successful and competitive, businesses must ensure their talent and succession planning takes into consideration what skills need to be sourced, nurtured and developed now, in order to create successful and productive workforces of the future.

41. In order to improve the UK’s skills profile it is not enough to focus on initial education and training. Employers understand the importance of investing in and improving the skill levels of employees, including on-the-job training, in-house development programs and coaching.

**Industry**

**Question 13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?**

42. In the past SMEs would have been at a significant disadvantage in attracting and retaining highly qualified or young, hungry talent. The same cannot be said for the next five years. Newer workers are showing an increasing propensity to want to work in smaller, faster paced, less bureaucratic environments that bring them closer to the ultimate customer.

43. Being able to bring in this kind of young innovative talent will help SMEs be seen as more responsive, creative and cutting edge. SMEs must be the first to adopt new technologies and new tools to serve their customers. They have to position themselves as leaders. They need to remember that just as millennials are supplanting baby boomers as their own employees, so too they are starting and taking over the businesses who are and will be their customers.

**Question 14: How can businesses help equip the workforce with new skills in a rapidly changing environment?**

44. The biggest thing is to recommit to training and on-the-job experience. Companies are rarely finding just the exact right fit for their openings. They need to be willing to consider people who have potential and then skill them up.
Around the world, companies are acknowledging that they need to bolster their in-house IT skills. This is not necessarily a statement of deficiency for the IT department; in many cases, the structure of the IT department and the funds available for training do not lend themselves to ongoing skills improvement. Further complicating the problem, IT skills are not exclusively needed among IT staff, trends such as BYOD or rogue IT dictate that all users must raise their levels of IT awareness.

In order to keep skills gaps from impacting productivity, customer engagement, or product development, companies must take initiative to educate their current staff and make new hiring decisions intelligently. This begins with a process for identifying gaps – in total, 38% of companies say they do not have such a process.

Once gaps are identified, current employees can participate in training programmes to become more proficient in their field of expertise. Four in ten companies believe it is critically important to verify the knowledge gained through training, and certifications are a primary method of verification.

Certifications are also valuable when evaluating talent outside an organization. Some companies may have the ability to hire, and certifications can be proof point of relevant skill. Sixty one percent of hiring managers believe certifications have a high value in assessing candidates. Other companies may not have the luxury to hire internal resource, but turn to third parties that specialize in IT solutions. Here again, certified staff with the contract company gives more assurance that skills are up to date.

**Infrastructure**

**Question 15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?**

Over the last five years an increasing number of new tech innovations have begun to come out of the UK. In terms of innovation the United Kingdom is probably only second to the US in this regard. But the UK needs to allow for more pathways to a knowledge career and support individuals from all socio-economic and academic levels. The knowledge worker from the future won’t fit a traditional mold. They’re likely to be people who are able to exploit a particular innate skillset and not just from the accumulation of esoteric knowledge.

*5 September 2014*

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126 CompTIA’s State of the IT Skills Gap Study 2012
127 CompTIA’s International Employer Perceptions of IT Training and Certifications Study
128 CompTIA’s International Employer Perceptions of IT Training and Certifications Study
Transcript to be found under BCS, The Chartered Institute for IT
1. The CBI is the UK’s leading business organisation, speaking for some 190,000 businesses that together employ around a third of the private sector workforce. With offices across the UK as well as representation in Brussels, Washington, Beijing and Delhi the CBI communicates the British business voice around the world.

2. The CBI welcomes the opportunity to respond to the call for evidence of the House of Lords Digital Skills Committee. Raising skill levels must be a core element of the UK’s long-term growth strategy – it enables business to compete in an increasingly competitive global marketplace and allow employees to progress to great, well-paid careers. Digital skills provide a route to a wide variety of high value, high skilled occupations and the importance of digital and other technological and scientific skills will continue to increase in the years to come.

3. In this submission we argue that:

- There is concern in the business community about employees’ IT skills and about employers’ ability to recruit people with higher level digital skills.
- Recent reforms to education and apprenticeships are a step in the right direction...
- ...but more needs to be done. Business has an important role to play – but this needs to be facilitated by government.
- The pathway to higher digital skills must be widened, but provision must be employer-led and responsive to the demands of the economy, not government mandate.

4. The UK has a world-beating digital economy. The digital sector directly contributes nearly £69bn to the economy and has seen employment growth at an average rate of 5.5% between 2009 and 2012. The sector will require nearly 300,000 recruits at higher skills levels by 2020 but nearly 20% of vacancies are already difficult to fill due to skills shortages. In the digital environment creative firms need a fusion of core STEM skills as well as skills in art and design. The creative industries contribute 6% to GDP, employ over two million people and are forecast to play a bigger role in coming years.

5. The pressure to find staff with the appropriate level of digital skills is forecast to grow significantly in the coming years. 83% of employers in hi-tech/IT industries anticipate increased demand for higher skills in the next 3-5 years. The majority of these businesses expect to find difficulty in recruiting as a result and are responding by increasing training for existing staff.

6. The CBI/Pearson Education and Skills Survey 2014 reported that 61% of employers are concerned about the level of IT skills in their current workforce – an increase from 56% in

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Evidence Report 73: Technology and skills in the digital industries, UKCES, September 2013
The creative nation: A growth strategy for the UK’s creative industries, CBI, January 2014
2008. The issue varies by sector, with public sector workers appearing particularly ill-equipped (86% of public sector employers reporting concern).

7. Businesses are working hard to improve the standard of their employees’ IT skills, with 39% reporting that they have provided remedial training for their adult staff in the past year (with substantially lower figures for graduate and school leaver recruits).

8. Employers report great difficulty in recruiting people into roles that require STEM knowledge and skills, including digital skills. See Exhibit 1 below. Employers also report that some STEM recruits also lack the appropriate attitudes and aptitudes for working life, and general work experience.

<table>
<thead>
<tr>
<th>People to train as apprentices</th>
<th>Technician-level</th>
<th>Graduate-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>In the next three years</td>
<td>21%</td>
<td>26%</td>
</tr>
</tbody>
</table>

*CBI/Pearson Education and Skills Survey 2014*

**Exhibit 1: % firms in Engineering, Hi-tech/IT and Science reporting difficulty in recruiting individuals with STEM skills and knowledge**

**Recent reforms to education and apprenticeships are a step in the right direction...**

9. The new school curriculum in England – which includes computing at Key Stage 1 and 2 and a new computer science curriculum at secondary – is a significant step forward. This change has the potential to develop the active, creative interactions with technology that will be fundamental to economic success – and to life in general - in the 21st century.

Employers need people who are not only effective users of technology, but who also able to innovate with it. Part of this goes beyond technical skills to the behaviours and competencies that can be developed by engaging with the digital process – such as resilience, curiosity and creativity. The inclusion of computer science as one of the science components of the EBacc should also encourage young people to continue their digital studies to GCSE level.

10. Reforms to vocational qualifications are also welcome. Business has long called for a gold-standard technical qualification to sit alongside A-levels at age 18 – and the new Tech Levels and Applied General Qualifications are intended to deliver this. The level of rigour that that government is expecting from these new qualifications is welcome - however, awareness of these is very low and we remain concerned by the potential for confusion about the role of these qualifications in the education system. With still more complex vocational options alongside the stability of A-levels, we fear that parity of esteem between academic and vocation routes is still some way off. We need to create vocational A-levels: different courses, differently examined, but at the same level of rigour and with the same brand. Ensuring that only high-quality, well-respected and relevant courses are classified should help ensure a higher value is placed on technical and vocational routes by teachers,
parents and students themselves – and such routes are key to encouraging more young people to study digital and other skills to a higher level.

11. The changes to the apprenticeship programme – which are aimed at putting employers in the driving seat – should ensure that apprentices develop the skills, knowledge and behaviours that employers need. The digital industry has already risen to the challenge of the reform programme and is trailblazing new standards that are more relevant to the needs of the sector, preparing standards for software developer and network engineer apprenticeships. The apprenticeship route has the potential to deliver a significant proportion of the digital skills that business needs but, if employers are to engage in the apprenticeship programme, that the system must be simple to use, work for businesses of all sizes and be well supported.

...but more needs to be done. Business has an important role to play – but this needs to be facilitated by government.

12. Business has an important role to play to encourage the development of the higher digital skills the UK economy needs. It is vital that provision of digital skills is focused on the needs of the economy rather than prescribed from the centre. To achieve this employer engagement is crucial.

13. CBI survey data shows that businesses are already working hard to engage and inspire young people. 80% of employers are involved with schools or colleges and 55% say their levels of engagement are increasing.\textsuperscript{132} This engagement takes many forms – but there is more that could and should be done to connect businesses and schools. Through inspirational speakers, for example, business can help provide a line of sight for pupils between their studies and possible future careers. They can excite and enthuse students about computing and digital technologies, encouraging them to pursue higher study.

14. It is crucial that more is done to enthuse girls and young women to consider careers that use digital skills. In manufacturing, for example, work is being done to inspire young women to pursue manufacturing and engineering careers. The Women in Manufacturing Ambassador Programme arranges for Industry Ambassadors to visit schools to provide information and positive role models. Women in Science and Engineering (WISE) similarly takes a pipeline approach, running inspirational workshops in schools. Jaguar Land Rover operates a “Young Women in the Know” programme, aimed at changing outdated perceptions of the engineering industry.\textsuperscript{133} The recently announced “Your Life” campaign to engage women in science and maths careers is another positive step.\textsuperscript{134} There is a need for programmes such as these in the digital sector, with computing careers, for example, still largely perceived as “male”. This is reinforced by recent EU research which shows that women make up less than 30% of the ICT workforce, comprise around 20% of computing graduates and less than 10% of app developers.\textsuperscript{135}

\textsuperscript{132} CBI/Pearson Education and skills survey 2014, July 2014
\textsuperscript{133} Engineering our future: Stepping up the urgency on STEM, CBI, March 2014.
\textsuperscript{134} See http://www.yourlife.org.uk/
\textsuperscript{135} See http://www.euractiv.com/sections/eskills-growth/employers-tackle-unpredictable-skills-mismatch-ict-sector-301938
15. Over half of engineering, hi-tech, IT and science firms are engaged with schools to promote STEM study. Some businesses are already working hard to make sure the transition to computing teaching is a success, for example, as illustrated in Exhibit 2. Much more support is needed, however, to give teachers the confidence to deliver classes in computing. 38% of businesses work with universities to provide students with “real-life” projects and resources. This kind of engagement is critical if students are to have a full range of career options available to them.

16. The poor quality of careers advice is a key concern, with a large proportion of employers reporting that young people are not sufficiently aware of the full range of career options and of the different pathways that are available. Good careers advice should support young people in navigating the wealth of information available, and in making informed decisions about the routes and options available to them. In line with this, it is becoming increasingly important that young people are getting this advice from an earlier age, as the number of vocational routes with entry at 14 increases.

17. Employer engagement in a reformed system of careers advice is key to ensuring the information young people receive is relevant, up to date and grounded in the realities of the labour market. It is businesses who are best placed to articulate what they are looking for in terms of skills, knowledge, qualifications and wider characteristics and behaviours. Government must work to facilitate this process, creating channels and structures to help bridge the gap between education and the workplace. We have made more detailed recommendations about the need to improve school and college connections with business through local brokers in our recently published Future Possible.

Exhibit 2: Efforts to support teachers delivering the new computing curriculum

Barefoot Computing
BT are collaborating with BCS (The Chartered Institute for IT) to provide cross-curricular resources to help primary teachers deliver computing classes, relating computing concepts to other subject areas. For further information visit http://www.bcs.org/content/conWebDoc/52225

Computing at School
CAS, another initiative from BCS, is supported by Microsoft. Microsoft have provided £334,000 to help train and support 50,000 teachers in the UK teaching computing in primary schools. CAS also provides a large number of other resources to promote computer science teaching. More information is available at http://www.computingatschool.org.uk

The pathway to higher digital skills must be widened, but provision must be employer-led and responsive to the demands of the economy, not government mandate.

18. The pipeline of digital skills must be widened. The simplest way to do this is by placing a special focus on encouraging more women to take up IT and computing subjects, a demographic currently massively under-represented. The CBI has previously called for

136 Engineering our future: Stepping up the urgency on STEM, CBI, March 2014.
137 CBI/Pearson Education and skills survey 2014, July 2014
138 Future possible: The business vision for giving young people the chance they deserve, CBI, August 2014
Davies-style targets for women taking digital skills-related courses at sixth form colleges and universities.

19. At the university level, funding and support strategies must reflect the importance of STEM. Sufficient resources must be dedicated to offering students in IT and computing the best possibility of progression into meaningful work, by making courses relevant for business and connecting students with industry. More must be done to encourage wider take-up. The long term value of studying IT and computing at university must be better advertised, as well as the number of varied careers to which the subjects can apply.

20. We must also expand existing routes and create new routes to higher level skills. This includes more high quality apprenticeships. This will require the reforms to put employers in the driving seat to be maintained. The provision of skills in the workplace cannot be mandated – it must be a response to the needs and demands of the market. The long-term health of the UK’s skills system requires that it works for and is responsive to demand from industry. It must genuinely be demand-led. The focus must be on quality not quantity – which is why mandating employers to recruit apprentices is the wrong approach. Apprenticeships must represent a genuine opportunity and provide a pathway into employment and tying recruitment to public sector procurement or to overseas recruitment would represent a significant step backwards.

5 September 2014
The CIoS LEP and Cornwall Council welcome the review of Digital Skills and the opportunity to provide evidence to the Enquiry.

**The changing technological landscape**

**What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?**

The pace is rapidly changing. It is impossible to tell how the digital landscape will change within 5, 10, 15 years. What is certain is that the growing number of embedded sensors collecting information about the world, and the rise of social networks that store the data people share, will generate immense quantities of information. There are suggestions that the amount of digital information created each year will increase to 35 trillion gigabytes by 2020, requiring 44 times more data storage than in 2009. (IDC, market research). We have been pointed towards Accenture, a leading digital trend company, as having a good view. They say:

- **Digital–physical blur**: Extending intelligence to the edge with smart objects, devices and machines
- **From workforce to crowdsource**: The rise of the borderless enterprise
- **Data supply chain**: Putting information into circulation
- **Harnessing hyperscale**: Hardware is back (and never really went away)
- **The business of applications**: Software as a core competency in a digital world
- **Architecting resilience**: "Built to survive failure" becomes the mantra of the nonstop business

Our expectation is that computing power will continue to grow and costs will continue to fall. We expect mobile internet coverage to reach 99% and well over 90% of the Cornish population to be using the internet regularly in less than 10 years. We expect the public sector to adopt a range of technologies to transform how it operates. This includes areas such as health, care, housing, policing and the management of energy production and consumption. We think the public sector will inevitably follow the paths set by manufacturing, banking, media and retail with greater use of the internet for transactional activities, greater automation of processes and greater use of analytics. For this reason we are currently developing a cross public sector ‘Digital Strategy for Cornwall’. We expect leading innovations in the public sector to include the uptake of big data to inform better evidenced commissioning decisions and a steady increase in the proportion of people wanting a greater role in managing their health and care.

**What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?**

The main challenge is a lack of confidence and a lack of skills. There are a number of nationally available papers which provide UK wide evidence on this topic:
What is the employment impact on the UK’s labour market? What are the regional differences?

The digital and creative sectors account for 6.2% of all businesses in Cornwall and employ approximately 14,300 people. ICT Digital businesses represent 4.6% of businesses in Cornwall and the Isles of Scilly compared to 9.3% in England. The broader impact that these sectors have on businesses across Cornwall (particularly in helping overcome any disadvantage of geographic isolation) makes these sectors particularly important to the overall economy.

- The digital and creative industries share of overall employment in Cornwall is approximately half the national average, but it is worth noting that between 2008 and 2011 employment in the sector grew by 6% compared with a drop of 3% in employment in the sectors nationally.
- Software activities are the largest sub-sector, with 30% of all businesses responding that they expect to grow and recruit additional staff over the next 1 – 3 years. For businesses with a turnover of between £300K and £1M 80% predicted growth.
- Estimated growth for these sectors (based on Adroit Economics/e Skills model) is at least 5.4% or 768 jobs, over the next 5 years.\(^{139}\)

A large scale evaluation of the economic impact of the roll-out of the Superfast Cornwall programme is currently underway and is the first evaluation of its kind to explore the economic impact of the roll out of Next Generation Broadband on British small and medium sized enterprises (SMEs). The evaluation gathers empirical data on the impact of the roll-out of fibre based broadband as it is taking place. The independent reports\(^ {140}\), produced by SERIO at the University of Plymouth, demonstrate how the technology is facilitating changing business practices and driving internet innovation, enabling businesses to overcome the difficulties caused by the region’s peripherality and poor road and rail connectivity and enabling residents to start-up businesses.

The latest report demonstrates that the Superfast Cornwall programme is on track to deliver 10,000 businesses connected, 5,000 jobs created and safeguarded and £218M GVA created and safeguarded. Although a small number of businesses surveyed attribute a proportion of job losses due to increased productivity through to fibre broadband, the report shows that there is an overall increase in jobs created. The evaluation report also shows that fibre broadband is allowing businesses to work in new and different ways (55% of respondents to the survey agreed) with about half (49%) of businesses indicating that it had allowed employees to work more efficiently from home or remotely. An unexpected impact is the

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\(^{139}\) Identification of Creative and Digital Skills Needs in Cornwall and the Isles of Scilly, July 2013 , Perfect Moment

\(^{140}\) Available at www.superfastcornwall.org/about-sfc/research-innovation/superfastimpact
start-up of residential businesses: of 220 residents surveyed to date, the latest evaluation report estimates that superfast broadband was a factor in the start-up of 11 businesses.

One other key issue is that of pay parity. There are nationally ‘set’ expectations for the remuneration of digital skills, led by the London market. However, these take no account of the regional variations in pay and in a much lower wage economy such as Cornwall this can be an issue. Equally, it is also why the LEP are keen to support and develop the economic growth potential of the sector locally as it can generate higher wage jobs and be a driver for wage growth in the local area.

Therefore the value and impact of the digital sector is significantly important to local economic growth and therefore should be supported effectively by the development of relevant skills.

**Future workforce**

What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

In a survey of the Cornwall ICT Digital Sector carried out in 2012\(^\text{141}\), a total of 86 businesses (68\%) reported that specific technical skills were required for future growth. Programming and internet skills were viewed as the most common technical skills required for the business to grow, with over a third of businesses reporting these as required skills. When asked to describe the technical skills required, 79 respondents reported a wide range of specifics. Those cited by four or more businesses included web development (11 respondents), PHP (7 respondents), SEO (5 respondents), SQL (4 respondents) and Java (4 respondents). The most common solution to address skills requirements was to undertake in-house training for current staff, reported by 57\% of respondents. Over a third of respondents said they would consider outsourcing the function in order to get the skills; this was considerably higher than the proportion who would consider recruiting people who would require training. Over 20\% of respondents reported that they might have to recruit from outside Cornwall to get the skills.

Availability of skilled ICT staff was a barrier to growth for 50\% of businesses in programming and other software sectors.

More specifically, a report\(^\text{142}\) produced by the Software Cornwall group identified the following:

"The top five skills identified by the contributors to this paper are:

1. Understanding and experience of modern software development process, in particular Agile
2. Broad understanding of the technical area involved – e.g. Web architectures, streaming

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\(^{141}\) Research into the Cornwall ICT Digital Sector to support future business growth, Adroit Economics

\(^{142}\) Developing Software Skills for Cornwall - A position paper by the Cornish software industry, November 2012, Software Cornwall
media, embedded systems, user interfaces
3. Specific experience and capability in particular development platforms – e.g. PHP, C++/Unix, Perl, .NET, C/RTOS
4. General problem solving and mathematical skills
5. Awareness of and commitment to the need for quality and security

It is worth noting that only one of these is a “hard” technical skill and it is often the case that someone skilled in one platform can transition relatively easily to another within the same overall level of development (switching from embedded C to .NET or vice-versa may take a little longer!). The critical thing is that the individual has a proper understanding of the fundamentals of software concepts and processes and the flexibility and willingness to learn.”

This report also assessed the current skills development provision in and near to Cornwall and concluded that it was both too low a level (provision in Cornwall being limited to Foundation degree) and that the various syllabi were old fashioned in content. They expressed similar concerns about the pre-HE teaching, with the GCSE IT curriculum neither delivering the basic skills required for future software engineers and programmers, nor exciting students about careers in IT. It is not clear how the new IT curriculum will tackle these issues at this stage.

The Software Cornwall group have proactively engaged in this and have held regular meetings regarding curriculum and content with the key providers and changes are visible. This requires ongoing work between the providers and companies to shape and develop the opportunities and teaching staff skills to move the curriculum towards a more useful industry accepted base.

Anecdotal feedback from non digital sector companies highlights the important on digital skills across sectors, as expressed by this comment:

The biggest area for demand in the last 12 months, and it is growing, is around the world of e-marketing and use of social media to support business activity. There is also a consistent demand (from the Tier 2 SME businesses mainly) for Computer Aided Design training at beginner, intermediate and advanced levels. This includes 2D and 3D, with mainly 2D the biggest requirement.

Cornwall Marine Network membership feedback
The support of this business activity requires both technical and ‘user’ skill sets in the workforce and must therefore form part of this debate.
How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

There are skills gaps nationally in the IT Digital sector, particularly in programming. This is in part due to a lack of knowledge within the labour market of the opportunities that this work presents for well-paid employment and in part a negative perception of the work. The key issue is the time lag between the industry needs and the skills development mechanisms. We recognise that the digital skills required by industry will always be ahead of both the Further and Higher Education supply as these institutions cannot move as quickly as industry would like. However, there are some fundamental flaws in the current delivery. Currently Computer Science and Software engineering courses (particularly degree level) produce an ‘engineering’, linear approach to software development, whereas the industry has moved to embrace the ‘Agile’ mechanism of working – this needs to be reflected in both the skills being taught and the approaches to teaching i.e. the use of real life agile base projects needed to develop the necessary teamwork, communication and working processes used consistently in the industry.

One recent example where the industry have proactively engaged in developing the future workforce is through a project funded by the ESF Skills Support for the Workforce Local response Fund. This allowed the companies to develop, fund and deliver a Summer School for budding software engineers. These included some ‘hobbyist’ programmers who had no formal training or experience; some college students on relevant FE courses and some A level students. The two week intensive ‘schooling’ included working on real projects with other company staff assisting and advising, and significant ‘expert input’. The teaching staff of institutions were also invited. It was treated as both a learning experience and as an extended recruitment process for the companies involved. The positives were that 4 job offers were made and accepted – allowing some to change career or to work alongside their formal studies. What became apparent was that those undertaking the formal courses were less able to fit into the ‘real work’ activity and floundered more significantly when asked to perform tasks. A full evaluation of the activity will be completed shortly, but anecdotal evidence suggests significant changes are required in both what and how these skills are taught through the post 16 years. This required financial investment (approximately £20,000) and significant staff time form the companies involved but it did test and prove a potential methods for encouraging and recruiting the future digital workforce.

How are schools preparing to deliver the new computing curriculum in an innovative way?

It is unclear how the new curriculum will both excite and encourage the uptake of digital careers – that can only be reviewed in time. However, work with the Software Cornwall group has developed a number of extra curricula activities that can support schools through the Cornwall Digital Technology Education Programme described below:

“Connected!”
A selection of the schools has been chosen as “pathfinders” and a programme of workshops and online coaching driven by businesses began in October 2012. The focus is on ‘teaching...
the teacher' using tools such as Raspberry Pi, Greenfoot and Scratch which are the new generation of systems designed specifically to teach computing in schools in the same way that the BBC Micro and LOGO kick-started the interest of a generation of programmers in the 1980's.

Coding Clubs:
Structured learning opportunities outside the timetabled day but that provide experiential learning push beyond the standard expectations and curriculum.

These activities again rely on the local companies to give time and resource, and for schools to have agreement at senior and teacher level. Our Education Business partnership have been instrumental in bringing the two together for the Raspberry Pi initiative and this coordination role that bridges the two worlds cannot be underestimated.

There is room to look to expand this activity beyond Cornwall but investment would be needed.

**How can the education system develop creativity and social skills more effectively?**

The majority of the digital sectors now work on Agile methodologies and through extensive teamwork. The common concepts of ‘client/contractor’ are often blurred and strong partnership, communication and team working skills are essential. These could be developed through the use of different teaching methodologies, and encompass digital information management skills; problem solving; creativity of thought; which are not necessarily supported through current curricula. Ongoing work with Plymouth and Falmouth Universities are seeking to embed these in the relevant degree course, but they need to be embedded throughout the education system. This was similarly reflected locally:

**There is a real need for employees who can marry together high level creative skills with high level IT skills.**

These skills will not only be necessary for the digital sectors, but increasingly in all areas of work and should become the underpinning basic skills we develop in our children.

**How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?**

As indicated above, there is a need to train beyond the technical skills and embed the concepts of ‘Agile’ practices, teamwork and creativity in digitally related areas (and potentially others) would be welcomed.

In addition we would like to see more of the specialist development opportunities exemplified by dBS in Cornwall (http://dbsmusic.co.uk/cornwall/). This project uses the world of digital music to encourage young people to develop skills applicable across a wide range of digital sectors. It has had huge success and has increased its take-up of young people from an original cohort of 30 to over 300 a year. These young people would not be attracted by the world of programming/software development and yet those skills are those which are being developed and expanded.

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144 Identification of Creative and Digital Skills Needs in Cornwall and the Isles of Scilly, July 2013, Perfect Moment
Similarly, increased activity around the ‘gaming’ sector at Falmouth University is bringing different young people and skill sets into the wider digital industry and is to be supported.

We believe that an effective Apprenticeship route from level 3 to level 7 would also add value – using a model similar to the Chartered Engineer route developed by SEMTA, we would welcome the development of a ‘Chartered Software engineer route. This would not only encourage a more workplace and vocational approach to the skills development, it would give the software engineering sector a higher, culturally valued professional place. Software Engineers will, we believe, be as important and Doctors and dentists in the future and the professional recognition of this career path will make it attractive to high calibre students, backed up with a vocations route for those who prefer to learn through more practical methodologies and in the workplace.

**Short- and medium-term support to the digital sector**

**How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?**

Findings from the Identification of Creative and Digital Skills Needs in Cornwall and the Isles of Scilly report indicated the following:

“Many businesses are confident of their own technical and craft skills, but struggle to recruit additional staff with those skills.

This may be in part a reflection of the difficulties faced by micro-businesses in training up appropriate staff. It is also worth noting that across Europe reports have indicated that an over-concentration on degree level qualifications is causing a shortage of technical skills. Interestingly, there is currently virtually no take up of apprenticeships in this sector which is one of the government’s key initiatives to address possible skills shortages.”

When asked about how companies wished to train their staff, messages similar to those from other sectors came out:

- Training delivered in an intensive pattern (and not through long courses)
- Access to expert driven training not just based on the existing accreditation models - Only a third of the sector are interested in accredited training and of those who are interested in accredited training the highest interest is in vocational training (44%), degree or equivalent (33%), statutory – health and safety etc. (30%)
- Online learning is growing but businesses also value peer-to-peer learning

Through project work and the relationship built between individual employers and the supply sector, this is being addressed but is not currently recognised as a valid skills activity by national skills systems.

Other models to meet the existing skills gaps that are being trialled in in Cornwall include:

- Increasing the pool of adult talent (i.e. movement between sectors)

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145 Identification of Creative and Digital Skills Needs in Cornwall and the Isles of Scilly, July 2013, Perfect Moment
- In house ‘trainee/apprentice’ processes i.e. start as a software tester and move up through in house support to developer
- Bringing staff in from other parts of the EU (and world)

Is there a need for increased high skills immigration in the short-term? What are the implications of this?

Companies in Cornwall have experienced the difficulties of immigration to meet skills gaps – this has led to many companies no longer looking beyond the EU due to cost and processes required. There will be a need to enable companies to manage this more effectively, whilst changes to the proposed skills system take effect.

Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

The Government have launched a UK Digital Inclusion Charter as they recognise the lack of basic digital skills and capabilities applies equally to UK businesses and charities. The Governments Digital Inclusion Strategy includes evidence on all aspects of inclusion, including businesses and the VCS. They have also noted organisations involved in supporting businesses with their digital capability, Tinder Foundation being one of them, which our local libraries engage with.

There is an inclusion agenda in relation to digital skills in the workplace. Evidence for this, in Cornwall, has been provided by a recent survey of the Voluntary and Community Sector which identified ‘improving IT skills’ as one of the sector’s ‘top three’ priorities. Across health and care – which are industries with a high proportion of women and those in part-time employment – we have also identified that developing better digital and analytical skills is a priority as digital technologies become more commonplace.

There is no specific approach to addressing digital inclusion across the whole workplace. National funding sources to support digital inclusion initiatives, such as SFA and ESF, largely target those seeking work and neglect the need to upskill the existing workforce. They are also qualification driven, whereas digital inclusion requires a focus on confidence building and gaining basic skills in using IT equipment and the Internet.

ONS quarterly Internet usage statistics suggest that 15-20% of adults in Cornwall and Isles of Scilly have never used the Internet; however these statistics do not identify employment status of those surveyed. A large digital inclusion initiative has been underway in Cornwall as part of the Superfast Cornwall programme, funded by BT’s Get IT Together programme and also supported by ERDF. In three years the programme has helped more than 3,000 people to develop basic IT and Internet skills. Based on data available for nearly 1,000 of these learners, the vast majority (75%) were retired, and only 10% were in employment.

148 Research into the Voluntary, Community and Social Enterprise Sector (VCSE) in Cornwall and the Isles of Scilly, December 2013, Transform Research
Cornwall and Isles of Scilly Local Enterprise Partnership – Written evidence (DSC0054)

Research\textsuperscript{149} undertaken by Citizens Online shows that approximately 70% of these learners went on to become regular Internet users after this training.

What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

Cornwall has a strong foundation of partnership working, and this has underpinned the success of digital inclusion initiatives in the county. The Superfast Cornwall programme itself is a partnership between Cornwall Council, BT and the EU. Digital inclusion initiatives have been coordinated between the Superfast Cornwall programme team, Cornwall Council, DWP, social housing providers and numerous community and voluntary organisations to design and deliver basic digital skills provision to those that need it. The Library Service is also an essential resource in providing a safe and welcoming environment to new IT users.

The third sector plays a vital role in identifying members of their community or organisation that are in need of support and providing a venue that can be used to host beginner IT sessions. The Superfast Cornwall Volunteer Network has been developed to coordinate the involvement of over 50 digital volunteers who play a key role in providing additional support at a community level.

The LEP and its Employment and Skills Board have already been instrumental in bringing together employers with skills providers and funding opportunities (see the example cited in question 5) and this dialogue must continue and prove productive. Influencing the curricula followed and opportunities available at school, FE & HE is a crucial role for industry groups as much on a local level as a national; Software Cornwall came together because, as employers, they shared similar issues. They predict that there will be an additional 200+ software jobs available in Cornwall by 2020 and the collective approach we are now taking will help meet that significant challenge.

Industry

What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

The 2012 study of the ICT digital sector in Cornwall found the most common barrier to growth as the speed of broadband, with 43% of businesses reporting this. Businesses were asked specifically about the impact of superfast broadband. Almost 80% reported that they expected it to improve productivity and over 50% expected it to increase their competitiveness. This is reflected in the latest results from the evaluation of Superfast Cornwall, in which more than half of businesses (51.8%, 116) agreed that superfast broadband had enabled their business to grow, and for 40.6% (91) it had already helped to generate new sales, business contracts and access to new markets or customers.

A wider survey also undertaken in 2012 of over 650 businesses in Cornwall (across multiple sectors) identified that the most important potential uses of superfast broadband included enabling home/remote working, reducing carbon footprint, website design and accessing international markets. When asked how they would like to find out more about these topics, the majority of responders interested in finding out more identified e-learning or fact sheets

as their preferred learning method. Less than 10% were interested in attending training courses or workshops. These results suggest that releasing staff to attend external courses is a barrier, and that businesses would prefer to be able to access resources to learn new skills in their own time.

How can businesses help equip the workforce with new skills in a rapidly changing environment?

Please see our response to Question 9

Infrastructure

Does the UK have a competitive infrastructure to support a knowledge-driven economy?

How does the UK compare to other countries?

Nationally, the UK has a very good digital infrastructure. There is very good coverage of superfast broadband, and the government is running the BDUK project to tackle areas of market failure. This aims to provide 95% of superfast broadband by 2017.

Cornwall is fortunate to be ahead of the curve in terms of superfast broadband rollout, and EU funding has already helped deliver 90% fibre broadband coverage (95% by mid-2015). Longer term, Cornwall is aiming for 99% coverage by 2018.

Organisations consulted and involved in supplying information to this response:

CloS Local Enterprise Partnership Employment and Skills Board members

including:

- Cornwall Council
- Cornwall Chamber of Commerce and Industry
- Department for Work and Pensions
- Cornwall Marine Network
- TUC

Others:

- Superfast Cornwall
- Software Cornwall

Reports cited:

- Identification of Creative and Digital Skills Needs in Cornwall and the Isles of Scilly, July 2013, Perfect Moment
- Superfast Cornwall report (available at www.superfastcornwall.org/about-sfc/research-innovation/superfastimpact
- Research into the Cornwall ICT Digital Sector to support future business growth, Adroit Economics
- Developing Software Skills for Cornwall - A position paper by the Cornish software industry, November 2012, Software Cornwall
- Research into the Voluntary, Community and Social Enterprise Sector (VCSE) in Cornwall and the Isles of Scilly, December 2013, Transform Research
4 September 2014
Creative Skillset (Sector Skills Council for the Creative Industries) – Written evidence (DSC0095)

Creative Skillset (Sector Skills Council for the Creative Industries) – Written evidence (DSC0095)

Introduction:
1.1. Creative Skillset empowers the Creative Industries to develop skills and talent; it does this by influencing and shaping policy, ensuring quality and by securing the vital investment for individuals to become the best in their field and for businesses to grow. As the industry skills body for the Creative Industries, we work across film, television, radio, animation, visual effects, games, fashion, textiles, advertising, marketing communications and publishing. www.creativeskillset.org

1.2. We welcome the Committee’s focus and inquiry into Digital Skills across the UK economy. Our particular focus is on the vital digital skills issues of the Creative Industries, one of the high-growth sectors for the UK economy. For this call of evidence, we have headlined key issues for our digital industries with links to some further evidence and information.

1.3. Given the centrality of digital skills for our industries, we would welcome further communication with the Committee and we would be available for oral evidence.

Government and industry partnerships for skills:
1.4. The Creative Industries have been identified as a key sector for the UK Economy; it is a sector of the economy where high-level digital skills (what the Committee has recognised as the “specialist skills needed to build and maintain a digital environment”) are vital and integral to its existence, growth and competitiveness.

1.5. Creative Industries play a key role in the Government’s industrial growth strategy: Creative Industries Council (CIC) has been convened as a joint forum between the industries and government. CIC published the industry’s strategy for driving growth, Create UK in July 2014. The strategy calls for Government and industry to work in partnership to achieve success and growth. Creative Skillset leads the work of the Creative Industries Council’s skills group.

1.6. Parts of the creative industries have entered an industrial skills partnership, managed by Creative Skillset, and set up a strategy that addresses vital skills issues in the workforce, as well as across the talent pipeline (entry and progression into the industry). Currently, Government and key sectors of the creative industries co-invest in the skills partnership to support growth and innovation through new skills solutions and partnership arrangements and, crucially, through co-investment models. However, this co-investment covers certain sectors only, or has time and geographical limitations.

150 See information on Creative Industries Council: https://www.gov.uk/government/groups/creative-industries-council
151 See link to the full publication of the Create UK - the creative industries’ growth strategy: http://www.thecreativeindustries.co.uk/resources/create-uk
Digital high-level skills issues

1.7. As demonstrated by the recently published (and updated) Creative Industries Economic Estimates (January 2014)\textsuperscript{152} the Creative Industries (CIs) have the potential to drive significant growth. The extension to tax credits for sub-sectors of the CIs is partly an affirmation of this potential. However, the on-going and rapid development and diffusion of new digital technologies, coupled with globalisation and the emergence of new competitors such as China and India, mean that the UK’s creative sector must ensure skills and talent issues are addressed in order to stay ahead. This will require innovation and agility, as well as consistent investment in the skills and talent that will drive creative business success.

1.8. The issues we headline relate to:

- Ensuring that we address the fitness of purpose at all stages of our education system to systematically and strategically build a ‘skills and talent pipeline’ from schools, further and higher education.
- Developing and extending new co-investment models to ensure that we address existing and future skills gaps and shortages so that our technical, craft and creative workforce is always ahead of the digital curve and so that our business and production companies are not impeded by skills blockages.
- Supporting business development by focussing on the managers, leaders and entrepreneurs who will grow companies of scale and in turn increase jobs and overall industry growth.

1.9. Digital technology has transformed the landscape and the content production process in many parts of the CIs reducing costs and barriers to entry, disrupting long established business models and supply chains from digital downloading in music to e-books in publishing. These require companies to diversify and innovate new business models. But the sector is dominated by very small companies (84% of media firms employ under 10 people) who are not always connected to the sources of innovation and investment or to research and technology expertise. There are also sub-sectors with high-levels of freelancers who are also finding it difficult to update their skills (cost/time constraints and availability of niche training). Moreover, the education system is not always conclusive to creating skillsets that could support the development of such models; inherently there is still a ‘siloed’ approach to education that makes it difficult to combine science/technology, creative and business related skills and learning.

1.10. As Creative Skillset research\textsuperscript{153} monitors the needs for our industries, there has been over the last 8 years an increasing demand for “fusion skills”; fusion skills is the combination of creative and digital/technical skills together with entrepreneurial skills\textsuperscript{154}. The key to success is that these different skillsets are not developed separately but they are


\textsuperscript{153} See Creative Skillset research available: http://creativeskillset.org/about_us/research

\textsuperscript{154} First time this term was coined (in our knowledge) was in The Fuse report by then CIHE, now NCUB. It is a term used more in creative & digital industries context to demonstrate that when creativity and technology are mixed, new business models follow. Creative Industries are not just the only sector of the economy that sees the development of fusion skills as a key comparative advantage. There is already competition for people with fusion skills across the economy.
Creative Skillset (Sector Skills Council for the Creative Industries) – Written evidence (DSC0095)

integrated within the business. It is not just a case for a software engineer at the technical department of a company; in a creative future-proof company they work together with a team of creative and business leaders and understand the work of each of them.

1.11. The industrial strategy has prioritised this point. The need for fusion and digital skills for the Creative Industries to remain competitive was highlighted in the Create UK strategy; the industries are talking with DfE, BIS and DCMS on the following:

**Schools:**
- Ask that the Ofsted inspection framework requires all schools and wider education providers to evidence their commitment to a broad and balanced curriculum including opportunities for young people to study a fused combination of creative, technical, scientific and entrepreneurial subjects. Ofsted should be required to produce an annual assessment report for the CIC to show progress on this commitment.
- Support the teaching of creative subjects, Intellectual Property awareness, computing and enterprise/business skills in the school curriculum.

**Careers for young people:**
- Celebrate and promote the spread, breadth and value of the creative industries for learners, parents and educators by: (examples)
  - Connecting existing organisations such as STEMNET, Speakers for Schools and Inspiring the Future with creative industries ambassadors and speakers; and
  - Industry adopting schools and strengthening direct partnerships at a local level.

1.12. Creative Skillset has worked closely with our industries to develop fusion skills in new entrants and the professional workforce of the industry. The ‘fusion skills’ concept is integrated in the Creative Skillset Tick provision (industry approved and accredited provision for Apprenticeship programmes and Higher Education courses). The industry is also developing an education strategy to maximise the role and expertise of both further and higher education in developing clusters/regionally, national and sectors and supporting new industry based research. Creative Skillset has also developed fusion principles within the new Apprenticeship Frameworks, as, for example: the Higher Apprenticeship in Interactive Design and Development. We need to expand this and ensure all training provision is developing fusion skills.

1.13. However, the one of the biggest challenge for the Creative Industries remains in the need for high-level specialist digital skills fused within the creative business context for the existing workforce and those just entering it. For this challenge, co-investment on skills between the government and industry is crucial to develop programmes and support that can be innovative, relevant and flexible.

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155 See Creative Skillset Tick and courses/apprenticeship provision: http://courses.creativeskillset.org/
156 See example of Apprenticeship frameworks: http://creativeskillset.org/who_we_help/young_creative_talent/wayscreative_industries/creative_skillset_apprenticeships/432 higher_apprenticeship_in_interactive_design_and_development
1.14. For the last year, Creative Skillset and DCMS/Treasury have pioneered a new investment model via the **Skills Investment Funds (SIF)**\(^{157}\): The funds channel, via an industry-led commission of specialized training provision, collected investment in the training of the workforce based on industry identified key skills gaps and shortages in sectors such as VFX, Games and high-end TV. The emphasis is on creating the UK as the source of world beating skills as well as energizing growth and inward investment through fiscal incentives.

1.15. £32 million combined co-investment has been made available over two years (2014-15 being the second year) to re-skill and up-skill the film, high-end TV, visual effects (VFX), animation and computer games workforce. These are creative sectors with tax breaks but also with critical skills gaps and shortages, which could be exacerbated due to increased demand and impede growth.

1.16. **There is need and appetite for more.** Creative Skillset Skills Investment Funds (SIF) is one model but **what is needed is an industry-Government co-investment strategy which could also address other sectors’ urgent workforce needs** (due to the rapid impact of technology), **as well as spatial rebalancing and gaps** (to support also key digital infrastructure developments). This is why the industries we work with have been asking to **extend and make permanent the Creative Skillset Skills Investment Funds (SIF) and development them within the framework of a co-investment strategy that can support the industrial partnership for skills.**

1.17. An example of how important and urgent these skills issues are is from the visual effects industry (VFX). The VFX sector currently has 17 occupations in the Shortage Occupation List (which influences decisions on migration of workers in the UK). Please see Appendix below for a list and the rationale for this inclusion.

1.18. **And, finally, we need to support our businesses to grow.** Skills and training must play a part in developing the capacity of the leaders of business to embrace technical and creative opportunities to exploit our natural assets and existing regard globally. In the recent report **Brighton Fuse**\(^{158}\) a new type of business has been identified, known as ‘superfused’, combining creative, digital and business skills to achieve growth figures almost three times as fast as other businesses and ten times that of the British economy overall. ‘Fused’ and ‘superfused’ businesses are finding intense competition and major skill gaps, and are more likely to face barriers recruiting skilled talent than other firms.

**More references and further evidence for the Committee**

1.19. Creative Skillset Research pages list our Censuses, Workforce Surveys and the latest employer panels reports which provide useful information on skills gaps and shortages: [http://creativeskillset.org/about_us/research](http://creativeskillset.org/about_us/research)

1.20. CBI’s **Creative Nation** Report – a strategy for the Creative Industries – confirms growth estimations, the important need for fusion skills, mentions the work that Creative Skillset

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\(^{157}\) See information on Creative Skillset Skills Investment Funds: [http://creativeskillset.org/who_we_help/creative_businesses/skills_investment_funds](http://creativeskillset.org/who_we_help/creative_businesses/skills_investment_funds)

\(^{158}\) See Brighton Fuse report: [http://www.ncub.co.uk/reports/the-brighton-fuse.html](http://www.ncub.co.uk/reports/the-brighton-fuse.html)
Creative Skillset (Sector Skills Council for the Creative Industries) – Written evidence (DSC0095)


1.21. Creative Skillset’s **Fusion Skills** report (Perspectives and Good Practice) provides a short analysis of the nature of fusion skills in the creative industries and lists some models of good practice in order to develop these skills: [http://creativeskillset.org/assets/0000/0230/Fusion_report.pdf](http://creativeskillset.org/assets/0000/0230/Fusion_report.pdf)


**Appendix**

[We have included a short Appendix on SIF and the current Occupations Shortage List, but we could provide the Committee with more information upon request]

1. **The Skills Investment Funds (SIF) – a short introduction**

Originally set up to manage film industry investment, the SIF channels industry and government investment to support training and skills development in film, high-end TV, animation, games and VFX. The Government is co-investing up to £16m to match industry investment, leading to a total of £32m over two years. The SIF has catalysed significant change in the creative industries falling under its remit, including:

- Putting in place five sector skills councils comprising senior industry representatives to advise on priority industry needs;
- New voluntary levies in high-end TV and animation and collective arrangements in other sectors.
- Raised a total of £9,654,866 from industry (levy and match investment);
- Engaged employers to design new systems and training interventions;
- Placed trainees within companies, and supported employer-specific training interventions for companies via Challenge Fund;
- Invested (so far) £2.21 million for Nations and regions training initiatives;
- Triggered systematic research to identify skills gaps and shortages.

2. **Shortage Occupation List (Migration Advisory Committee) - an example and case study for visual effects industry**

The UK is a recognised global centre of excellence for the production of high-end, sophisticated visual effects (VFX) work increasingly being featured in films, commercials and television programmes, and is widely acknowledged as the most important hub for VFX production after Hollywood.

VFX is still a relatively young industry, which is going through both a period of significant growth in volume demand and a constant re-invention of the technology and workflows necessary to create increasingly complex effects. This explosive growth in world-wide
demand for VFX means that UK companies are also compelled to compete internationally to gain access to the very limited pool of intensively skilled and highly experienced labour necessary both to deliver large projects and to train junior staff.

There are currently seventeen (17) occupation roles relating to the VFX industry that sit on the Shortage Occupation List. The number of migrant VFX workers brought in via the Tier 2 (General) route is small relative to overall headcount but these non-EEA, highly skilled professionals are immensely important, both in terms of the UK’s ability to attract and deliver high value, inward investment feature films, and in terms of the creation and protection of indigenous UK jobs.

The VFX industry is working closely with Government and with Creative Skillset to address this issue. But it should be noted that some of the skills interventions will take some time for the impact to be noted. For example, it will take around ten years for the first tranche of students of the new Computing GCSE curriculum to emerge from higher education. And, after entering the industry, it takes several years to become a skilled practitioner.

The currently 17 VFX roles on the Shortage Occupation List.

<table>
<thead>
<tr>
<th>SOC 2010 Code</th>
<th>SOC Group</th>
<th>VFX Job Titles</th>
<th>Skill Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>2135</td>
<td>IT Business analysts, architects and systems designers</td>
<td>Systems Engineer</td>
<td>NQF6+</td>
</tr>
<tr>
<td>2136</td>
<td>Programmers and software development professionals</td>
<td>Software Developer, Systems Engineer, Shader Writer</td>
<td>NQF6+</td>
</tr>
<tr>
<td>3411</td>
<td>Artists</td>
<td>Animator</td>
<td>NQF4+</td>
</tr>
<tr>
<td>3416</td>
<td>Arts officers, producers and directors</td>
<td>2D Supervisor, 3D Supervisor, Computer Graphics Supervisor, Producer, Production Manager, Technical Director, Visual Effects Supervisor</td>
<td>NQF6+</td>
</tr>
<tr>
<td>3421</td>
<td>Graphic Designers</td>
<td>Compositing Artist, Matte Painter, Modeller, Rigger, Stereo Artist, Texture Artist</td>
<td>Individual roles – NQF4+; Occupation - lower</td>
</tr>
</tbody>
</table>

11 September 2014
Creative Skillset (Sector Skills Council for the Creative Industries) – Oral evidence (QQ 205-209)

Evidence Session No. 16    Heard in Public    Questions 205 - 209

TUESDAY 28 OCTOBER 2014

Members present
Baroness Morgan of Huyton (Chairman)
Earl of Courtown
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Lucas
Lord Macdonald of Tradeston

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Examination of Witnesses

Dinah Caine, Chief Executive Officer, Creative Skillset (Sector Skills Council for the Creative Industries), and Saint John Walker, Head of Development, Creative Skillset (Sector Skills Council for the Creative Industries)

The Chairman: A bit of housekeeping first. You have a list of interests that have been declared by Committee members that were declared back in July. They are also in the transcripts. This is a formal evidence-taking session of the Committee and a full note will be taken. This will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you can revise any minor errors that are within that. This session is on the record. It is being webcast live and will subsequently be accessible via the parliamentary website. You are very welcome to submit any supplementary evidence, and particularly because we are slightly at the tail end of the morning, if we end up a bit tight and you want to send us some further stuff, that is extremely welcome. We all need to speak up pretty clearly because the acoustics are okay but not brilliant. That is by way of introduction. I am going to ask you to introduce
yourselves. If you want to make any opening remarks, that is fine; otherwise, we will kick straight into the questions. Ms Caine?

_Dinah Caine_: My name is Dinah Caine. I am Chief Executive of Creative Skillset, which is the industry’s body for skills in the creative industries. I also chair the skills and education work of the Creative Industries Council, which has developed and is leading on industrial strategy for these industries. This is my colleague.

_Saint John Walker_: My name is Saint John Walker. I am the Head of Development at Creative Skillset. I look after designing skills solutions for the creative industries.

_The Chairman_: That is great. Do you want to make any opening remarks or shall we head straight in?

_Dinah Caine_: In the interests of time, just very briefly, the evidence and the views that we bring to this session—thank you very much for inviting us, by the way, to give evidence—very much stem from our work interfacing with employers across the creative industries and taking recommendations and analysis that fed into the development of the creative industries strategy.

Q205  _The Chairman_: Thank you very much. To kick off, we wanted to meet you this morning because we have heard intermittently quite a lot about the importance of creative industries during the course of this inquiry as an important driver for the UK’s growth and competitiveness. Just define for us, if you would, the level of the importance of creativity and how the creative industries can be supported better both nationally and locally going forward.

_Dinah Caine_: Okay. That is quite a big question.

_The Chairman_: A big, broad question, yes.

_Dinah Caine_: If we can take that in chunks, then maybe people might want to press pause buttons and intervene as we are going through those chunks.

_The Chairman_: Absolutely, yes.

_Dinah Caine_: Okay. The creative industries at the moment are growing faster than any other sector and I think that is important to put on the record. It is very much now working under a definition that I think, interestingly for this Committee, brings together all the industrial codes that relate to what you previously might have thought of as the creative industries—film, TV and so on—but also, critically, the codes that relate to IT software development and so on. I think that represents the growing convergence that has been going on between what would historically be known as IT industries and what would historically be known as the creative industries.

_The Chairman_: Can you give us any figures? You said it is growing, but any figures either now or that you can send to us to nail that down would be helpful.

_Dinah Caine_: Absolutely. The growth statistics?

_The Chairman_: The growth and the numbers employed, yes.

_Dinah Caine_: Yes, absolutely. We have worked very closely with DCMS on all of that. We can give you detail on the GVA figures and growth.
The Chairman: That would be very helpful. If you can send us some of that, it will be very useful.

Dinah Caine: Yes, we will do. In terms of what is critical for skills, the interface with employment, to give you some idea of scale we now estimate and using the new definition of the creative industries, within those industries there is employment of around 1.5 million people. Critically, about 750,000 of those are working in areas where they are using mainly their creative skills to progress their employment, and the balance is basically would be called non-creative. Of course, in the middle of that there is a definite convergence, because at the end of the day everybody needs to have a certain level of digital skills to operate within the economy. Everybody needs creativity to operate within the economy, and then basically, drilling down from that, you will get different combinations.

On top of that—again, I think this is important for the work of this Committee—in other industries outwith what you would call the creative industries, there is also employment of creative occupations. That is what we would call the more broad creative economy. At the moment, we estimate that somewhere between 700,000 and 750,000 people work in, for example, banks but are doing a creative/fused role. I will come on to the fusion concept in a minute. Those are the employment statistics. The growth ones we will share and send afterwards.

The Chairman: Thank you. In terms of local and national, what is needed?

Dinah Caine: In terms of local and national, clearly the balance of these industries tends to be heavily based in London and the south-east, but the interaction of technology in and of itself with these industries should be enabling the ability to increasingly decentralise, which I think is an important point.

Also, going back to the Creative Industries Council and a concept that I am not sure you have heard talked about in the evidence that you have been given yet, certainly we in the industry and the employers recognise that in order to fuel growth it is absolutely critical that we develop generations through talent pipelines from schools onwards that present a new fusion of skill sets, basically. By that we mean a fusion of creative skills, technical/scientific skills, technical excellence and entrepreneurship. You will have heard and I am sure will have received a lot of evidence about STEM. There is a big focus on STEM, quite rightly, but STEM in and of itself and addressing STEM in and of itself will not capture what we believe to be a golden triangle of skills needs that need to inform the development of the 21st century workforce, not just for the creative industries but for the broader economy. Obviously, depending on occupation, the actual proportioning of those three elements will be different, but we are not good in terms of our talent pipeline at enabling those two things. I would point you to Eric Schmidt’s MacTaggart lecture a while back where he was talking about the importance of bringing arts and science together and looking back to the Victorian era where engineers were also artists. If we look forward—and I like the way Nesta puts it—we need to bring these disciplines together and at all levels of the education system, from the school curriculum design to university business links. The lamb of the arts and humanities must lie down with the lions of digital technology and computer science, which I think is just beautifully put. I had to get that on the record.

The Chairman: Yes, that is very good.
Q206 Baroness Garden of Frognal: You have talked about and I think you have pretty well covered the question of the interdependence between digital skills and creative skills. Perhaps you could say a little more about how and who creative industries recruit. Is it from universities, from schools, or are you using much more general pools of talent?

Dinah Coine: I will answer that and then perhaps I will also hand on to my colleague, Saint John, so that he can supplement some of the things I have been saying, because he is more into and an expert on more of the detail of this.

As a set of industries, the creative industries still massively recruit from higher education. We recruit roughly 60% on average from higher education, and of that a considerable percentage, over 20%, have postgraduate degrees. That is the average, but it will differ sector to sector. In some sectors within the creative industries, it goes up to nearly 80% or 90%. That issue, I think, relates to our industry’s diversity, fair access and reaching out to the brightest and best in society. A lot of work has been done recently and is still being done both to encourage the uptake of apprenticeships in the industry and to really work on ensuring that graduate internships are paid internships. That is the first thing to say.

The second thing to say is that we need to do a lot more work on further education. That also links across solidly to our work on apprenticeships. Saint John, do you just want to amplify on that?

Saint John Walker: Yes. I think Dinah is perfectly correct. HE is the motor for the creative industries because of the high level of skills that are needed, especially for innovation within the creative industries. The digital industries particularly are very highly skilled. The MA/MSc is becoming more of a standard than the degree. There are issues of access, of course, in getting new talent pipelines. If you only have HE, you are only getting academically gifted people no matter how practical the course. We have been trying to rebalance that by creating a higher level of apprenticeships that are more open to people and to give them the same levels of high-level digital skills. We have created a couple of apprenticeship frameworks, as they were called, on interactive design and development, deliberately to try to get these people, who are not academically gifted but may be in their bedsit doing amazing work, access into the industries. HE is the main motor. However, the spread has to be wider to balance. We are also working with HE to create new kinds of work-based learning so that it is not just academia over there and apprenticeships over there, but rather HE coming together with apprenticeships to create new hybrid forms that work for businesses.

The Chairman: From what you said about master’s being almost the norm, does that mean that HE is not thinking enough about what its first degrees should be either? Does the content of first degrees need to be looked at?

Saint John Walker: Again, it varies. There is a huge variation across the creative industries for the honey pots, if you like. We have had to do work with employers to create a form of quality assurance to ensure that our employers get the right kind of talent. We have something called the Creative Skillset Tick, which is a signposting of quality across our creative industries, so that anybody who works in the creative industries knows which HE institutions are the best to recruit from, but potential students are also a lot more aware of where they need to go if they are to get real world and contemporary skills. We have a system of quality assurance that we have initiated for a number of years now to work that way.
Creative Skillset (Sector Skills Council for the Creative Industries) – Oral evidence (QQ 205-209)

**Dinah Caine:** It very much started focusing on film and television, but it is now extending more broadly. Indeed, Glasgow Caledonian University has one of our Ticks for its MA in TV Fiction Writing course. I just thought I would mention that as a link to a member of the Committee.

**The Chairman:** Yes, a little plug there.

**Dinah Caine:** Interestingly, this approach is also going to be another critical way to start to try to encourage this whole integration and fusion. Of course, as we know, universities, schools and so forth still tend to put all these things that we are talking about into different departments; although not completely: there are really good examples of those that are not doing so but look into something more interdisciplinary such as Abertay and Ravensbourne. But usually you get the computer school, if you like, and then the business school.

**The Chairman:** Yes, it is all separate.

**Lord Macdonald of Tradeston:** One question on apprenticeships. I saw a figure—I think it was for the cultural industries—that suggested that out of 500,000 apprenticeships last year only 1,000 were in cultural industries.

**Saint John Walker:** The number is larger than that. I think it is 4,500.

**Dinah Caine:** It is 4,500 now (across the cultural and creative industries), but you are absolutely right. If you were to look back even two or three years ago, it would be about 1,000. We probably have one of the lowest numbers of apprenticeships of virtually any sector in the economy. That has to be and is a really big drive at the moment, but it goes back to Baroness Garden’s question about the fact that we have tended historically to rely on recruitment from higher education. It is interesting, when I talk to colleagues in other industries, even in the IT industry where they have significant skill shortages and problems attracting people into some areas, that the creative industries have always tended to have oversupply. That can also have its own problems, and one of those problems is that there has been a tendency to seek to get graduates who potentially will work for very little to start off with. It does not necessarily mean that it is the best fit for the right skills, talents and people we need as a set of industries. I think people are beginning to recognise that.

**Saint John Walker:** Yes, and I think there is a really important point to make here. The apprenticeship vehicle if you like, the format of apprenticeships, is a bit difficult for small companies. Eighty-four per cent of our sectors have under 10 people with no big HR departments, so it is very hard to organise apprenticeships. They also work on a short-term project basis, so the risk of taking somebody on for 12 months minimum is problematic. We need new ways of collectivising our employers so that they can take advantage of apprenticeships.

**Q207 Lord Holmes of Richmond:** Good afternoon. I think this is as close as it is possible to get to a rhetorical question while still hoping that you may choose to give an answer. You have pretty much answered it anyway, so feel free to give a yes, although just making the tick sign equally is good. Should we be prioritising creativity and the arts in the curriculum alongside digital skills?

**Dinah Caine:** Absolutely, yes: a huge tick with bows on. A creative tick, actually, without question. Indeed, if we can draw the recommendation to the Creative Industries Council and the skills and education section to your attention, it is a complete priority. There are real
Creative Skillset (Sector Skills Council for the Creative Industries) – Oral evidence (QQ 205-209)

concerns at the moment about the school curriculum and developments around schools. I have to say at this point that there are some examples of evidence, but I am not basing this on full evidence yet - we are trying to collect that but would point to the fact that it is disincentivising schools from engaging with and delivering creative subjects, both within school timetable and outwith the school timetable. That goes hand in hand with careers advice issues, which I am sure you have heard from other people who have given evidence. The combination of those two things means that the very thing that I started talking about at the beginning—the desire to see mainstreamed from playground to pension a balance between creativity, digital, technical and, indeed, we would say, the entrepreneurial piece—is unbalanced at the moment and we firmly believe it needs to be addressed more fully so that we can have the next generation of people able to drive the economy forward.

Saint John Walker: I think it is really important that creativity is not seen as siloed in the arts. It should be embedded throughout the curriculum. It is there in science. It is there in all subjects. You need that curiosity and you need that inventiveness. It is what the UK is very good at. We are a creative nation.

Q208 Lord Janvrin: I will not ask the obvious question, which is: can inventiveness be taught? The question in my mind is: how can you involve industry, the corporate world, in the education of creativity in its broadest form?

Dinah Caine: Do you mean specifically schools?

Lord Janvrin: In schools, but I am really interested in lifelong learning. You talked of playground to pension.

Dinah Caine: Playground to pension.

Lord Janvrin: That is the world we are in.

Dinah Caine: Absolutely.

Lord Janvrin: How do we get industry involved in this?

Dinah Caine: In many ways that is significantly our role, particularly, as Saint John was saying, with very large numbers of SMEs that are fragmented and with industry based on high levels of freelancing. That is a particular challenge. Nevertheless, we have seen some excellent examples in recent years of the industry coming together to work in a variety of ways such as introducing levies and so on.

As far as schools and careers are concerned, this is our big priority at the moment for the Creative Industries Council and for our work. While there are individual pockets of activity going on where employers are partnering with certain schools and so on, we believe that in a connected way and in a collaborative way we can arrive at more than the sum of our parts. At the moment, we are auditing everything that is already taking place. Then we are going to look at how we connect all that potentially under one brand that sits under the Create UK one, where we start to look jointly across the creative industries.

The other thing is that although we talk about fusion, the creative industries also tend to work in silos, so we need to do more to create fluidity across the sectors. In a connected way, we then start to really harness, both digitally online and offline, a more co-ordinated address from our industries such that it is much easier for schools and colleges to know
where to go to, to know where they can get speakers from, to know where they can access information. That is going to be taking place over the next 12 months.

In terms of further and higher education, we are working very hard behind the quality kitemark of the Tick that Saint John was talking about. Where courses get that Tick, they already—let us use Glasgow Caledonian as a good example—have good relationships with industry, but certainly there are people who may aspire to that tick who will then work to make sure that they have those relationships. That will happen on a local basis, going back to your question, Baroness Morgan, about a more national and international basis. The Tick then also drives co-ordinating support from industries to focus on those institutions and courses, equipment sponsorship and so on rather than—as you know, there is a significant amount of courses in this space—defusing the industry’s support. Does that answer your question?

**Lord Janvrin:** Yes, it does. Thank you.

**Q209 Lord Macdonald of Tradeston:** Is there one key suggestion that you would recommend that this Committee should make to Government, a suggestion that Government could take up to improve UK competitiveness in respect to digital skills? How would you make that happen and have you any idea how much that would cost?

**Dinah Caine:** Well, I certainly think that the current approach, which I have to say was first engendered in the last days of the Labour Government with work by Lord Mandelson and John Denham, is key. That is to say that the skills piece needs to be seen as an integrated part of an industrial strategy. Absolutely key is the work on the industrial strategy that is going on and which now I think commands all-party support ahead of the next election. Skills are being seen as key to that, absolutely. I say that because in the past skills policy has tended to march to the beat of its own drum. If we have business over here, we have a whole machine doing skills over there. We are now starting to see the two being integrated, because at the end of the day in austerity Britain—I will come on to the amount in a minute—if we are going to crack the skills issue, it has to be industry employers who lead that agenda.

To follow that through, I would say that the current patterns of industry investment being used to co-invest with industries, where industry is collaborating to address some of the key hotspot issues that have been identified through the industrial strategy, that co-investment should follow the industries. It should be niche to meet the needs of the industries or the progression of digital creative skills. Within that, without repeating where we were, I therefore think that there is a particular address to schools, to FE and to HE that flows through to enable that. We have done quite a lot of assessment of the levels of co-investment that we believe need to flow into the industries, which will then, we believe, create a kind of supply side response, which will deliver to driving jobs and economic growth.

**The Chairman:** If you want to send us a short note on that that would be helpful.

**Dinah Caine:** Would that be helpful? Without going into the detail of how we have arrived at that?

**The Chairman:** Yes. That would be helpful. The other thing that I think would be helpful to the Committee is a short description that is really usable of what we mean by creativity. I
think people use it in a very loose way and it would be very useful for us to get a clear definition.

**Dinah Caine:** Yes, a definition of what creativity is, and a definition of fusion, perhaps, would be useful for you.

**The Chairman:** Yes, it would be very helpful. Thank you very much. I am sorry it has been such a rush.

**Dinah Caine:** No, not at all.

**The Chairman:** We were very keen to make sure that we squeezed you in.

**Dinah Caine:** Thank you very much.

**The Chairman:** Anything else you want to send us we would be very pleased to receive.

**Dinah Caine:** Okay. Well, we consider ourselves squeezed and we are very, very grateful for that opportunity. Thank you very much.

**The Chairman:** Thank you very much.
Creative Skillset (Sector Skills Council for the Creative Industries) – Supplementary written evidence (DSC0116)

**Creativity**

Creative Skillset agrees with Sir Ken Robinson. “I define creativity as the process of having original ideas that have value”.

Creative skillset believe value is added by manifestation through skills.

Sir Ken Robinson goes on to say: “It’s a dynamic process that often involves making new connections, crossing disciplines and using metaphors and analogies.

Creativity is about fresh thinking. It doesn't have to be new to the whole of humanity – though that’s always a bonus – but certainly to the person whose work it is. Creativity also involves making critical judgments about whether what you're working on is any good, whether it's a theorem, a design or a poem. There are various myths about creativity. One is that only special people are creative; another is that creativity is just about the arts; a third is that it's all to do with uninhibited "self-expression". None of these is true. On the contrary, everyone has creative capacities; creativity is possible in whatever you do, and it can require great discipline and many different skills”.

We also note that Creativity is recognised as a high order thinking skill in key Educational taxonomies. In Blooms taxonomy of Cognitive skills, he talks of the nascent learner moving through stages of Remembering, Understanding, Applying, peaking with Analysing, Evaluating and Creating, or Synthesis.

Noted Learning Theorist Howard Gardner in his celebrated work “5 minds for the future” outlines the specific cognitive abilities that will be sought and cultivated by leaders in the years ahead. Drawing on decades of cognitive research and rich examples from history, politics, business, science, and the arts, Gardner lists these as:

- The Disciplined Mind;
- The Synthesising Mind;
- The Creating Mind;
- The Respectful Mind;
- The Ethical Mind.

**Teaching Creativity**

- Creative subjects should be on an equal level as the sciences.
- Creative skills can be applied to sciences – creativity is beyond the boundaries of the teaching of creative subjects.
- Creativity has a socialisation agenda, helps learning and boosts engagement with the world; makes us curious.

Where does creativity meet digital skills?
The Substitution Augmentation Modification Redefinition Model offers a method of seeing how computer technology might impact teaching and learning. It also shows a progression that adopters of educational technology often follow as they progress through teaching and learning with technology.

Creativity is infusing every stage of the model. So need to prioritise awakening people’s creative abilities alongside technical ability.

**FUSION SKILLS**

Our industries increasingly demand for “fusion skills”; fus **on skills is the combination of creative and digital/technical skills together with entrepreneurial skills**

“Business and enterprise is the multiplier effect that makes STEAM into Fusion.... Fusion is STEAM exploited”

Creativity and Technology have always been fused, but what the internet and ubiquitous cheap technology did was create a third crucial element - that of new business practices, new ways to leverage and value cultural production, and exploit it. The entrenched middlemen and gatekeepers were either routed from the industry, or sensibly co-opted the networks and new business models. They were the first fusion pioneers, who saw that there was only a profitable alchemy when technology and art were combined with enterprise and new business skills.

159 First time this term was coined (in our knowledge) was in The Fuse report by then CIHE, now NCUB). It is a term used more in creative & digital industries context to demonstrate that when creativity and technology are mixed, new business models follow.

160 See also [http://creativeskillset.org/news_events/blogs/2680_fusion_does_it_add_up](http://creativeskillset.org/news_events/blogs/2680_fusion_does_it_add_up)
3. Creative Industries definitions – learning from the new DCMS Statistical Data release\textsuperscript{161} (on definitions developed in partnership with NESTA, Creative Skillset and Creative & Cultural Skills):

- The \textit{Creative Economy}: includes the contribution of those who are in creative occupations outside the creative industries as well as all those employed in the Creative Industries.
- The \textit{Creative Industries}: a subset of the Creative Economy which includes only those working in the Creative Industries themselves (and who may either be in creative occupations or in other roles e.g. finance).

4. Creative Economy employment: 2.55 million jobs in 2012 (1 out of every 12 jobs in the UK). IT, software and computer services was the largest Creative Economy group – that is the area of employment where one can find a large number of creative occupations.

5. Creative Industries employment: 1.68m in 2012 (5.6% of the total number of jobs in the UK; employment in the Creative Industries increased by 8.6% between 2011 and 2012 (a higher rate than the UK Economy as a whole – 0.7%).

6. Gross Value Added (GVA from 2008 – 2012: Creative Industries GVA was £71.4 billion in 2012 and accounted for 5.2% of the UK Economy). It increased by 15.6% since 2008, compared with an increase of 5.4% for the UK economy as a whole.

7. GVA of the Creative Industries increased by 9.4 per cent between 2011 and 2012, higher than for any Blue Book industry sector in the National Accounts. The value of services exported by the Creative Industries was £15.5 billion in 2011, 8.0 per cent of total UK service exports.

8. How many digital businesses/jobs depend on creative skills or are part of creative industries sector?

- There is a very high level of crossover between the creative industries and the digital/IT industries – 490,000 working across both. This represents 33% of those working in the creative industries and 66% of those working in the digital/IT industries.¹⁶²
- 48% of companies identified gaps in technical skills (e.g. computer programming) and 46% in skills in using software packages.¹⁶³
- 43,050 individuals working specifically in interactive media¹⁶⁴; NOTE: The Interactive Media sector covers a range of specialist companies and jobs including the design and development of web sites and web applications, online content, offline multimedia experiences, mobile applications and content, and interactive television. The sector fulfils a key support function in the wider Creative Media Industries as well as other industries. This role clouds measurement of the sector’s output and importance - as Creative Skillset notes: Interactive Media is becoming more of a discipline than a sector.
- Technical development (e.g. software engineer, developer, programmer) was identified as the most common hard to fill vacancy by creative media companies (27%).¹⁶⁵
- Digital Imaging Technicians were identified as a key skills shortage by 27% of film production companies. Digital Asset Management (28% of companies) and art department software skills (18%) were amongst the most common skills gaps in film production¹⁶⁶.
- Example of changing jobs in Post Production: the most salient issue to emerge was a major difficulty finding people in the role of edit support or edit assistant. This is increasingly a data management role involving ingestion of material and assistance with the digital workflow – and increasingly far removed from the traditional edit assistant role in the pre-digital days. The problem is in finding people with the necessary mix of

skills as the role requires a technical understanding of audio and video as well as increasingly sophisticated IT and data management skills.\textsuperscript{167}

\textit{24 November 2014}

\textsuperscript{167} Creative Skillset Skills Needs Analysis in TV, Sept 2014, http://creativeskillset.org/about_us/research
In 2013, heritage tourism in the UK was worth an estimated £26.4bn\textsuperscript{168} to the British economy; and of the nearly 100,000 students studying historical and philosophical studies in the UK, 9% of them were international students drawn to the UK in large part by the strength of the British heritage sector.\textsuperscript{169} Historical studies helps to power British culture and the British economy. But to sustain this position, the next generation of university history graduates will need a high degree of technological literacy, and in some cases, advanced skills.

A familiarity with coding and data management comes as a standard component of many ‘STEM’ subjects. But, these same skills are also needed by historians and other humanists. Unless we are encouraged to teach our undergraduate historians how to manipulate data, critique information presented online, and use digital tools to create effective analyses and arguments, they will be ill-prepared to serve their role in a wider economy – both in the heritage sector, and in the many knowledge-based employments in which our graduates work.

Within our universities, an increasing number of research projects have substantial ‘digital’ components – anything from website design to advanced custom software built to implement large-scale analysis of ‘big data’. And many university historians are already learning the basics of data-mining and web development. But these skills have not trickled down to the undergraduate curriculum.

By actively promoting technological skills amongst humanities graduates, and working alongside the universities which are leading the way in this area, the government can help to ensure that Britain’s next generation of workers in the heritage industry, and in the wider economy, will be equipped for a future in which a broad base of skills will be essential.

Practical suggestions:

A) Incorporate history and technology in to the conversation:

The government could do much more to ensure that its programme for technological skills recognises and promotes the development of these skills amongst humanities students and scholars, by simply including history amongst the subjects it regularly cites. This is about using inclusive language, and ensuring that the significance of digital literacy for all subjects is recognised. At the moment, the tendency to focus exclusively on ‘STEM’ subjects in government publications undercuts the ability of universities and


Adam Crymble, Professor Tim Hitchcock and Dr Jane Winters – Written evidence (DSC0021)

individual academics to commit future time and investment to developing technical

skills training.

B) Ensure the technical component of historical projects can be assessed as a valid form of 

‘research’:

The current History ‘Research Excellence Frameworks’ (REF)\textsuperscript{170} panel has no single 

member with a background in digital history that would allow them to assess the 

research content and wider contribution of a web resource. As a result, many early 
career scholars worry that incorporating digital methodologies in their work will 
disadvantage them in relation to both jobs and internal promotions. By mandating 
national research assessment programmes to recognise the importance of digital work, 
government can effectively intervene and ensure that historians and humanists will be 
more likely to pursue these methodologies, and to embed them within the 
undergraduate curriculum.

These sorts of simple (and inexpensive) interventions would go a long way towards 
supporting the development of new undergraduate skills programmes and new 
collaborations, both across disciplines, and between universities and the private sector. One 
aspect of ‘digital history’ is that it almost inevitably encourages collaboration between 
humanists and computer scientists; and between the university sector and the private 
sector. Embedding history \textit{and} technology, digital skills and humanist skills in the discussion 
would help to support an increasingly important and vibrant corner of the academy – and 
the economy.

\textit{29 August 2014}

\textsuperscript{170} “Research Excellence Framework”, REF 2014: Research Excellence Framework. http://www.ref.ac.uk/
Evidence Session No. 14  
Heard in Public  
Questions 173 - 191

TUESDAY 28 OCTOBER 2014

Members present

Baroness Morgan of Huyton (Chairman)
Earl of Courtown
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Lucas
Lord Macdonald of Tradeston

Examination of Witnesses

Witnesses: Stephanie Daman, CEO, Cyber Security Challenge, Nick Coleman, Global Head of Security Intelligence, IBM Services, and Hugh Boyes, Cyber Security Lead, The Institution of Engineering and Technology

Q173 The Chairman: Thank you for joining us this morning. I will do a bit of a preamble before we start properly. You have a list of interests in front of you, which have been declared by the Committee at previous meetings in July, and they are also in the transcripts. This is a formal evidence-taking session of the Committee and a full shorthand note will be taken. It will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you will be able to revise it in terms of any minor errors. This session is on the record. It is being webcast live and will subsequently be accessible via the parliamentary website. You are very welcome to submit written supplementary evidence after the session. Indeed, if there is something where we are interested in receiving some extra information from you, we will ask you during the session as well. I am reminded to get everybody here to speak up reasonably well so we all hear each other and we get a good recording. That is by way of preamble.
Cyber Security Challenge, IBM Services and The Institution of Engineering and Technology – Oral evidence (QQ 173-191)

I am going to ask you to introduce yourselves and if you wish to make any opening remarks, please do so. If you do not want to, that is completely fine and we will go straight into the questions. You will find that on some of the questions you may all want to say something, on others you will not, and that is completely fine, so we will just play it by ear as we go along.

Ms Daman.

Stephanie Daman: Good morning. I am Stephanie Daman. I am CEO of Cyber Security Challenge UK, which is a small not-for-profit. Our mission is fairly straightforward: it is to get the right number of properly qualified people into the cybersecurity profession. The way we do that is utilise competitions to identify talent and then award job type ready awards to help people get into jobs. So we are talking courses, we are talking things like that. My background is mixed. I had a government background for a long time and then I worked for HSBC in the private sector, so I have both sides of the house.

The Chairman: Thank you very much. Mr Coleman.

Nick Coleman: Good morning. I am Nick Coleman, Global Head of Cyber Security Intelligence services at IBM. I am also an Honorary Professor at Lancaster University and, previous to that, I was with the UK Government as the national reviewer of security and authored the Coleman Report.

In terms of what I am going to start with this morning, the challenge of cybersecurity skills is changing; it is a fast-moving market. I think technology is evolving quickly. Therefore, some of the challenges of cloud, of big data analytics, allowing us to do new things in different ways are also creating a challenge for security, so, while we enjoy the benefit, we are doing that. That is a challenge for the citizen and for all of us as we consume services. As I see it, it is a challenge for business and government leaders in having to understand what risk means to their organisation. It is also a challenge of how we get enough information security, professional cybersecurity professionals available to create a vibrant economy in the UK and internationally.

The Chairman: Thank you very much. Mr Boyes.

Hugh Boyes: Good morning. My name is Hugh Boyes. I am the Institution of Engineering and Technology’s Cyber Security Lead. I am also a Principal Fellow in the Cyber Security Centre at the University of Warwick. I have a mixed background of both public and private sector, so I have a fairly good understanding of cybersecurity across the board. The work I do with the IET is principally around the skills agenda and spreading knowledge within the engineering and technology base, trying to encourage engineers to understand the cybersecurity issues that affect their jobs.

Q174 The Chairman: Thank you very much. That was a very helpful introduction. Let me start with a bit of an overarching question, which is probably fairly obvious but just to paint the picture for us properly. We have heard from various witnesses in the last few weeks that cybersecurity is terribly important and it is imperative for all of us. It is imperative for all of us as individuals to stay safe. It is also imperative for business to be competitive. Can you just explain for us, in relatively simple terms, why does cybersecurity matter? How significant an issue is it for us and where do you see the gap in the UK at the moment on cybersecurity? Is that increasing or not? Who would like to start? Mr Coleman, shall I start with you?
Nick Coleman: Sure. I think that it is a challenge for all of us. It is a challenge where, if I look at the landscape, in the last few years we have seen more sophisticated, targeted attacks for a different number of motives from a variety of sources. That is principally a concern for our critical assets and protecting them, so that our energy, our banking system and all of our assets continue to run as we would expect them to and do not get disrupted. There is a secondary concern, which is associated with the loss of intellectual property and what our critical assets are and making sure those are protected. What we have seen is an increase; as we have seen an increase in digital, we have also seen an increase in attack.

To put this into perspective, looking at operational data from across the monitoring base that IBM does, we see that mid to large organisations would face about 91 million security events a year. If you think about it in terms of your environment, your house perhaps, it would be 91 million rattles at the door or the window. From that, we have to get down to identifying the 100 or so significant incidents, where—if I take the analogy of your house again—somebody might be in your house or might have taken something from you. We are getting a lot of data, about 91 million events, down to having to look for the 100 or so things that are critical. When I talk about those cyberattacks, that is what we are talking about.

Therefore, in the context of skills, this is a new threat horizon for some, and some have done a lot of work in critical infrastructure stuff and others are still maturing their approach. Some people are struggling to build their capacity. Again, that comes down a little bit to the users and the people who are both customers and citizens, and all those interfaces, as well as the business and the technical skill.

The Chairman: Thank you. Ms Daman.

Stephanie Daman: Yes, I suppose I would characterise it perhaps a little differently. If you look at our lifestyle these days, everything is based on something that is connected to the internet, whether it is your banking, whether it is paying your tax, whether it is doing your shopping; everything at the bottom has an internet layer. Unless we make sure that that internet layer is properly secure, then none of us is going to have confidence in using it and that will ultimately affect our prosperity, because that way lies prosperity. At the moment, in my view, the real difficulty is that we do not have a sufficient number of properly skilled people to do that protection piece.

The Chairman: Is that because people do not want to go into that part of the business, or is it that the general high-level skills that are needed are so sought by so many people that there are not enough people to go around?

Stephanie Daman: I think it is a mixture of both. That second point is certainly true; there are not enough people with those skills. If you start thinking, “Why are there not enough?” you need to look back into our education system and what we have been doing over the last number of years.

The Chairman: Yes, we have been looking at that.

Q175 Lord Macdonald of Tradeston: Given that risk management is now such a rapidly growing area, and so well rewarded in places like the City, that is surely also true of cybersecurity. The money is there, but are people just very difficult to train? Is it so complex that there is a bottleneck there?
Stephanie Daman: Certainly the money is there and certainly the careers are there. On the face of it, it should be a very popular thing to be doing, but the skills are not there and there is a gap. I call it the lost generation: because we did not teach this specifically in schools, we have a generation of youngsters who went away and taught themselves. If you go away and teach yourself, you do not realise there is a career there. As an organisation, a lot of what we do at the moment is reaching out to try to find those people and trying to persuade them that their future should be within the profession. A lot of them do not have formal qualifications, though, so we are also backfilling on formal qualifications. There is a big gap, but there is no doubt there are good jobs there.

The Chairman: Let me pick up on that a bit further, because it is quite interesting. You take people without formal qualifications, so with A levels perhaps, or with a different degree altogether.

Stephanie Daman: Our competitions are based around skills in cybersecurity. We do not ask about previous academic qualifications in any way. It is all to do with your skills in this subject, and if we find you are very skilled, we will try to give you the things that you need to get into the profession. But I think you have raised a very relevant point. A lot of big organisations like to have those formal qualifications—a degree, an A-level—and if you do not have those you do not even get your foot across the door.

The Chairman: Yes. Thank you. Mr Boyes?

Hugh Boyes: Stephanie has mentioned the personal use of the internet and the threats that we face in that space. The area that I am particularly interested in is the whole manufacturing, energy production, transport base, where increasingly that connectivity is used for critical services. If we look at things like the smart grid, smart buildings, these all rely on internet-type technologies. It is not the internet as we know it but it is using the technology, and that commercial technology is fundamentally flawed. It is often very badly configured and the skills for configuring it are quite sophisticated. When we unpack a computer out of the box, it does not come out ready to use as a secure device. It needs hardening if we are to protect it. Those skills need to be taught and it is that problem that we face. We are short of IT-skilled people anyway. IT is often seen as a bit of an accidental career. You may start out doing business studies, engineering, a whole raft of subjects, and then you end up migrating into it. Of course, what we are lacking there is the underpinning knowledge. For example, how does the internet work? What is TCP/IP? How do you secure it?

Q176 Lord Giddens: How much is known about who the cybercriminals and cyberhackers are? Do a significant portion of them have professional qualifications and become rogue agents or are they mainly amateurs? If they are amateurs, I suppose they are more easily outwitted. In reference to the question about the City, is there a grey area where hacking merges with unjustifiable risk, where people are taking risks like they did in the City, which cannot be justified but are not exactly criminal? Is there an analogue to that?

Hugh Boyes: Let me tackle your second question first. Certainly the question of risk is quite an interesting one. Last week, I was briefing a—

Lord Giddens: It is fundamental, is it not?

Hugh Boyes: It is, but it is a case of: how do you get people to understand it? I was working with a team of executives for an SME last week, explaining to them some of the risks. Half an
hour into a two-hour session, a number of them were reaching for their phones to turn off apps after we had told them, “Do you realise what that discloses about you, your behaviour, your personal information?” They had not realised that. It is this “free to use”, “free to download” and the risk that comes with it. Once we explained the risks to them and they understood what it takes to secure their enterprise, they were saying, “Yes, we need to do that. We need to protect our IPR. We need to protect our communications”. But it was that process of taking them through the questions: what are the risks? What are the challenges? Why should you do this? They got the message and they understood it. You asked: who are the cybercriminals? Potentially, cybercrime is extremely lucrative, so it could easily be somebody who is IT trained.

Lord Giddens: It has to be, does it not, if you are really skilled?

Hugh Boyes: Not necessarily. Some of the best hackers are self-taught, so when we look at—

Lord Giddens: No, I mean the rewards you can gain could be gigantic. You can see that.

Hugh Boyes: Exactly. But where you get the talent to create the malware, to do the hacking, it is not necessarily IT professionals. It can be the teenager who decides that that is far more challenging and interesting to them than adopting a normal career.

Lord Giddens: No, I wonder if anyone has done any systematic studies of who they are, or is that not possible? It is also global. You can hack from anywhere. It is not like normal crime at all any more, is it, because of the intensely global nature of everything.

Hugh Boyes: Certainly there are suggestions that in certain countries professionals are being used to target UK assets. That is no secret. The Government says that is an issue, that that is part of the nation state threat to our assets.

Lord Giddens: But would it be true to say that mostly we do not know who they are then?

Hugh Boyes: I suspect the Government knows who they are. I do not personally.

Lord Giddens: No, I meant us organisationally because normally, if you are dealing with criminals, you have some surveys that tell you who they are and where they are located and what their likelihood of committing further crimes is, but when it is global and electronic it would seem to be much more difficult.

Nick Coleman: To some extent, you can look at their homework so that, when you see an attack and when you do the investigation, you can understand some of the skills. Some of them are formally trained and some of them are informally trained. It is a global issue—I think there is no doubt about that—and people are increasingly skilled in different ways. There are different groups who have different motivations and some of those skills will be attractive to different groups in different ways. You certainly can see a maturity of the skills in that I think, if we go back five years, people were trying things in their bedrooms and that seemed to be the exciting stuff. This has matured on to where we are talking about a targeted situation, a criminal issue, and these people are relatively well organised now. They almost have businesses with a common structure. They have people who look after HR. They have people who look after finance. These are properly run organisations in some respects, so much more sophisticated.

Stephanie Daman: I think law enforcement has some idea of where these groups are and how they operate. But, like everybody else, law enforcement is suffering because they cannot recruit properly skilled people with the matching skills to bring some of these
networks down. There is some knowledge but actually moving that to deal with it is more difficult.

The Chairman: The capability, yes.

**Q177 Lord Haskel:** We are interested in the digital skills of the population as a whole. Are you satisfied that, when digital skills are being taught, people are made aware of all of these things that we are discussing at the moment? Would you think that that is an important part of teaching digital skills to the population as a whole?

**Hugh Boyes:** With digital skills, and certainly with cyberskills, we need to be quite clear that there are different layers of skills. At a personal level, we all need some of those skills. We need to be aware of how to be safe online; we need to understand what risky behaviour is.

**Lord Haskel:** Is it being taught at the moment?

**Hugh Boyes:** Schools are trying, but you have to remember that an awfully large percentage of the population is outside the school system; they are outside formal education and they are often not aware of the threats that the new technology brings with it. When you then move into people in their working lives, we see regularly events where their behaviour online and their behaviour using their corporate IT puts them at risk. That is a space where, effectively, businesses and employers need to look at providing the education and training.

**Stephanie Daman:** I think it is very patchy in the schools, and I think a lot of that is down to teachers not knowing what and how to teach. There is a huge need to rectify that, otherwise we are going to have patches where digital skills teaching is very good and other patches where it is very poor.

The Chairman: We had a very long session on teaching last week and it was absolutely clear it was very patchy.

**Q178 Baroness Garden of Frognal:** I think you have answered quite a lot of the questions I was going to ask you about the cybersecurity skills shortfall. Just continuing on this theme of what is taught at school, we are aware that there is a new computing and digital syllabus now being introduced. Would you consider that the aspects of cybersecurity should be a key part of that syllabus when it is being taught, and generally are universities preparing young people, if it is universities where the shortfall is needed? Ms Daman, I was interested in what you were saying about your skills competition where you are not looking for specific qualifications but are trying to assess the skills without that. How do we move that aspect forward?

**Stephanie Daman:** Certainly within the schools there is a curriculum. To my mind—and I suspect to my colleagues’ minds too—it is absolutely vital that cybersecurity is covered in the right sort of way. I also agree with my colleague, Hugh, that there are different layers of skills. In my view, one thing that is happening is that we are beginning to teach safety at the lower levels and we are beginning to teach cyber at the higher levels, but I think we are perhaps missing some of the linkages in between. We understand there is a difference between safety and cybersecurity, but I am not sure whether schools understand that nuance.

**Baroness Garden of Frognal:** Yes, there is a big movement for safety online, to try to make sure that children are aware of cyberbullying and those aspects of things.
Stephanie Daman: Yes, there is.

Baroness Garden of Frognal: But you are saying it is not then a seamless curve up to the more sophisticated levels.

Stephanie Daman: Exactly that. There is not a seamless curve and increasingly, from my knowledge and from our own schools’ programme, which we have within the Challenge, I feel that this is a missing link. We are not being very helpful to the schools by making that particular division. Although we understand what it is, I am not sure it is very helpful for the schools, because that just confuses the issue. But, yes, it is absolutely vital that it should be taught at those levels.

Hugh Boyes: If we are looking at the teaching outside of schools—so in FE and HE colleges—one of the big gaps is the way we teach coding, so a fundamental part of cybersecurity is the quality of the software we write. The Government has been investing some money in a thing called the Trustworthy Software Initiative, and we are trying to make progress in injecting core skills, core knowledge into university curriculums, but it is quite slow progress because it is quite hard work.

The Chairman: At the moment, it tends to be an add-on rather than integral to the course?

Hugh Boyes: Yes. Certainly from the IET’s perspective, we would like to make that integral. We are keen to encourage any accredited degrees—whether we accredit them or the BCS accredits them—to deal with the question of good-quality coding, not just teaching them how to code, but how to defensively code, because that will reduce our risk.

Nick Coleman: If you have teenagers or you are trying to do it at primary school, of course they are busy talking to their fellow friends and understanding and getting ahead of the technology often of the teachers and of the parents. This is not just a challenge at school; it is also about the whole environment and where you get those skills. That comes down to the adult population as well. So I do not think it is just in schools; it is a society challenge and I think we have to make it very practical. For me it is how we use services. You log on to a banking service or an electricity provider online, or you are going to get a smart meter, and if it comes as part of that education and part of you using the service I think it is very powerful. If we have it as an add-on later it is very, very difficult. We still have to do that education, but I think we missed—

The Chairman: It is sort of boring, yes.

Nick Coleman: It comes with the car, it comes with the service and you get it as part of your life. I think that is where we have to move to.

The Chairman: That is very interesting.

Q179 Lord Lucas: Karen Price of e-skills said to us, when she gave evidence, that she was concerned that we were very bad at bringing returners and career changers into tech occupations. I see you have some very interesting competitions and a MOOC on your site. What is out there that would enable someone, say, who has a career as a nurse—and, therefore, is pretty careful and exact in what they do and is the sort of person who will pick up the faulty software in the example you give on your site—to click on to the idea, “Maybe I can make this conversion”? Then what course do they do afterwards that industry will regard as serious enough that they would take the risk of picking up that person and training them? Is there that route and can it be created for adult returners and career changers?
Stephanie Daman: I do not think there is an obvious route. There are ways of doing it. I suppose I would say this but we have some people who have no background in this subject at all who start playing our competitions because they are interested in playing competitions. I have one person particularly in mind who started with us about a year ago. He was very interested in the subject and started playing the competitions. He did well, moved through the competitions and ended up at our finale at the end of the year. He was immediately picked up by a number of employers who could see he was very skilled. He had that great mix of good technical skills but also that ability to translate that into business risk language. He is now in a cybersecurity job with a large bank. That is a perfect example of somebody who came to it not because they had qualifications; they came to it and transitioned. In many respects, it is career transitioners who will save our skill shortage because, much as we want a pipeline, you have to have people who are going to transfer now. For example, we have been doing work around people coming out of the armed forces, taking the skills that they have, which are huge, and moving into this space. But certainly I am not aware of an obvious pathway. There is not one.

Nick Coleman: There is certainly an MSc in cybersecurity and there are now four Government-recognised centres of excellence who are teaching MScs in the UK for universities. We are starting to see people who have, for example, a scientific background—perhaps in biology or chemistry or something like that—looking at cyber because it is popular and then using the master’s level as a route in. That is a recognised entry level into a more professional or advanced layer into an organisation. Of course, we have the challenge of getting the right graduates who are STEM ready and cybersecurity ready. We also have a challenge at the professional advanced layer, where frankly we do not have enough people there either. This route with the master’s level starts to form someone quite well with a discipline, which helps.

The Chairman: Mr Boyes, I do not know whether you have anything, do you?

Hugh Boyes: Just picking up on what Stephanie was saying about the skill sets, one of the interesting challenges with cybersecurity is not just about technology. There are significant people and process aspects, so this is about being able to communicate how to behave, how to improve your system design. It is an area that we often overlook. We think of cybersecurity as being deeply technical, whereas it is quite a broad subject.

Q180 Lord Macdonald of Tradeston: Building on this, I see here that last year the National Audit Office reported that it would take the UK 20 years to close the cyberskills gap. Given the almost existential risk, which you alluded to in terms of a critical national infrastructure, we cannot wait 20 years. Is there some emergency task force way of pushing this through and getting a quicker, perhaps even dirtier, solution rather than waiting for 20 years for the educational system to slowly deliver the talent?

Nick Coleman: I think we have to do both, in some respects. We have to build the set of skills, through competitions, through university education. I am also involved in getting it involved in MBA programmes, so starting to get it on business degrees, taught in business language, so we are starting to broaden that pool of people. In parallel we are moving to new models that will address some of it, such as cloud computing, where you will be able get in to and access infrastructures that have security designed in that have some of those controls. One law firm said to me that previously they had one person in their IT department and they had no idea what they were doing. They moved to the cloud and that gave them
Cyber Security Challenge, IBM Services and The Institution of Engineering and Technology – Oral evidence (QQ 173-191)

standard operating procedures, it gave them a whole level of cyberskills that they could not have accessed on their own. I think it is partly the skills and partly the technology evolution that will help.

**Stephanie Daman:** I think it is also innovation: being innovative, stepping outside the box. We have apprenticeships starting, we have new training courses, and we have competitions. I think we need a variety of different ways to encourage people to get into this subject. We do not need to throw out all the old ways of doing things, because that would be very foolish and quite unnecessary, but I think we need to accept that this is a subject where the old ways of doing things do not necessarily work. I am coming back slightly to the HR expectation of formal qualification or university degrees. If we want people with the skills, we have to accept that they are not all going to look like that and we have to accommodate that.

**Hugh Boyes:** If we are looking at innovation, we need to look quite closely at what was achieved in health and safety. Over the last 20 to 30 years, we have seen a culture shift in the UK. Now if you go into any engineering organisation, safety is high on the agenda. It is often the first item on a meeting agenda. We need to transition security to that status, where everybody in an organisation is doing it. It is not just for the specialists.

**The Chairman:** That is very good. We will bank that, because we will ask you at the end to give us one idea. That is exactly the sort of bankable specific that is very helpful to us.

**Q181 Lord Giddens:** Could I go back to the issue of risks and dangers and how we deal with them, since that is the core of it? I am an economist primarily and if you look at the nature of the global economy, it has changed in the most unbelievable way over the past 20 years. It has been calculated that, if you look at the proportion of cash in the economy, it is 100 times less than it was 20 years ago, so physical cash has dwindled away. When you had cash, you had an independent way of assessing things. You can pass money on as an independent existence; now money is just dots in computers. So, if I shift a dot in your bank account three places, you become a millionaire; I shift it four places, you become a billionaire. How vulnerable is this new electronic economy either to attack or to systemic risk? Having looked at it quite a lot myself, it seems to me it is intrinsically quite vulnerable and, since it has never existed before, it is like a new frontier here.

Then you may have answered the second question but, in everyday life, how do you deal with the proliferation of scams that exist? I counted up the number of passwords I have—and I am sure it applies to most people in the room—and I have 30 passwords. If you include the ones you have to get money out of the wall in the bank or you have to get in to the Houses of Parliament and so on, how are you going to handle this on an individual level? You can get an electronic vault and you can put them in there but, if someone gets the master password to that electronic vault, you are presumably lost. That seems to me a really serious issue on the level of everyday life: how you manage your own personal security in relation to these risks. It would be good if you could comment on these two aspects of it all, because they seem to me to be where the core issues are. Obviously we need to train people to deal with them, but they seem to me pretty new. I do not think they existed in this way before.

**Nick Coleman:** Talking about digital currencies as an example, what we have seen, as new models of bitcoins and other forms of digital cash, the number of attacks on those infrastructures and trying to steal bitcoins and exploit them is growing significantly—
Lord Giddens: Well, this guy lost about £800 million or something.

Nick Coleman: Also you have seen recently high-profile credit card attacks of retailers, not of banks. They are going after the retailers and where they are stored. There is no doubt that, as we have gone to digital, we have that. I think the skill set that we need, though, is that we need people with practical experience and understanding of the risk and how to manage that risk, and understanding how technology is changing. Therefore, if these people do not have an understanding of that environment, it is very difficult. In reality, we are not going to prevent every attack. So, as an industry, we have had to focus more on response and intelligence, to be able to spot and then monitor the environment, as well as design. A little bit is in designing the infrastructure and getting the skills of architects, which we have not talked about, so it is about a lot of other related industries and IT professionals building it in securely, the coding that Mr Boyes talked about, all those things, but also about getting people—and this is a big growth industry—who understand how to operate intelligence centres and the intelligence response.

Q182 The Chairman: I have a second point about the individual level. We have talked about there being a little bit in schools, but it is pretty patchy and it is not joined up properly. Where do any of us, or anybody else out on the street, go to think, “I have made my own personal use of the internet as secure as it can be”? Where is the kitemark on that?

Lord Giddens: It is 60 passwords.

The Chairman: Yes, exactly. It is not going to be the citizens advice bureau, so where is it that you go that says, “Here you are. Realistically, this is the best we have at the moment”? Nick Coleman: As we have talked about, it is patchy right now. I think where one is going to go is to one’s internet provider, to one’s electricity provider, to one’s bank and, as you can see, to one’s Government. When you consume those services I think that is where you will say, “Hang on. What do I need to log in? Hang on, what is the password?” I think that is the first level, but we are also going to have to think about a second level, be they cybersecurity professionals, which people can have in their communities and you can have in your networks, in everybody’s networks—somebody they can turn to and trust. That is where the institutions, the professional bodies, are trying to certify people to recognised professional standards. I have been through some of it myself. I think that gives us some kitemark. I do not think you can do the kitemark for your environment or for your computer at any point, but I think you can have a kitemark as to whether somebody knows what they are talking about and has been tested both on skills and experience.

Stephanie Daman: Also the Government has created several initiatives to try to attack this particular issue: Get Safe Online, Cyber Streetwise. I think there is a question around why those perhaps do not receive the attention that you might hope they do. I am reminded of Clunk Click Every Trip, which was in everybody’s consciousness.

The Chairman: Yes. I have to say, I have never heard of the ones you have just referred to.

Stephanie Daman: I suspect that illustrates why they have not been successful, which is a pity because they have exactly this sort of information: how you do things, how you can make yourself safe. Perhaps there is an issue around how we do that general awareness campaign, because Clunk Click Every Trip was very successful.
Q183 Lord Giddens: If I might say something, I also think one should not just succumb to the electronic world. I think sometimes people should be encouraged to use back-to-the-future solutions. If you keep things written down and you lock them away, they are more secure probably than they are online. Even organisations might have to go back to doing things they used to do in the past and having independent verification. I do not think it all has to be electronic on the level of personal life. It at least takes you out of the system for a bit. You have to make sure that no one gets into your safe, though, or into your locked drawer, very likely.

Stephanie Daman: Yes, absolutely. It does not all need to be electronic. I am also minded that in this particular space the technology has moved so quickly that all of those protective things have not caught up. To me there always seems to be a gap between that: the technology develops, it does amazing things, but everyone forgets that there is a flipside to that and that flipside takes a long time to catch up.

Q184 Lord Janvrin: If I can follow up on this point, and it is almost a philosophical point: is there an ebb and flow between offence and defence in this whole area? It is like the First World War, when the heavy machine gun was defence, and someone came along and said “tank” and offence was dominant for a bit. Are you seeing the same? In terms of technological change, are we seeing the same kind of ebb and flow between the hacker technological change and the defensive technological change, or is that too simplistic?

Stephanie Daman: My own view is that, yes, we are. I think the trouble with this particular subject is that hackers have no boundaries. We do. A hacker can do anything they like online and they do not have any ethics to guide them. That keeps them well ahead, because they will conceive of and do things that we would not even dream of doing. We are then fighting to find defensive measures to tackle those things.

Lord Janvrin: So they can use chemical weapons and the rest of us cannot. Sorry, I am in World War I mode, but—

Stephanie Daman: Yes, it is exactly the same as terrorism in many respects. A terrorist will do things we would not even dream of, so how do you protect against something that you cannot conceive of? It is the same issue.

Nick Coleman: I do not think it is all new, though. This concept makes it sound like everything just appeared last year. The reality is some of the attacks that happened have been known-about vulnerabilities, sometimes for 10 years. From the outside perspective, if you leave your house vulnerable an attacker will look at you and go, “Oh, you might be easy”. Whereas if you use good locks and they have a look, you become known as quite a hard organisation and they might go next door because it is easier. I think in your ebb and flow defence certainly alters the landscape, there is no doubt about it, although there is a reality that if you just rely on “design it”, there are new techniques coming along as well that mean that you have to be able to spot it, so it does have to be this ebb and flow of understanding and responding.

Hugh Boyes: As we heard earlier, part of the challenge is the scale of the attacks on organisations. What we are facing is almost a tsunami of electronic attacks. It just requires one to get through successfully and a system is compromised.

The Chairman: And it destroys confidence.
Hugh Boyes: Yes, and this is a very difficult balance because you can repel 99.99%, but it is the one bit of malware that gets inside the fence that breaks down your boundaries. The innovation we are seeing in some of the attacks is quite interesting. At times they are actually turning our own technology against us, so that—

Lord Giddens: If I may say so, that is a very good point, which the Committee should register, because that is the nature of system risk. We saw what happened in the global financial crisis. It could not have happened like that before the economy became electronic, so you only need one system risk that you fail to grip and then the war analogy holds. It seems to me that you could have various kinds of catastrophes, depending on what systems are involved.

Nick Coleman: If you look at the recent significant attacks, then they all become a leadership issue. Part of the reason why I talked about getting this into business schools is that all the CEOs of these companies and organisations—public or private sector—have had to stand up and explain some quite technical attacks and what it meant in the business, not trying to confuse the people and their stakeholders and saying, “Well, it is this geeky piece here”. Real leadership comes down to risk management, so whether we talk about your school and the people and the pupils in that school, whether we talk about Parliament, whether we talk about public sector organisations, it has now translated where we need the professional skills, but we need the leadership skills to be able to understand the risk that they are taking and what they want to invest in.

The Chairman: Yes, that is very clear.

Q185 Lord Lucas: You seek to put the onus on us to be secure, but you do not provide us with the systems to do it. You provide immense amounts of conflicting advice. As Lord Giddens said, you end up with 30 passwords, you do not remember them, and then you make us change so we forget them again. If we die, who is going to make sense of anything? Surely you must get your heads together and produce something like Clunk Click that we can do. Would it not be safe if we wrote our passwords down and kept them somewhere at home? What is the danger in that? Can you do something that is doable and then produce consistent advice that stays there, so that then we might learn to do it?

Hugh Boyes: In a sense, yes, you can write passwords down. This is where we get conflicting advice. In a business environment, the reason why we say, “Do not write passwords down” is often they are written down, put on a Post-it and left by the computer. For critical passwords, what is wrong with storing them securely at home? That is one of the ways—

Lord Lucas: Yes, but that is not in any advice anywhere.

Hugh Boyes: Quite.

Lord Lucas: If you want Clunk Click, you have to produce that simple thing that we can just do.

Hugh Boyes: Some of the things that we see, which are supposed to be there to make life easier—for example, the federated access through things like Facebook, Yahoo or Google—actually increase the risk. If that particular account of yours gets hacked, it then gives access to all the accounts that are linked to it. It is often not spelt out to the public that you are trading their convenience and speed for a different risk.
Nick Coleman: I think there is good news—and I would like to give a little bit of good news—that we are moving to a world where technology is also going to help us understand what normal looks like in our environment, so imagine you have a phone, a tablet or whatever. We can now start to look for things to understand when the behaviour on that device is normal. In other words, if you open a document and it starts to do other things, you have a problem. We have to get new solutions. By the way, part of the skills discussion is not just about getting skills in organisations. I think we have to have a vibrant cybersecurity market in the UK. If we do not have those professionals, we are not going to get the start-up environments powered up to create the next generation of solutions. We are already seeing some approaches that are going to help in simplifying by designing it into processes and hopefully simplify the 30 password problem, which I am sure we all wrestle with.

Q186 The Chairman: Is there a trust issue? Let me can take you back to the analogy you used. We have all been told over the years to secure our houses, in a sense, and we have received pretty consistent advice on that. Ultimately, if we were broken into, then probably somebody will come around from the police and give advice or whatever. There is a body of people where you think, “That is probably reasonable advice,” and they are not necessarily trying to flog you something at the same time. But on the issue of whether we write our passwords down on a piece of paper and keep them in a locked drawer, is there a danger that we are told we have to buy the next thing to protect our passwords, the next app or the next whatever it is, but at the same time you feel as you are doing that, “I am buying that” or, “Somebody is making money out of me doing this”? As consumers and as citizens, where do we go to get what we consider is unbiased advice that builds our confidence in the internet and the structures we need to be competitive?

Stephanie Daman: You would hope that the place was government. You would hope that this was a public interest thing, but I think we are almost going into a cultural change. In the years of Clunk Click, if there was a government message that came out on the television that said, “You had to put your seatbelt on”, I think mostly the tendency was to accept that and do it. I am not so sure that that exists today. It is not for me to try to understand why that is the case, but it seems to me that it might be the reason why things like Cyber Streetwise and Get Safe Online are not so widely known about and accepted. I think there is partly a trust issue and I am sure that is part of it, but I think my question would be: that advice is available but why is it that it is so difficult to find it? Why is it that people do not know about it? What is it that we have missed? How have we failed to get the word out there, because we do seem to have done?

The Chairman: We had better move on. Thank you very much. Where are we up to? Lord Janvrin.

Q187 Lord Janvrin: It is almost a continuation of this, but taking it to the corporate or SME level, how do they get advice in looking at their own protection? Is there some way in which this could be clustered? In other words, you would have regional cyber experts who would be available for SMEs to tap into to seek knowledge and to seek solutions. We have been talking at the individual citizen level. At the SME level, can you see how they can get this kind of advice?

Stephanie Daman: There is a very good example of that with the Malvern cluster, which provides a great deal of that. The Government has also produced something called Cyber
Essentials, which is also aimed at SMEs, and that is exactly what it sounds like. It is the essential things that an SME needs to know to protect themselves. There are initiatives out there to tackle these things, and my strong feeling particularly is that we are not marketing these; we are not getting the word out sufficiently, because the material is there.

**Nick Coleman:** I think there are two levels of this. There is the level where you want to get a general awareness and you want to look at a website or you want to try to find out some information and you want to try to figure out what you do with your passwords and that kind of stuff. Then there is another level, which is where you are designing—you might be a relatively small organisation but you might be a supplier of a large organisation, so you might be connected in. You might be a small organisation but be in the financial services industry and have quite a big footprint, but you do not have many employees. Then it comes down to getting professional advice. There is a marketplace and that is where we need the skills in the UK to make sure it is a vibrant marketplace to give that professional advice; it is a commercial marketplace.

Then I think the other thing is there are increasing ways of delivering this, not just via advice, but via services, so buying in the next generation of services and understanding what is right for your business. I think the good news is with the growing publicity around the challenge, which means that a lot of business leaders are looking. As I say, the stuff I am doing is to talk to them in business terms, not in technical terms, so they start to get it as a risk. Because they understand other risks, it is just making business and public sector leaders understand this as a risk decision. So that, where the board members can start asking some of the questions in risk terms; and can tell whether they have the in-house skills to be able to give them the answer or whether they need to go out. In some cases, I have heard them say, “I am not getting it from my own organisation”, so we need to build our own capability and get external help to support.

**Hugh Boyes:** We have just touched on Cyber Essentials, which is a scheme that is very much aimed at SMEs. The challenge is that, if you go beyond the basic step of self-analysis and self-check, delivering that sort of advice is not cheap. You are looking at a professional whose costs and income potentially are similar to those of solicitors, accountants and so on. When you start looking at SMEs, they have to go to an accountant to have their accounts done. That is a legal requirement. They do not have to buy IT security advice and cybersecurity advice, so they decide not to. Unless we can find some way of getting that advice to them at an affordable price, they will not take it.

**Q188 Lord Macdonald of Tradeston:** On this question of how important it is to have a much higher profile for this issue, where in government do you think such a campaign should be directed from? Is it from the Cabinet Office or do you just leave it to the individual departments, whether it is BIS or the Ministry of Defence? I am sure the security departments are active in their critical national infrastructure, but there does not seem to be somebody whose voice the nation is impelled to listen to when it comes to digital security, despite its obvious importance.

**Stephanie Daman:** It could emanate from several different departments, but the Cabinet Office seems to me to be currently in the lead, so I would favour the Cabinet Office, simply because they already have a number of these pieces in place. I have often wondered whether what we are lacking is some sort of champion, some recognised person that
everyone respects who could give out these messages. We do not have that sort of person on this subject and I think we suffer for that.

**Hugh Boyes:** I think Government needs to use all of its levers. It should not be down to a single department like the Cabinet Office or BIS. We need to make sure that we are using the influence we have across the whole of government, so Ofgem should be dealing with the energy industry. The regulators have incredible power; they can mandate. If we are looking at education, we need DfE fully engaged. It is no good leaving it to BIS and saying it is a workplace issue. My position would be that this is not for a single department. It is for the whole of government to energise and use.

**Nick Coleman:** I served in the Cabinet Office and wrote the Coleman Report from there, which talked about government departments having a role in security. That was about delivery of public services and citizens’ services and running the function of government, so I think the Cabinet Office clearly has a cross-cutting role, but then departments have a role, as I have reflected.

The other thing is that we have to start to have the discussion about enabling the good things that are happening in government, so the stuff that is happening in skills, in GCHQ and, again, programmes such as the recognition of a master’s. I think we should probably be making a bigger noise about that, because we have probably have not raised it as much as we could in industry. As my colleagues have said, there are multiple bits of government and government obviously needs to look after itself. BIS can help with the outreach to business and the industry.

Fundamentally, on skills, it is about the national framework that the Government has started to put in place for itself and has done some good work on, but it is also a role that it has played in promoting good work, which I think both in the UK and internationally can show that we can grow a pipeline of people and get some talent, here and internationally, coming to learn cyber. I think the more people we can have embedded into those skills, if we promote the services that are running, the more we will increase the flow and I think that is certainly what Government could really help with.

**Lord Macdonald of Tradeston:** From your background in government, Mr Coleman, is there a sense there, do you think, in the Cabinet Office perhaps, of not being too alarmist and keeping this thing a bit under the radar, so that you are working with a lot of the key industries but you do not want to frighten the horses outside?

**Nick Coleman:** I do not think so. My report is there, which sets out both the challenge and the recommendations for dealing with it. I think it has to be a balance of enjoying new ways of doing work and new ways of flexibility, but at the same time we have to understand the risk. I think that the Government probably has it about right. I think if it made it over-sensationalised it would turn a lot of people off, and so you have to have a balance. I then think you have to build the capability behind. For example, the Government has senior information risk owners—I talked about having department-level board representatives who would not necessarily be cyber people or IT people, but would be the champion—who have made a big difference. Some of the things have put it into quite a lot of context and then you can turn around to other sectors and local government and say, “Are you doing the same things? Do you have somebody at your board who understands this? Are you really?” I think overall it is about right, but it is growing and we are going to have to keep talking about it being the reality.
Q189 Lord Holmes of Richmond: Good morning. You have touched on a number of issues around this. I want to develop the points around inclusion and inequality. We have heard a lot of evidence about how the digital revolution will increase inequalities, and obviously the areas of safety, security and privacy online come into that. What do you think is the best way to inform everybody around protecting their privacy and having safety online and at what age do you think they should begin?

Stephanie Daman: I think it needs to start at school. It needs to start in primary school and it needs to be in every single school, not just patchily across the UK.

Hugh Boyes: In a sense, I think I have missed a trick in trying to communicate cybersecurity. We have had these initiatives to get the digitally excluded online. For example, I am aware of foster parents who have been given computers. They are just given the computer and they are not given any training with it. That was an ideal time, when they were given the machine for the first time, to educate them as to how to be safe online and how to protect their charges. Looking ahead, I think that is an area where if we are rolling out more of these inclusion programmes, we need to build the training and the skills element into the rollout of the hardware or the access.

Nick Coleman: I think it has to come earlier, when you get your first mobile phone. I am seeing lots of people, eight, nine years old, getting their phones and I think then we start to have the challenge of: do the parents know what they are doing with it? Do they understand? It is the age there. I think similarly it is also in all the games that they play and the social networks. It allows us a real opportunity — both in schools but also more widely — to get to them in those environments. That is what they are up to, so if we embed it into those things, I think we have a chance.

Lord Holmes of Richmond: On the practicality of rolling that out and enabling that to happen, do you think there is a philosophical hurdle to be got over from people who are currently in the industry, in terms of the sense of the internet being unregulated, free, with Yahoo, go to the frontier, all that stuff? Though obviously you panellists understand this very clearly and it is a critical and important business, is there a sense for a lot of people that this runs counter to that free spirit?

Stephanie Daman: Yes, I think there is. I think that is our own fault. Again, back to schools, one of the things that I notice with a lot of the candidates I see who are self-taught is that they are very, very woolly about ethics; they are very woolly about what is acceptable and what is not. That is simply because they have not been taught what is acceptable and what is not.

The Chairman: Yes, that is very interesting. Anybody else want to come in on this? No, that is fine.

Q190 Lord Giddens: On the big issues around terrorism in everyday life for children, what trolls do to people and cyberbullying and so on, they fall within the general category of security of the individual, I would have thought. How are we going to deal with those, because it cannot just be a matter of individual training, can it? There has to be some systemic intervention of some sort. You cannot have absolute freedom to say anything to anybody because then you can terrorise them. A troll might find out where you live, might say, “I know the names of your children and I am going to come around and burn your house
Cyber Security Challenge, IBM Services and The Institution of Engineering and Technology – Oral evidence (QQ 173-191)

down”. You might know one of those children. I am not clear in my own mind, and perhaps it is not your field but it seems to me to be part of cybersecurity.

**The Chairman:** It is part of law enforcement.

**Lord Giddens:** Yes. You just leave it to the police, is that the answer?

**Hugh Boyes:** I think what you are looking at in some ways is a cultural shift. In personal behaviour, face to face, there are accepted cultural norms. In cyberspace, there are few. We need to start developing those norms so that children understand that cyberbullying is not acceptable. But that is a large issue for society. You cannot just teach it; you have to get people to believe it, behave it. We also need, for example, legislation to be used sensibly. When we saw the cybernats and their behaviour in the recent referendum, it was outrageous. That should not be tolerated. That is not what we should accept in our society, but how do you deal with it? It is almost treated as though it does not matter, but if we encourage people to believe that and to behave that way, it will get worse, so we need to find ways of stopping that.

**Lord Giddens:** But all these things to me are compounded by the fact that government is national and you are dealing with a truly global phenomenon, which a national Government can only very partially control.

**The Chairman:** I am going to pause on this, because I think we could go on for an hour on this. Can we go on to the last question, Lord Courtown?

**Q191 Earl of Courtown:** This is a question that we have asked all our panellists, and just remembering why we are here and the whole point of this Committee: we would like to make recommendations to Government to improve UK competitiveness in respect of digital skills. What is your one point, bearing in mind financial ability to deliver? What is the one point that you would like to suggest that we could recommend?

**Hugh Boyes:** I would like to see greater encouragement of people to take up training in this area, or training generally in technology skills. At present, the way our tax system works, training cannot be set against tax, either at personal level or often at a company level. We need to ensure that we are upskilling our workforce. Technology is moving fast and the Government could do various things to encourage employers and the individual to raise their skill levels through formal and informal training.

**Nick Coleman:** I think for me the one thing we can do is make the university system much more relevant, as in: continue that journey to make it a fast-moving response to emerging technology. If I think five years back we were hardly talking about cloud. Now if you are leaving university without an understanding of cloud, how are you relevant? Also, we see a lot of graduates where, frankly, soft skills—not just the formal education but the way of responding and fitting into employment—would be helpful. I do not think it will cost very much and I think we do a lot of it in a lot of places already, but we should make sure that the curriculum on those master’s degrees and those undergraduate degrees, both in computing and the specialist degrees, is focused on keeping track of where the technology is, so it is experiential learning rather than all applied.

**Stephanie Daman:** I would say, “Get it right in the schools, because that is the fundamental thing”. If you give the teachers the resources they need to teach this properly at that level, you serve two purposes. You serve the wider digital skills agenda, but you also build that
pool of people who I want coming out the other end, who I can upskill into the cybersecurity profession. With that one thing, I think you would serve two purposes.

**The Chairman:** Thank you very much indeed. That was really useful, thank you.
Para 1: Context of this submission: Responses in this submission of evidence are based upon the expertise of the authors in their capacities as professionals with a long track-record of working in the fields of behavioural aspects of digital technology and social informatics in varied contexts and in many sectors. Their responses to Q11 are based on research findings and outcomes of a major project which was part of the RCUK-funded ‘New Dynamics of Ageing’ programme. They initiated, and have led and managed the Sus-IT project (Sustaining ICT use by older people to promote autonomy and independence) since its inception in January 2009. The research is now in the ‘Impact’ phase, informing and influencing policy and practice in promoting and sustaining digital participation of older people and strategies for digital inclusion and inclusive design. There is a considerable volume of evidence available to inform the deliberations of the Digital Skills Committee in relation to older users of digital technologies. The authors would welcome the opportunity to contribute further to these deliberations in any way deemed appropriate by the committee.

Para 2: Responses to questions in domains which have been the focus of investigation or attention of the authors are provided in this submission. A nil response is indicated where the authors do not believe they have the specialist knowledge necessary to provide well-founded responses to the questions.

The changing technological landscape

Para 3: q1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations? The pace of technological development can only increase – and with it the complexity and array of platforms, devices, systems, business models and so on, associated with them. Leading innovations include ambient or pervasive computing which will mean that our surroundings, vehicles, homes, clothing etc are all ‘connected’, enabling a multiplicity of applications from surveillance to remote environmental controls. The prevalence of the technology will mean that it will be the norm to use digital technologies in most if not all aspects of our lives – anyone not able or not confident and comfortable doing this is likely to be marginalised progressively, likely to experience associated social exclusion and to find it increasingly hard to live independently.

Para 4: q2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

A key challenge is to recognise that the major power of technology lies in using it to empower and support human endeavour rather than seeking to automate as many human functions as possible. A knowledge-driven economy, by definition, relies on human expertise and knowledge. The prevailing preoccupation with cost-cutting and the practice of awarding contracts for delivery of services on the basis of cost appear to be driving out opportunities for the application and nurturing of human judgement yet human judgement and insight remain the root and inspiration for innovation and the success of the knowledge economy.
Para 5: q3. What is the employment impact on the UK’s labour market? What are the regional differences?

An important emerging characteristic in the labour market appears to be the growing number of people at either end of the age spectrum who are becoming self-employed – and who often lack digital skills. The motivation for this trend is not well-researched but may reflect growing discomfort in society with corporate values and practices (such as ‘zero hours contracts’, low pay and poor conditions of employment) that are associated with the ‘credit-crunch’. There is also a sense that neither the young or the old are confident about their place in society and seek to be in greater control of their own employment/economic activity. Another factor could be the lack of intrinsic reward in the growing number of computer-based jobs which do not offer job satisfaction and opportunities for self-actualisation but rather are routine, repetitive and sometimes with doubtful ethical or moral values. Whatever the reasons it is a concerning development because although small businesses are responsible for much of the innovation in the economy, it is also the case that the failure rate of new self-employed ventures is high – with the consequential negative implications for the individuals involved, for any associated supply-chain and for the local economy. Enhancing digital skills of the self-employed could help to reduce the failure rate of ‘start-ups’ and promote success and growth of small companies and social enterprises.

Future workforce

Para 6: q4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Digital skills for technical roles are generally those needed to operate complex software packages and /or to write software. Digital skills required by the wider workforce relate to those which enable communication e.g. use of email, publishing, social media.

Para 7: Can the current supply chain deliver this?

Nil response

Para 8: q5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

Preparing students for, as yet, unknown and undefined roles requires the teaching of generic skills such as ‘thinking skills’, philosophy, communication skills (especially networking skills/use of social media), development of innovative business models, and understanding the role of partnering, collaboration and political relationships in the economy.

Para 9: q6. How are schools preparing to deliver the new computing curriculum in an innovative way?

Nil response

Para 10: q7. How can the education system develop creativity and social skills more effectively?
Professor Leela Damodaran, Wendy Olphert and Jatinder Sandhu – Written evidence (DSC0093)

As above in response to Q 5 – engaging young people in inspiring and challenging projects tailored to different age groups and the context of local communities offers a powerful means of motivating them and compelling opportunities for developing their creativity and skill.

Para 11: q8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

Nil response to first part of question – but response to Q5 is relevant to this question too

Short- and medium-term support to the digital sector

Para 12: q9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

The digital sector needs help to develop awareness and understanding that technology per se cannot deliver adequate solutions or improvements – it needs to be an integral part of a sociotechnical system in which human roles and unique human capabilities are a key part. Work conducted many years ago on job design and work organisation and the appropriate allocation of tasks between human and technology (e.g. Fitts and Posner, 1967; Davis and Cherns, 1975\(^1\)) should be re-visited to create jobs which are worthwhile for human beings to do in the 21st century. An integrated approach to a skills and employment strategy is urgently needed – engaging all of the parties identified in the question along with those experiencing the greatest difficulty in being accepted into the labour market – namely the young and the old.

Para 13: q10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

Nil response

Para 14: q11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

Para 15: Is there an inclusion agenda in relation to digital skills in the workplace?

There has indeed been growing interest in older and disabled people in the work place in the past decade and some employers have actively sought to employ and older workforce. Many initiatives/projects are in evidence and guidance is increasingly available for employers to help older people to stay in employment longer. However there is scant evidence of an associated strategic approach to promoting and achieving digital participation of older and disabled people either in or outside the work force.

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Para 16: Nationally there is of course a high-profile alliance of some leading companies in
the UK and some supporting organisations with the stated goal of reducing digital exclusion.
However, their efforts to reduce the number of adult non users and to raise the skill level of
all those – including those who were struggling – are characterised by the assumption that it
is appropriate and desirable to apply one model of skills development and a standardised
approach to three very different constituencies - namely: individuals, SME’s and charities.
The unitary approach may have its roots in the history of the IT industry - Windows and
Apple in their earlier days saw their main market as the business world where the demands
were varied and complex. As Windows became a more and more powerful presence in the
market place other software manufacturers had to deliver software that could run on the
Windows OS. As a consequence, a suite of applications emerged which assumed the high
levels of complexity with which the business world is familiar.

Para 17: From a digital inclusion perspective, a problem with Windows and MS Office is that
it is not as relevant to simple tasks and functions in the workplace or to domestic/personal
use as it is to business use. Individuals, especially those with few computer or online needs,
do not need the same digital skills that many companies may require of their employees.
The prevailing unitary model does not reflect the enormous diversity of users and their
needs, assuming as it does that SME’s, charities and individual beginners and novices have
the same computer-related and online needs. Experience of working with older people
learning to use information and communications technologies (ICTs) shows that individuals
benefit from starting from a position which is relevant to their own goals and potential usage
– and tailored to their own needs - rather than following a pre-determined standardised
training plan or curriculum.

Para 18: Despite this reality, the notion that there is a set of basic IT skills which are
universally required and relevant appears to be compelling and to have gained widespread
support. While many businesses may have a set of generic basic digital skill requirements to
be met by all employees and for them this makes the concept of a specified curriculum for
digital skills a valid and appropriate proposition, many older people start from somewhere
quite specific and individual (see below under section ii for some examples of the ‘triggers’
which motivate their active digital participation)

Para 19: The top-down, unitary approach to skills development is being given tacit support
by major players engaged in computer training and endorsed by funding bodies, including
the BIG Lottery. Yet empirical research evidence, described below, makes clear that the
successful digital participation of older people requires varied approaches to ICT learning
and support:

Para 20: Research evidence relating to digital participation of older people

Older people are still less likely than younger people to be computer users – this is true in
the workplace as well as outside. Research evidence from the ESRC-led New Dynamics of
Ageing Programme: Sus-IT project (Sustaining ICT use by older people to promote autonomy
and independence) (see: http://sus-it.lboro.ac.uk/index.html) has particular relevance to this
question: The project which generated data from around 1000 older people across the UK,
has published extensive findings (see: http://sus-it.lboro.ac.uk/publications.html). Some key
points relating to this question are the following:
Para 21: Digital skills picked up in the workplace do not necessarily carry forwards into retirement. It cannot therefore be assumed that ‘once digital always digital’. Reasons include:

- Some older people associate using computers with ‘work’ and are reluctant, uninterested or cannot see the benefits of using ICT in their domestic and social lives.
- Older people can experience a range of capability changes (e.g. eyesight, mobility, joint stiffness and pain) that can hamper their ability to continue to use ICTs as they age and can lead to giving up altogether.
- The pace and often dramatic nature of technology change means that familiarity with systems and equipment gained in the workplace soon becomes redundant.
- Provision of appropriate support and learning opportunities to help older people to sustain usage and develop their capabilities is generally in short supply and ‘patchy’ across the UK. This applies to self-employed people – who increasingly include the over 50s.
- ICT support available to users in the home/community for ICT related learning and problem-solving compares poorly to the support available in many workplaces.

Para 22: ii. Many older people do not wish to learn computing skills simply for the sake of doing so – or to gain a qualification - and prefer to learn skills relevant to their own lives, interests and concerns - in ways of their choosing.

Para 23: Evidence from the Sus-IT project generated from several learning venues across the UK shows that focusing ICT skills development on purposeful and relevant activities directly related to the passions and interests of older people (i.e. using ICT to enable them to do what matters to them), motivates them to participate in the digital world. Such interests included re-visiting childhood haunts in the virtual world (sometimes on the other side of the world in the case of older immigrants); re-establishing contact with people from their past; genealogy; sourcing craft materials; locating recipes and sewing patterns; finding websites relating to former military service and comrades/war time experiences and so on – there are myriad examples available. The salient point is that the particular skills relevant to doing any of these things will differ and may not, for example, involve email or on-line shopping.

Para 24: While a minority of older people enjoy classes and teaching themselves, many do not enjoy classroom based learning and prefer to learn from and with their peers. One reason voiced for this is to avoid potential embarrassment about their lack of confidence/competence with using ICTs in front of highly-computer literate tutors/computer experts or ‘techy whizz kids’. They seek opportunities for learning about ICTs which are readily accessible in congenial and familiar venues in the community and which are embedded in undertaking activities which they find intrinsically interesting and motivating. To elicit their ICT learning and support requirements, a co-production process was used, involving older people, practitioners and researchers in a facilitated workshop (see: http://kt-equal.org.uk/uploads/monograph%20taming%20the%20dragon%20final.pdf). From this process, the need and demand for community based support emerged clearly. This has been developed as a detailed and well-informed proposition (see: http://sus-it.lboro.ac.uk/SusIT_KT_HubsOct13.pdf). This proposition, extensively deliberated with a range of key stakeholders in a consultation at St. George’s House, Windsor gave rise to a...
Professor Leela Damodaran, Wendy Olphert and Jatinder Sandhu – Written evidence (DSC0093)

forward action plan, which is included in the consultation report by St George’s House: (http://www.stgeorgeshouse.org/index.php/download_file/481/226/).

Para 25: How are groups with protected characteristics such as older people, those with disabilities and women being engaged?

Para 26: Numerous campaigns, initiatives, projects and pilots to help people develop digital skills/use the internet over more than a decade have delivered some successes, particularly in helping people into employment. However, with regard to achieving and sustaining digital participation of older people, success has been limited.

Para 27: One of the reasons for this may be the paucity of learning opportunities and support outside the employment setting. Findings from a study conducted on the Sus-IT project to map the ICT learning and support provision offered in seven cities in the UK shows the striking disparity between the widespread, co-ordinated, sustained and well-resourced provision available for many in the working population and the piecemeal, usually short-term, variable availability and quality and sporadic funding of provision for older people (see Ramondt, Sandhu and Damodaran, 2013[1])

Para 28: The Sus-IT research provides examples of good practice for the type of provision that engages individual older learners and builds a learning and ICT support community. The value and importance of a user-centred approach is evident from research data: interviews with older ICT users who attended ICT learning classes at a community centre located in Teeside and observations conducted with older ICT users in the Midlands showed that learning and support provision which allowed people to focus on their own agenda and interests – rather than on computers and their standard office functions - stimulated and sustained interest in being part of the digital world. Similarly, the opportunity to influence the contents of classes was clearly important to participants in computer classes held in the local library of a community in the Midlands where new cohorts of older learners were consulted at the beginning of the course about what they would like to learn. The content of the next six weeks of the course was then structured around their interests. (The topics older ICT users’ selected included online communication; searching for information; and how to research their family tree). A set curriculum or pre-defined lesson plan is unlikely to have met the diverse learning needs of this group of older novice ICT users.

Para 29: How can this be improved?

To fundamentally improve digital skills and digital inclusion in the UK with a view to enhancing the lives of people, promoting the success of our economy and to achieving the government’s targets may mean reassessing the prevailing unitary model.

1. The unitary model which currently prevails will need to be augmented in three key areas:

   (i) simpler systems will need to be added to the mix – these already exist and some small scale studies have shown their effectiveness (particularly with the old and frail who have not been able to cope with the demands of using standard systems).

   (ii) costs will need to be lowered.
(iii) less expensive ways of providing effective training and support are needed to engage non-users and strugglers (e.g., community-based provision supported by relevant stakeholders and the full participation of the users; use of existing simpler technology to reduce the burden of support).

2. Ready access to resources/case studies is needed to demonstrate how employers are successfully engaging with older and disabled people to achieve and to sustain their digital participation, and to promote the application of good practice.

Para 30: q12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

Para 31: What do the best local skills delivery models look like?

Leicestershire CareOnline services offers an exceptional and well-established model (it has been operating for over 10 years) delivering services to enable severely impaired people to have some independence and autonomy, be economically active in some cases and to empower them to engage in fulfilling activities (see: http://www.leicscareonline.org.uk/). It excels in its user-centred focus which and excellent long-term relationships with its clients.

Para 32: What is the role for local Government?

Extensive current developments led by local government indicate important innovation and transformation is underway, as evidenced by the example at Scarborough Borough Council:

Para 33: “Work in the Borough of Scarborough has been funded under the customer led transformation programme. The fund aims to embed the use of customer insight and social media tools and techniques as strategic management capabilities across the public sector family in order to support place-based working. The customer led transformation programme is overseen by the Local Government Delivery Council (supported by the Local Government Association). The fund was established specifically to support collaborative working between local authorities and their partners focused on using customer insight and social media tools and techniques to improve service outcomes. These approaches offer public services bodies the opportunity to engage customers and gather insight into their preferences and needs, and thereby provide the evidence and intelligence needed to redesign services to be more targeted, effective and efficient.” (see: http://www.local.gov.uk/c/document_library/get_file?uuid=482289e7-a15f-4030-b4c1-3d7d8741888b&groupId=10180)

Para 34: Extensive local government activity focussed upon transformation in delivery of services is in progress and the diversity of provision reflects the wide-ranging needs of their service users. Further information will be available from the LGA and SOCITM and related agencies.

Para 35: What is the role for the third sector?

There is considerable organised activity by large third-sector organisations in the UK such as Citizens Online, the Tinder Foundation, AGE UK who are all engaged in programmes intended to promote the digital inclusion agenda amongst excluded groups.
Para 36: However a crucial role is also being played by community groups such as e.g. Older People’s 50+ forums, University of the 3rd Age and other informal voluntary group, who can be also powerful catalysts for the digital inclusion of excluded individuals and groups. Typically the funding they require is very modest but their needs tend to be overlooked because it is assumed that the major players are providing all that is necessary. Yet there is enormous beneficial impact gained by the interventions of very small informal groups and inspirational individuals who help others utilise ICTs and the internet. Respecting these grass-roots contributions to digital inclusion is a prerequisite for gaining their support for the wider digital inclusion agenda.

Para 37: Sustainability of provision is crucial – the practice of funding individual ‘projects’, however successful these are, is flawed because, the projects generally cease to operate once funding runs out. Findings from a study mapping the ICT learning and support provision offered in seven cities shows the striking disparity between the widespread, co-ordinated, sustained and well-resourced provision available for many in the working population and the piecemeal, often short-term, variable quality and uncertain funding of provision for older people. One of the common complaints from older people was that projects which received Government funds to help older people to engage with technologies were often only short-term and were not sustained over time. The requirements, clearly articulated by older people, are for locally available, accessible and on-going support in familiar and welcoming venues in the community. The availability of on-going support is of crucial importance to help older users deal with the ad hoc difficulties (such as cross-platform issues) with ICT which arise frequently and need ‘trouble-shooting’ assistance to resolve.

Para 38: To achieve more sustainable provision, there is a role for partnership models involving local authority, third sector and commercial organisations in collectively providing resources, equipment and skills. It is important to emphasise that this does not need to depend on ‘new money’ but can be based upon ‘re-purposing’ existing facilities in schools and libraries and other community locations to good effect.

i. There is an ongoing need for equipment, systems and services to be designed in an inclusive way to make them easy to use by older people, those with disabilities and other potentially excluded user groups. There is also a need for simpler devices to enable easier access to the internet and to make the support task easier for the many volunteers who support use of ICTs by other, less-skilled individuals.

ii. There is a clear role for central government in establishing policies to address these issues and to provide leadership in raising awareness amongst key stakeholder groups of the significance of digital inclusion for society and the economy. In response to a growing concern about the changing demography and growing ageing population there has been considerable recent activity in central government. For example, the Digital Connectivity for Older People Roundtable held on the 16th July 2014 was jointly organised by the Government Office for Science (GO Science) and the Department for Communities and Local Government (DCLG). “The round table had two key aims:
To examine the evidence base in this area both in terms of what is currently known and initiatives that have worked well, and to look forward and consider how and where digital inclusion could make a real difference to an ageing population.

To bring together people with different perspectives but a shared interest in digital engagement for older people to help in form future cross-sectorial working and thinking about the issues of ageing in a digital society.

The event formed part of and will feed into the ongoing GO Science Foresight project on ‘Analysing the Challenges and Opportunities of an Ageing Society’ which is being led by Sir Mark Walport, the Government Chief Scientific Advisor. (See: http://publicservicetransformation.org/images/articles/learning-zone/digital_tech/DigitalConnectivityforOlderPeople16July14v4.pdf for full report of event). The event outputs will also inform DCLG’s ongoing work on Ageing in Communities and the DCLG “Grey Cells” Open Policy Making initiative (see: https://openpolicy.blog.gov.uk/2014/06/03/joining-up-the-grey-cells/”).

Industry

Para 39: q13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

A significant barrier is the lack of ICT learning and support opportunities for the self-employed and for small companies. They face many of the same difficulties as older and disabled people and share the same need for community-based ICT support provision which is accessible and readily available at or near the point of need. An example of a well-developed proposition for promoting digital participation based upon sound investigation of user needs is available: http://sus-it.lboro.ac.uk/SusIT_KT_HubsOct13.pdf

Para 40: q14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

The most effective way of ‘upskilling’ the work force is by ensuring there is on-going ICT help and support in an environment which fosters continuous shared learning – especially between peers. Building the confidence of employees is crucial and requires a supportive culture and environment.

Infrastructure

Para 41: q15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

Nil response

10 September 2014
Summary:
The Digital Youth Academy (DYA) is a training provider which specialises in supporting the digital sector. DYA dovetails with industry to understand both the current needs and future needs of employers and cross matches those needs in the form of qualifications and programmes which are primarily delivered by our supply chain of Further Education (FE) Colleges and Private Training Providers.

Pera Training (Pera) is a national independent training provider, based in Melton Mowbray in Leicestershire which specialises in the Manufacturing/Engineering, Retail and Digital sectors. Pera was established back in 1946 as the Production Engineering Research Association and is a delivery partner of the Digital Youth Academy.

As the leading provider of digital programmes within the FE sector then DYA believes itself to be well in tune with both the needs of employers and the sector. As a leading provider of digital skills training within the FE sector then Pera also believes itself to be well aligned to the needs of the sector. On this basis and the close natured working relationship between DYA and Pera, then we believe that a joint response was more relevant and therefore we are together providing a joint statement of evidence as part of the House of Lords Select Committee review into Digital Skills.

Having completed the questions within the House of Lords Select Committee Call for Evidence, DYA believes that in order to develop a digital skilled workforce equipped with the skills to both handle and take advantage of the rapidly changing marketplace, then more needs to be done to support employers in their need to first understand and be given a better awareness of the already developed and market leading apprenticeship and staff training vehicles. These programmes can help underpin the digital workforce that will keep the UK at the leading edge of global digital competitiveness. DYA’s only concern is that the technical nature of apprenticeships on offer (i.e. at Level 3 and above) means that Government funding for training is restricted to those apprentices aged 16-23 and on this basis DYA believes that the UK will struggle to support the need for 745,000 extra skilled digital jobs required by 2019 as predicted by the UK Digital Skills Taskforce.

Finally, DYA also believes that more investment is required to ensure that the growth of the UK Digital Economy does not become further segmented and become the privilege of the established hubs of Tech City in London and Media City in Manchester. Extra support is required to ensure a more inclusive geographical growth expansion across the UK, building upon the developments of the superfast Broadband roll out.

Response to Individual Questions
The changing technological landscape
1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?
1.1 In the DIGITAL SKILLS FOR TOMORROW’S WORLD Report, published by the UK Digital Skills Taskforce July 2014; as of August 2012, the digital economy already accounted for 14.4% of all companies and 11% of all jobs in the UK. The Digital Youth Academy (DYA) and Pera Training (Pera) believes that the pace of change in regards to the future digital technological landscape in the UK will continue to accelerate between present day and 2030 as it is important to remember that it’s not just the technology sector that need digital skills but in fact digital is cross sector theme across a multitude of sectors that operate within the UK. DYA and Pera very much supports the statement that every business in the UK is a digital business. This assumption is supported by the Science Council, which estimates that the digital workforce alone will grow by a further 39% by 2030.

1.2 In regards to the leading digital innovations over the next number of years, then DYA and Pera both believe that the development and deployment of 3D printers into mainstream products will be one at the forefront. The move to mainstream production will impact and benefit first business and then home consumers as volumes rise, increasing economies of scale, thus driving down price. Outside of the UK, then Global Mobile Penetration will continue to increase, connecting more potential markets. Furthermore we see continued growth and expansion in social and cloud based technologies along with growth in Virtual Technologies, whilst Gamification will continue to grow and become more relevant and mainstream over the next few years.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

2.1 Both DYA and Pera believe that one of the key challenges around the growth of the UK knowledge-driven economy is the need to ensure there is an appropriately qualified and skilled talent pool to support the development of a digitalised future workforce. As highlighted in the DIGITAL SKILLS FOR TOMORROW’S WORLD Report, published by the UK Digital Skills Taskforce July 2014, it is anticipated that over the next 5 years the UK will require an additional 745,000 skilled workers in the digital industries.

3. What is the employment impact on the UK’s labour market? What are the regional differences?

3.1 At the Digital Youth Academy we recognise that there is a non-symmetrical pattern of digital growth across the UK and this brings significant regional variances and differences which directly impact the UK’s labour market. DYA has made this judgement based on the work we do with 16 leading Further Education (FE) Colleges who help provide us with an accurate geographic topography of the hot spots in employment growth in the digital sector across the UK.

3.2 In the experiences of DYA we see the South-East of England and especially London as experiencing rapid growth and investment, creating new vacancies, new jobs and driving growth. Likewise the large cities in the North West of England are significantly outpacing other parts of the UK in terms of their growth. DYA feels that the common denominator in both these locations is the basis of a physical and intellectual network which breeds collaborative working and growth acceleration. In London there is the Tech City concept and in Manchester the concept of Manchester Digital aligned around Salford and Media City.
other large conurbations, such as Liverpool and Nottingham the development of ‘Digital Quarters’ are supporting the digital growth agenda, albeit at a slower pace than in the likes of Tech City and Media City.

3.3 In order to rebalance the developing regional variances both DYA and Pera feels that there is a need to further support the development of new or stronger regional digital growth hubs, possibly through the use of incentives such as tax breaks and rebates. One other idea is to use the newly formed Tech Partnership as a vehicle to help stimulate and support this growth through investment and infrastructure projects.

**Future workforce**

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

4.1 Both DYA and Pera believe that the future workforce will require a broad set of digital skills in order for the UK to be globally competitive. Some of these digital skills will be fairly generic, basic digital and softer digital skills (e.g. using email and the Internet), whereas others at the cutting edge leading to more technical skills (e.g. coding and programming). In essence whatever the job role the importance of having a workforce that is ‘Digital by Default’ will be key to the UK’s global competitiveness.

4.2 In terms of the softer digital skills then DYA and Pera believes that there are already a wide suite of initiatives driven by the likes of Go On UK and Barclays Bank (Digital Eagles) embedded and in place with significant public backing, underpinned by national advertising campaigns to increase public awareness. In regards to the more technical skills, the UK is a strong position with regards the number of existing technical qualification apprenticeship career pathways either currently available, such as Social Media and Digital Marketing, Creative and Digital Media, Digital Learning Design and Interactive Design and Development. On the near horizon further technical pathways are being developed by e-skills UK as part of the Trailblazer reforms, covering of Cyber Intrusion, Software Developer, Network Engineer, Database Specialist, Data Analyst, Internet TV Technician, IT Project Manager and Enterprise Applications.

4.3 However despite the existing availability or planned availability of these apprenticeship vehicles DYA and Pera believe that it is imperative that employers’ awareness is increased, not just with large blue chips, but also at SME level, especially as the Trailblazers are billed as qualifications developed “by employers for employers”. Alongside this more investment is required to make potential candidates aware of these career pathways at an earlier age with not enough being done at a school level to drive this agenda. This also includes raising awareness with parents.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?
5.1 DYA’s content/learning is increasingly being built by employers and specialists in the field of digital technology, we see this as best practice and an effective way of keeping abreast of latest and future trends. We feel that this could be replicated across other disciplines where FE Colleges particularly should be encouraged to break traditional syllabus pedagogy. DYA encourages the use of eLearning and learning on the go which is compatible with mobile and social technologies, this is current for young people and effective in terms of updating and refreshing content.

5.2 DYA and Pera feel that there should be greater collaboration between LEP’s, employers and schools to ensure that curriculum and schools are kept abreast of the labour market and future local economy. Both DYA and Pera welcome the deployment of Studio Schools and UTC’s which can focus in on specific and specialist skills which are required for the future.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

6.1 Although neither DYA nor Pera deliver provision to pre 16 young people we do welcome the mandatory introduction of programming and coding into school’s curriculum from September 2014. This said we are cautious regarding the readiness of roll out. We believes existing teachers need better upskilling and confidence to teach the subject, the DIGITAL SKILLS FOR TOMORROW’S WORLD Report outlined that 60% of teachers did not feel confident and that the Government allocated budget to support training of £3.5million only equates to £175 per school. DYA and Pera believe further training and investment is required here. There is a lack of IT teachers at both pre 16 and post, the average age of an FE teacher/tutor is 44 and further work is required to upskill.

7. How can the education system develop creativity and social skills more effectively?

DYA and Pera do not want to submit an answer to this question.

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

See answer 5

**Short-and medium-term support to the digital sector**

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

9.1 Both DYA and Pera believe that the vocational education sector (including FE Colleges and Private Training Providers) has a pivotal role to play in supporting the digital sector in both the short and medium term. As previously highlighted the number of vocational digital routeways developed and available for funding by the Government is already significant and still growing.

9.2 However, this relationship between the vocational education sector and industry is about to be turned on its head. The recent Apprenticeship Reforms announcement by BIS in regards to the requirement for mandatory employer financial contributions (trialed through the Trailblazers) and a move to employer led funding will mean that the connectivity
between what employers in the industry want and what the vocational sector can provide must be significantly improved. This is a significant switch where industry was previously somewhat at the mercy of what provision was offered by their local FE College or Private Training Provider. DYA ourselves have seen instances for example where employers want a specific skilled apprentice, but are sold a generic Business Administration apprenticeship as that is what the provider offered as that is all they delivered and in some cases it was funded at a better rate, meaning a better return on investment for the provider, with the employer being used purely as a means to an end. The move to an employer-led approach to training and funding might well be unwelcomed within the vocational education sector, but in theory should mean that the vocational education sector becomes much more aligned to the needs of what the industry (and digital specifically) want and need to be competitive.

9.3 The explosion of connected devices and increased bandwidth represents strong opportunity in this regard. Both DYA and Pera project and welcome the ability to conduct further mobile, distance and eLearning training which is more flexible, relevant and convenient to all parties involved.

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

10.1 As identified in the DIGITAL SKILLS FOR TOMORROW’S WORLD Report, published by the UK Digital Skills Taskforce July 2014; it is anticipated that the UK will require an additional 745,000 skilled workers in the digital industries over the next 5 years. If this skills gap is met then this growth opportunity is potentially worth £4 billion per year to the UK.

10.2 DYA and Pera believe there is no need to encourage high skilled immigration to support the growth of this sector in the UK as we are already one of the world’s front runners in regard to the digital agenda. We both believe that the UK should be doing more to promote growth through investment in young people with natural creative and digital skills, but who lack experience in commerciality and we believe that apprenticeship programmes should be the vehicle to make this happen.

10.3 However, despite the growth of apprenticeships, this vehicle alone will not be enough to generate the number of skilled workers to hit the aforementioned target of 745,000 in just 5 years. Over the last year apprenticeships are very much limited to those aged 16-23 or those aged 24+ undertaking a first Level 2 qualification. DYA and Pera believe that this in itself will have a limiting effect on the digital sector where most of the qualifications offered start at Level 3, meaning funding is limited to those under 24 and meaning that those over the age of 24 would have to take out an Advanced Learning Loan to self-fund their training if they wish to retrain for a new career or to develop the skills required to progress. On this basis we feel that there needs to be more flexible options for those employees aged 24+ are already in employment – granted there are some vehicles already in place, such as Skills Support for the Workforce, but many of the programmes are time bound and have less than 12 months to run and the need for continuity is key for long term success and inclusion.
11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

11.1 As the Sector Skills Council (SSC) for the wider IT sector e-Skills (UK) (Tech Partnership) recently highlighted that there is still a significant gap in the wider IT sector in regards to women participation. e-Skills UK reported recently that in 2013, less than one in six (16%) of the 1,129,000 people working as IT in the UK were women and also point out that this gender imbalance in the IT industry is an issue to all EU 15 nations, however female representation is in these industries is lower in the UK than the EU 15 counterparts. Based on the findings from this research there is clearly an inclusion agenda driven by the SSC on this specific topic, but the success of it will only be measurable over a period of time.

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

12.1 DYA and Pera believe in the need for flexibility is critical in regards to localised skills delivery models as this enables the model to best fit the differing needs of local industry and the regional local economy. From our joint experiences of delivery in the UK the needs of the different regions can be significant, with some regions developing significantly faster, with better engagement and competition. Other regions face the prospect of being left behind and require more specific development in order for them to reduce the knowledge gap in the market.

12.2 It is the opinion of DYA and Pera that the Local Enterprise Partnerships (LEPs) should be the key conduit in helping to develop and implement local skills delivery models. LEPs should be given the responsibility in setting their own regions’ targets based on the individual geographical needs and demands. The LEPs should include wider stakeholders, such as local Government and the third sector to ensure inclusion, but ultimately lead on setting and managing the localised requirements within their given regions.

Industry

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

13.1 Having worked with many digital micro businesses and SMEs the two main barriers that both DYA and Pera come across frequently is the challenge to quickly upscale, growing their own workforce and expanding to meet their order books. Also as we move to a knowledge-driven economy a number of businesses have told us they are unsure how best to protect their IP.

13.2 In regards to the first point about scalability and accessibility both DYA and Pera believes more needs to be done to promote to the development of bespoke vehicles such as Apprenticeship Training Agencies (ATAs) to better support micro-businesses and SMEs quickly upscale through alternative recruitment models in both the digital and creative sectors. We feel that if employers are able to effectively take on resource quickly and at a reduced risk this will support more effective growth within the sector.
13.3 In regards to IP, then employers are telling us that more and better support and information is required to support SMEs as we move into a knowledge driven economy, transitioning away from historical methods of business where IP is more tangible.

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

14.1 In order to develop a digital skilled workforce equipped with the skills to both handle and take advantage of the rapidly changing marketplace, then DYA and Pera believe that employers need to first understand and be given a better awareness of the already developed and market leading apprenticeship vehicles. DYA’s own research highlights the number of employers aware of such specific and tailored vehicles as currently being too low; with apprenticeships either being associated with traditional and technical craft skills, such as Engineering, Construction and Hair Dressing or more recently the bad press associated with apprenticeships in regards to quality, length and the less technical nature of generic programmes such as Customer Service and Team Leading for employees over the age of 25. Both DYA and Pera believe there is much work to be done to increase awareness with employers to alternative and more specific newer technical programmes.

14.2 The number of apprenticeship programmes already developed and in this field is developing all the time and worth noting that all frameworks in this field start at Level 3 Advanced and not Level 2 Intermediate. There are also a number developed at Level 4 (Higher) – these being the likes of Social Media and Digital Marketing, Creative and Digital Media, Digital Learning Design and Interactive Design and Development. By taking advantage of the growing availability of recognised work-based apprenticeships in this field employers can grow and develop their workforce at low cost and the flexibility to support both large employers and SMEs. The pipeline doesn’t stop or standstill there, with e-skills UK the Awarding Body for IT the leading light in forthcoming Apprenticeship Trailblazers, for example at Level 3: Cyber Intrusion, Digital Marketer, Digital Media and at Level 4 the likes of Digital Marketing and Social Media Specialist, Software Developer, Network Engineer, Database Specialist, Data Analyst, Internet TV Technician, IT Project Manager and Enterprise Applications. It is imperative that employers’ awareness is increased, not just with large blue chips, but also at SME level, especially as the Trailblazers are billed as qualifications developed “by employers for employers”.

Infrastructure

15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

15.1 The UK already has invested significantly in a core infrastructure to support a knowledge driven economy, this can be highlighted by the fact that the UK has an Internet Penetration rate of 87%, one of the highest in the world, higher than the likes of the USA and compares strongly to just 39% worldwide average. Yes granted the Internet speeds in the UK are lower than a number of our European and North American competitors, however the fact that the Internet penetration is so high means that the roots required to underpin both a digital and knowledge driven economy are well and truly in place.

3 September 2014
Dynamo North East – Written evidence (DSC0107)

1.0 Dynamo North East
The Dynamo North East partnership have come together to promote and grow the ICT sector in the region. Dynamo is led by a Board which includes prominent industry leaders. Membership includes the MD of Accenture’s UK operation, Sage’s Chief UK Technology Officer and Hewlett-Packard’s National Delivery Centre Lead. Our comprehensive and long-term IT skills strategy, linking business and education, makes the North East region unique in the UK.

In September 2014 we submitted a proposal to the Department for Business, Innovation and Skills to base a National College for Software Engineering in the region. This is consistent with our long-term strategy and is matched by a financial commitment from employers to invest in a National College. Our proposal is supported by the North East Local Enterprise Partnership.

Our comprehensive and long-term IT skills strategy, which links business and education, makes the North East region unique in the UK.

The aims of the Dynamo North East IT skills strategy are to:

- Significantly increase the reservoir of young people who want to join the IT industry;
- Ensure young people have the technology skills to prepare them for a career in IT;
- Ensure there is an ongoing close and productive link between business and education.

The North East has significant digital strengths on which to build. The region is home to a vibrant and growing ICT Sector. It is the location of the Global HQ of FTSE 100 software company Sage, with significant bases for British Airways, IBM, BT and a world-leading gaming industry which includes Ubisoft, the largest independent game publisher in Europe.

The area is the location of UK operations for high technology companies including Accenture and Hewlett-Packard. These employers have come together through the Dynamo North East IT cluster to lead the expansion of the sector and grow the aggregate skills base of the region.

Other business services make use of a strong Digital skills base. The region hosts the headquarters of Virgin Money and Atom bank, along with a significant public administration presence in DWP and HMRC.

2.0 Digital Skills gaps within a growing sector
Despite the opportunities of the digital economy, there are many challenges in developing the local and national skills base to maximise growth potential. In the UK, only 4% of 15 year olds want careers in engineering and computing - placing us 35th out of 37 countries in an OECD survey.

The UK Commission on Employment and Skills (2013) noted that nationally, 21% of vacancies across the economy are due to a lack of advanced IT and software skills. This rises to 40% in
the Digital sector, with a further knock-on impact in prohibiting innovation and the development of new products.

Our partner Sunderland Software City projects revenue in the North East ICT sector to double between 2009 and 2020. The Science Council further expects the UK digital economy as a whole to increase by 39% between 2012 and 2030.

Despite this growth potential, the UK Government’s Information Economy Industrial Strategy highlights that the number of students studying Information and Communication Technology has fallen in the last 10 years.

**There are currently significant skills gaps in the ICT Sector in the north east.**

An employer survey conducted by Dynamo found that the ICT sector in the region in 2013 had nearly 2,000 unfilled vacancies due to a shortage of ICT skills. The UK Commission’s Employer Skills Survey (2011) noted that 18% of north east employers had vacancies in skilled trades occupations, compared to 14% nationally.

Government data from the first quarter of 2014 shows that only 33% of jobs in the North East are classed as ‘High Skill’, which is the lowest rate in the country. The establishment of a National College, with demonstrable employer leadership, will provide the infrastructure to support Dynamo’s growth ambitions for the sector. This is consistent Governments’ approach to industrial growth:

> “Without long term action and planning to address skills shortages, organisations will struggle to recruit the right staff. Without the right infrastructure, both physical and virtual, businesses will struggle to develop.”

*Information Economy Strategy, UK Industrial Strategy. June 2013*

**Digital Skills are critical to local and national economic growth strategies.**

Dynamo operates in collaboration with education and business. When supply chain jobs are added to direct employment in Digital, Media, Telecoms and Software, the share of employment in the new economy is greater than the England average in Software Development, Computer Service and Telecommunications in the North East Local Enterprise Partnership area.
Sunderland Software City noted that SMEs in the region’s ICT sector require a skilled workforce as a priority to support their growth aspirations. Our proposal for a National College aims to strengthen the intuitional capacity required to meet demonstrable employer demand.

Barriers to growth faced by software companies in the North East (Sunderland Software City)

3.0 A National College for Software Engineering in the North East LEP

E-skills have collected evidence from employers which underline the need to accelerate the supply of Digital Skills. In the recent depression, employers primarily met immediate skills shortages by attracting experienced workers from existing businesses; with 52% of the intake of ICT and telecoms workers in the North East transferring from other careers and only 19% entering the labour force directly from education.

In 2012, the Richard Review of Apprenticeships acknowledged that learner demand was held back by inadequate provision:
“Learner demand is currently being artificially held back. When quality is consistently higher, we will need our schools, our teachers, and all those who inform and guide young people, to do a better job at providing them with the information they need to seriously consider apprenticeships.”

Despite evidence of skills gaps and underutilised business growth in the region and nationally, apprenticeship starts in the ICT sector are volatile within the current arrangements for skills provision. Apprenticeship starts in ICT actually fell from 19,520 in 2010/11 to 14,120 in 2012/13. Basing a National College in the North East would capitalise on a strong industrial base with huge growth potential and demonstrable employer leadership.

Dynamo has strong industry links across the UK and is working with the Cambridge network, Tech City UK Partnership and Cisco National Vertical Indicator Network. The north east has five universities – Durham, Newcastle, Northumbria, Sunderland and Teesside - with strengths in computer science, robotics, high performance computing and software engineering.

All local colleges see the potential National College as an exciting opportunity; with the Association of Colleges willing to work alongside us to develop this offer. Dynamo has already opened discussions with Code College in London to explore opportunities for collaboration and is keen to work alongside this institution and others to make the National College a success.

The bid is endorsed by the North East Local Enterprise Partnership, recognising the need to tackle skills supply issues that will enable continued growth.

10 October 2014
About EE

EE is the largest and most advanced digital communications company in Britain, delivering mobile and fixed communications services to consumers, businesses, government and the wholesale market. EE has approximately 15,000 employees and 520 retail stores, and serves more than 30 million customers across its mobile, fixed and wholesale businesses. Today we employ more than 500 apprentices and plan to extend this to 1300 apprentices by the end of 2015.

EE runs the UK's biggest, fastest and most reliable mobile network, pioneering the UK's first superfast 4G mobile service in October 2012. EE's 4G coverage today reaches more than 70% of the UK population. EE's 2G coverage reaches 99% of the population while 3G reaches 98%. EE's superfast fibre broadband service covers 54% of the UK population, and ADSL broadband service covers 98.7% of the population.

In August 2014 the independent network analysts Rootmetrics named EE as the number one overall mobile network in the UK for the second time, following comprehensive independent testing. Rootmetrics’ study is the most thorough independent, customer-centric mobile network testing ever undertaken in the UK, with the findings used to underpin a recent call quality report from Ofcom.

The awards follow EE’s announcement that it is investing more than £275 million this year in making phone calls better for consumers, through a comprehensive upgrade of 2G equipment, increased capacity on 3G sites to support 50% more calls and trials of services including 4G voice (VoLTE) and WiFi calling. EE has also recently emphasised its focus on improving coverage in rural areas by bringing EE 4G to 3.5 million additional people across more than 2,500 villages and small towns.

General comments

As a telecommunications provider digital skills are at the heart of our company, as the success of our business is driven by our staff having up to date digital skills and in helping our customers get the most from the technology we provide them.

Alongside our £2bn network investment to build the UK’s biggest mobile network EE is a founding partner of the digital skills alliance Go ON UK to improve digital skills in the UK.

Digital skills and connectivity are as important to our personal lives as they are in the world of work. Being online allows people to access public services, communicate with friends and family and save money. Our response covers this in more detail below.

Our response focuses on the skills and infrastructure questions that you set out in your Call for Evidence.
Future Workforce: Digital Skills
Digital Inclusion
As part of EE’s Corporate Responsibility work in 2014 we commissioned Plum Consulting to review the use of mobile devices in digital inclusion, and whether the evidence supports the contention that it is easier to impart digital skills through a mobile touch screen than it is through more traditional methods.

In reviewing the current digital skills landscape, it is clear that existing programmes are contributing to getting people online, but the question Plum considered is whether greater progress could be made if mobile devices were used as the gateway online for those who are currently offline. Improving digital skills has short term implications and longer term economic benefits. A mobile centric approach to improving digital skills might be more cost effective given the ease at which the majority of people already use their mobile devices.

Teaching digital skills to children and those in post 16 education is of great importance, and as Plum Consulting state in their report “a touch interface is easier to learn for many people than a mouse, as exemplified by the rapid adoption of touchscreen devices by [both] young children and older users.”

Whilst smartphones and tablets with touch screens are relatively young products, the importance of touch screen devices – and the skills required to use them and developed by using them – needs to be recognised now by policy makers to ensure that both the digital excluded today and the workforce of the future have the relevant digital skills.

Short and Medium Term Support to the digital sector
William Dutton and Grant Blank, along with Pew Internet\footnote{Dutton, William, and Blank, Grant. 2013. “Cultures of the Internet: The Internet in Britain.” http://oxis.oii.ox.ac.uk/sites/oxis.oii.ox.ac.uk/files/content/files/publications/OxIS_2013.pdf Pew Internet. April 2014. “Older Adults and Technology Use”. http://www.pewinternet.org/2014/04/03/older-olds-and-technology-use/}, have looked at why some people chose to not go online. These studies have found that lack of interest, and skills and cost barriers account for non-adoption. For the UK labour market this is of concern, and requires a focused response to improve digital skills. EE is committed to playing a part in this, and Plum have argued that smartphones and tablets, with appropriate connectivity, could help reduce the skills barriers to being online.
Figure 1: Potential contribution of mobile in overcoming barriers to going online

Digital inclusion programmes to date have tended to have a ‘PC centric’ focus, with an emphasis on skills that relate to a desktop computer environment rather than mobile. At the same time government policy has yet to fully recognise the change that mass adoption of apps from app stores has brought about, with government departments slow to develop their own apps.

As part of our responsibility activity we aim to improve the digital skills of one million people by the end of 2015. There are a number of ways we will achieve this:

Our founder-partner status of Go ON UK, a charity which aims to make the UK the most digitally capable in the world.

Techy Tea Parties: run with partners such as Age UK EE volunteers spend time helping older people learn how to use their technology.

Digital Living website which includes resources for customers, parents and teachers on keeping children safe online, online security, digital skills and advice for small businesses.

Working with Age UK, we hold Techy Tea parties across the country at which EE staff volunteer to help Age UK members with their digital queries. On 9 September this will be taken national with the UK’s first nationwide Techy Tea Party.

EE National Techy Tea Party Day is part of our ongoing commitment to improve the digital skills of the UK. We’re also on-shoring over 1,000 jobs back to the UK and recruiting 1,300 apprentices to boost our own investment in British skills.

**Government policies should be rebalanced to reflect mobile**

Government has provided subsidies to fixed networks, but applies levies to mobile, in particular proposed spectrum annual licence fees, or through thirty year old legislation that governs the relationship with base station site owners. These issues are covered in the next section, but in summary substantial levies on mobile can be expected to prove
counterproductive assessed against goals of digital inclusion and investment, productivity and GDP growth throughout the economy.\textsuperscript{173}

Government should also continue to work towards ensuring that services are accessible and work well on mobile devices. The government might also adopt a more permissive approach to apps, which currently require Cabinet Office approval.\textsuperscript{174}

Action 6 of the Government Digital Strategy states:

“\textit{Stand-alone mobile apps will only be considered once the core web service works well on mobile devices, and if specifically agreed with the Cabinet Office.}”

Apps have a role to play offering deeper integration with mobile device sensors, greater responsiveness and potentially improved discoverability (for example in the US apps development in relation to disaster relief has been encouraged).\textsuperscript{175} The role of apps is recognised in the government open data initiative which seeks to open up government data sets for app developers who are then able to provide new and enhanced services to users.

In conclusion, the growing role of mobile in terms of how people get online and stay online, and in terms of the benefits that are possible, should be a central plank of the Government’s digital strategy.

\textbf{Infrastructure}

Ofcom’s annual Communications Market reviews\textsuperscript{176} have highlighted the competitive nature of the UK communications sector, and how the pricing of an average mobile bundle has halved over the last decade making it ever easier for UK citizens to get online. At the same time the UK saw the roll out of 3G mobile services in the mid 2000s, and since our launch of 4G in 2012 the roll out of high speed mobile 4G. UK government policy has continued to support the roll out of fixed and mobile broadband, with over £2 billion of tax payer money committed to roll out fibre broadband and improve mobile coverage in the final 10%.

The Department of Business and HM Treasury are currently reviewing the Business Rates Regime. EE would like to see a regime that encouraged site sharing amongst the different mobile networks and the deployment of non macro cell solutions to further coverage.

Alongside a reform Business Rate regime there are two key policy areas which require further government intervention if the UK is to gain the infrastructure needed to support a knowledge economy: reform of the Electronic Communications Code and more sustainable spectrum Annual Licence Fees.

\textbf{Business Rates}

Business rates are charged on most non-domestic properties, including commercial. EE pays business rates on its offices, shops and network installations such as mobile phone masts.

\textsuperscript{173} Plum. January 2014. “Annual licence fees – you cannot have your cake and eat it.” http://www.plumconsulting.co.uk/pdfs/Plum_Jan2014_ALF_-_you_cannot_have_your_cake_and_eat_it.pdf

\textsuperscript{174} http://digital.cabinetoffice.gov.uk/2013/03/12/were-not-appy-not-appy-at-all/

\textsuperscript{175} http://www.whitehouse.gov/blog/2014/07/07/announcing-white-house-innovation-disaster-response-and-recovery-initiative-demo-day

\textsuperscript{176} http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr14/UK_5.pdf
and street cabinets. The Valuation Office (VOA) is responsible for setting business rates in England and Wales, whilst the Land Property Service in Northern Ireland and the local assessor in Scotland have a similar role. Billing and collection is the responsibility of local authorities who are funded by the tax, but receipts are pooled centrally by HM Treasury.

**The Need for Change**

The current business rates regime fails to support the deployment of telecommunications equipment that is essential to the promotion of economic growth and does not encourage site sharing. Whilst site sharing is expressly encouraged in planning policy and regulation, the current rate regime places a disproportionate burden on small cell and Wi-Fi installations. Finally, the current regime distorts the market through differential treatment of different telecommunications providers.

**Proposed Avenues for Reform**

EE would like to see a reformed Business Rate regime that:

- Encouraged site sharing
- Rated small cell and Wi-Fi installations at reduced or zero rate to encourage further investment
- Applied the same charging regime to all fibre installations

These changes would help facilitate network investment and roll out in both urban and rural communities.

**Electronic Communications Code**

The Electronic Communications Code (ECC) is over 30 years old and should be reformed to enable mobile networks to continue to invest in better mobile infrastructure, particularly in rural areas. The Code governs the rights of operators to access and maintain sites and has been under review since 2011. DCMS now needs to consider how to take forward these recommendations, which with a few amendments, would provide a modern legal system for mobile infrastructure.

**Why it matters**

Currently the Code offers no protection from unscrupulous landowners who have the power to discourage investment in areas which are, more often than not, already loss making. In 2011, the Law Commission started work on recommendations about how to make the Code fit for the 21st century, publishing its recommendations in February 2013.

By making a few small enhancements to the Law Commission’s proposals, the Government has the chance to improve the case for investment in rural areas and promote the roll out of mobile services. A recent analysis commissioned by DCMS found that reform to the existing system would boost GDP, create jobs and reduce customer pricing.

DCMS is still considering the Law Commission’s recommendations. We hope that the Government will see the Law Commission’s work through and introduce legislation before the 2015 Election.
Specific reforms to the Electronic Communications Code

The following specific policy reforms would modernise the code and help improve the economic case for the rollout of mobile services in rural areas and provision of a critical piece of national infrastructure:

<table>
<thead>
<tr>
<th>Reform</th>
<th>What</th>
<th>Why</th>
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<tbody>
<tr>
<td>Site-sharing</td>
<td>Ensure operators are able to share sites with other operators at a reasonable cost</td>
<td>This would improve competition and choice in partial not-spots</td>
</tr>
<tr>
<td>Upgrading</td>
<td>Ensure operators are able to upgrade sites on a frequency neutral basis, at no extra cost and with no reference to the visual impact of the upgrade</td>
<td>Gives customers access to the latest technology as soon as possible. Removing the visual reference also ensures that the legislation is technology neutral.</td>
</tr>
<tr>
<td>Site access</td>
<td>Ensure operators are always able to get immediate access to their sites to maintain or repair them</td>
<td>Immediate access will allow operators to fix issues and restore service to customers as quickly as possible</td>
</tr>
<tr>
<td>Market value</td>
<td>Reform the definition of market value to ensure a fair price based on other uses of the land</td>
<td>Analysis for DCMS found that moving towards an energy market model could boost GDP by £500m, create jobs and reduce customer pricing. Rent reform would vastly improve the case for investing in rural areas and extend coverage.</td>
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Annual Licence Fees

Mobile airwaves are either bought or ‘rented’ from the Government by mobile network operators (MNOs). In 2013, MNOs collectively paid £65 million in rent for the use of 900 and
1800 MHz airwaves, used for 2G, 3G and 4G services. This payment is known as the spectrum Annual Licence Fee (ALF) and is a model commonly used across Europe.

The level of ALFs is overseen by DCMS and determined by Ofcom. The previous Government directed Ofcom to review the ALFs for radio spectrum that had previously been acquired to ensure that they reflect full market value based on the outcome of the most recent spectrum auction. In October 2013, Ofcom published a consultation on the fees and recommended a fourfold increase, from £65 million to £309 million pa. Following careful consideration of responses, Ofcom published a revised consultation in July 2014 which revised down the proposed increase to £247 million pa.

Even at this revised level, an increase on this scale would have a profound impact on all MNOs, with negative implications for economic growth, jobs and investment in mobile coverage, and may lead to higher consumer prices. The proposed increases in ALFs are excessive and risk undermining investment in the UK, and thereby harming the ability to create the infrastructure required to support future innovation and job creation.

2 September 2014
1. The e-Learning Foundation is pleased to contribute to the work of the Digital Skills Committee. We are an education charity, set up in 2001 with the mission that every school age child in the UK should have access to the learning technology they need at home and at school. For the last 14 years we have worked closely with thousands of schools to help them offer their pupils personal access to a computer and the Internet for when and where they want to learn, contributing to their academic progress, their digital skills, and in order to provide a personalised element to the support they get from their school.

2. Despite the considerable progress made over this period, over 500,000 school age children are still not able to access the Internet via a computer at home, which is contributing to the challenge to reduce the attainment gap in our schools. (Source: ONS Family Spending Survey, DfE League Tables on attainment gap). Our Mind the Gap campaign (www.mindthegap.org.uk) aims to help schools identify those families who have proved unable or unwilling to get online at home, and help them do so.

3. Many schools provide surprisingly low levels of access during the school day, and there remains a stubborn resistance to make the most that technology offers from a significant number of teachers and, perhaps surprising, parents. (Source: e-Learning Foundation Parents Survey 2014).

4. The result is that a generation of young people are leaving school with poor digital skills in the context of using technology for independent learning and for the digital skills expected from future employers. These young disadvantaged people are therefore highly unlikely to be able to benefit from the well-paid tech-related jobs seen in areas such as Tech City in Shoreditch where we are developing a Career College School to help local young people prepare for work in this high growth dynamic employment market. The first students should start their courses this September.

5. Government policy over the last 4 years has made no contribution to addressing these issues. The closure of BECTA (originally known as the British Educational Communications and Technology Agency, a non-departmental public body funded by the Department for Education) in 2010 was followed by large-scale reductions in Local Authority ICT advisory teams and the closure of the ICT Policy Unit at the Department for Education. So while some schools have responded to their new found freedom and forged ahead, many schools have been left behind. Severe cuts in capital spending for schools have also left their mark with the quality of school computers steadily deteriorating as they age and become obsolete. (Source: BESA Annual Schools Survey)

6. Children’s access to hardware, learning software (Apps/Learning Environments, etc), and digital skills is therefore influenced in three ways:
   - The disparity between homes of low income families and everyone else (often referred to as the digital divide).
   - The disparity between pro-ICT schools and those that are still resisting the inevitable advance of technology into the teaching profession.
The difference between large schools with the critical mass to employ experts to manage the infra-structure and keep systems up to date and small schools who have lost their support network and have inadequate capital funding to make adequate provision to teachers and pupils.

7. We are pleased to offer this information in the hope that the position of children in the digital skills debate will receive proper recognition. So often the agenda is dominated by digital skills for employment, entitlement to state benefits, e-Government savings, etc and hence all about adults. We would be happy to provide further information should that prove helpful in highlighting the plight of school age children in the digital skills debate.

15 July 2014
Executive Summary

1. The UK economy has moved from a “knowledge based” to a “knowledge driven” economy, a structural move fuelled by the growth of new digital technologies and the exponential increase in availability and manipulation of data. At the end of 2011, it was estimated that if the UK had the right digital capabilities and fully exploited the potential of the digital era, there could have been a £63 billion uplift in total GDP in that year.

2. That said, the UK is simply not maximising the potential of digital, yet. This paper addresses two questions:

   - What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge driven economy? How are these best overcome?
   - How can businesses help equip the workforce with new skills in a rapidly changing environment?

3. What are the barriers that businesses and SMEs face in trying to operate in a digital economy?

   Elix-IRR believes there are four barriers SMEs face to operating successfully in the digital economy:

   - **Education and skills**: Limits in Science Technology Engineering and Mathematics (STEM) education and training have contributed to digital skills gaps, shortages and an underutilisation of these skills by businesses
   - **Culture**: Limits in an SMEs ability to retain digitally skilled employees, business ‘rigidity’ in understanding the value of digital capabilities and weaknesses in aspects of the UK’s business environment prevent further digitisation among businesses
   - **Change**: The scale of digital change required to match customer expectations across distribution channels, supply chain and customer service can be difficult for SMEs to access
   - **Investment**: The investment options available to SMEs are limited, because they need to direct capital towards competing short term priorities and funding opportunities from traditional lenders are constrained

4. How can businesses equip the workforce with the required skills to operate in a changing environment and a digital economy?

   The workforce needs to evolve to match the progression of digital technologies. This is not possible without support from UK businesses. The four areas in which business can play a role are:

   - **‘On-the-job’ training**: Businesses need to modernise employee training methods including the use of social media and ‘reverse’ mentoring to cater for the evolution in skills requirements

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177 “This Is for Everyone: The Case for Universal Digitisation”, Booz & Co, 2013
• **Training methods and schemes outside of the ‘day-to-day’ job:** Industry schemes which encourage businesses to cross skill each other’s employees to learn digital skills outside their ‘day-to-day’ role should be promoted

• **Investment needed in industry, the community and the current workforce:** Large corporations should reinvigorate their social responsibilities towards smaller firms, including mentoring SME leaders

• **Businesses need to influence the training and skillsets needed in the next generation:** Businesses are ideally placed to educate the workforce of the future with the skills they will need through proactive direct initiatives, making new generations more employable

5. **The educational system, business and the government all have a role to play in increasing the digital capabilities of the UK economy**

• The pace of digital evolution in our knowledge economy shows no sign of slowing down

• Skill shortages caused by limits in education and cultural barriers are most difficult to overcome

• We need greater access to skilled and knowledgeable talent pools

• Business leaders must appreciate the value of digital skills

• A handful of schemes employed by large businesses are working well. The majority of these schemes are self-incentivised and the government should play a greater role in encouraging these

• If we fail to act now the future competitiveness of the UK economy will be compromised

**Introduction**

6. Economist Nikolai Kondratiev outlined in his 1925 book [178] that periods of economic change can be attributed to a series of ‘major economic cycles’. In short, he described these as:

• Spring (improvement or plateau)

• Summer (acceleration or prosperity)

• Kondratiev Fall (recession or plateau)

• Winter (depression)

Kondratiev argued that these ‘super cycles’ typically lasted 50 – 60 years, and were accompanied by great surges of change in the economy, driving eras of phenomenal transformation.

7. Today the global economy has started to move from ‘Spring’, into the ‘Summer’ or ‘Acceleration’ phase of a ‘Kondratiev wave’. This Kondratiev wave has been fuelled by the continual development of new digital technologies and the ability to store and manipulate vast quantities of structured and unstructured data. One statement captures the scale of change we are experiencing today:

**It took 75 years for the telephone to connect to 50 million users** [179], whilst it took only 5 years for Whatsapp to obtain 500 million users [180].

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[179] “How long does it take to reach 50 million customers?”, Réseau, 2012

8. With this acceleration in technology, the pace of Kondratiev waves is getting faster. The increased speed at which ideas and knowledge is spreading means that they no longer take 50 – 60 years. It is this acceleration in technology and the emerging ability to interrogate seas of data that is driving the UK’s advancement from a knowledge based to a knowledge driven economy. This is characterised by:

- a reduced reliance on the use of cheap raw materials and an increase in the importance of the intellect and creativity of people
- difficulty in replicating intellectual capital – exploitation of knowledge now plays the most important role in the creation of wealth
- a close link between the economy’s performance and the advancement of knowledge capital – knowledge capital is now a packaged commodity that can be bought and sold

9. Digital technology has not only been a driver in creating a new Kondratiev wave but it has also been the architect of a new era of creative destruction, a paradoxical term coined by Joseph Schumpeter\textsuperscript{181} to describe how economies evolve. In this theory, lost jobs, failing companies and declining industries are an inherent part of a growth system where over time, fundamental shifts in science and technology will provide a more productive outcome. In light of a number of high profile collapses in businesses in recent years (such as HMV, Blockbuster and Kodak), it’s difficult to dispute the constant evolution of digital technology and its resulting impacts as a force of creative destruction.

10. In the UK, SMEs account for 99.9% of all private sector business, 59.3% of all private sector employment and 48.1% of private sector turnover\textsuperscript{182}. Market leaders in the digital field – Google, Apple and Amazon – all started out as SMEs. These statistics and examples demonstrate the importance of SMEs to the UK economy and the benefit to the UK of SMEs becoming part of the digital age. In the context of Schumpeter’s economic theories we can also identify the potentially disastrous economic consequences (through vast numbers of failing businesses) for the UK if SMEs fail to compete in the digital economy. If SME’s form such a crucial part of the UK economy, why have so many failed to embrace digital? What are the barriers that stop them? How can SMEs overcome these barriers? How can the government help? In the following paper we link a knowledge driven economy to the developments in technology and the use of digital services. Firstly we take a look at the key barriers faced by SMEs and how these can be overcome. We then outline how businesses can further equip the workforce with the necessary skills to thrive in the evolution of a digitally-focussed economic climate.

Part 1: Barriers to businesses operating in a knowledge-driven economy

Barrier 1 – skill gaps and limited education / training

11. Changes within industry happen quickly and aggressively and the speed of change is increasing as our economy becomes more knowledge driven, eroding traditional structural barriers to change. However, the pace at which the workforce reacts often fails to mirror the speed of change experienced in industry. In 1970, around one fifth of the UK workforce were

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{180} “WhatsApp crosses 500 million monthly active users in less than 5 years of its inception”, BGR Media, 2014
\item \textsuperscript{181} “The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle, Joseph Schumpeter, 1912
\item \textsuperscript{182} Federation of Small Businesses
http://www.fsb.org.uk/stats
\end{itemize}
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described as ‘knowledge workers’. Today this number has risen to about two fifths. By 2020 it will be over half of the total workforce\(^{183}\). Despite this, access to the skilled labour that companies need in order to compete in a digital world remains limited as demand in the labour market continues to outstrip supply. A recent survey revealed that 36% of the UK’s smaller companies admit that a shortage of skilled staff is hindering their growth prospects\(^{184}\) whilst the UK Digital Skills Taskforce has estimated that an additional 745,000 additional workers will be needed between 2013 and 2017 to meet gaps in demand\(^{185}\).

12. The skills ‘problem’ experienced by businesses can be broken down into three areas:

- **A skills shortage** - a complete lack of the necessary skills, said to be attributable to roughly 1% of employees
- **A skills gap** - a misalignment in current skills and the necessary skills, attributable to 10% of employees
- **Underutilisation of skills** - where employees’ skills exist, but aren’t being applied correctly in their current job role, affecting 35-40% of employees\(^{186}\)

13. The educational curriculum is not aligned to the demands of the digital age

The skills shortage and skills gap in our economy can be largely accredited to the weakness in training and education that the labour market, or future labour market, receives. One of the root causes of the skills shortage is limitations in the provision of Science, Technology, Engineering and Mathematics (STEM) subjects within the education system. In a 3 year study of further education colleges by the New Engineering Foundation (NEF), it was found that STEM provision was inadequate in every case. In the worst example, 80% of a curriculum was ‘misaligned’ to industry trends in these areas\(^ {187}\).

14. Strength in STEM subjects act as a basis to enable development of digital capabilities in the workforce. The learning methods and skills required to succeed in these subjects lay the foundations for digital aptitude. With digital skills in increasing demand, the educational system needs to:

- Re-focus STEM in the national curriculum as core subjects
- Increase training and rewards available to teachers of these subjects to improve the quality and quantity of educational skills in these areas
- Increase access to physical and online support materials for teachers and students to increase knowledge in these subjects
- Enrich extra-curricular activities and links with external providers (e.g. British Science Association who provide on-site lab activities and competitions for students). Such

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\(^{183}\) "Employability and Skills in the UK: Redefining the Debate", Jonathan Wright, Ian Brinkley & Naomi Clayton, 2010

\(^{184}\) "Skills gap hindering SME growth, study finds", Seun Robert-Edomi, 2013

\(^{185}\) "Digital skills for tomorrow’s world” The independent report of the UK Digital Skills Taskforce Beta Edition, July 2014

\(^{186}\) “Employability and skills in the UK: redefining the debate” A report prepared for the London Chamber of Commerce and Industry Commercial Education Trust, November 2010

\(^{187}\) “Transforming STEM Economies”, Sa’ad Medhat, 2014
initiatives can help bring context and real-world examples to the subjects, to make them more engaging in schools and colleges alike.

15. It is of no surprise that those countries strong in STEM development, such as Finland and China, are also the countries who have heavily invested in the quality and remuneration of STEM teachers. They have both “instituted active programmes of reform that are focused on making science and mathematics more engaging and practical”\(^\text{188}\). Deploying learnings from these countries would support an uplift in both the quality of STEM subject education and lay the foundations for a digitally capable workforce in the future.

16. **A gender gap in STEM subject participation exacerbates the digital skills shortage**

Women now make up 46% of the UK’s workforce, but only 15.5% of the STEM workforce are women\(^\text{189}\). This disparity can be partly attributed to cultural trends throughout the education system, which have historically shown that male uptake of STEM subjects is far greater than that of female. An increase in women studying these subjects would help increase the volume of digital capabilities in the workforce.

17. There is however, positive evidence to show that a cultural shift is occurring and that the uptake of STEM subjects by women is rising. According to statistics gathered by the Women into Science and Engineering (WISE) campaign, between 2008 and 2011 there was an increase of 21% in the number of females achieving Engineering and Technology degrees\(^\text{10}\).

18. Industry run programmes like the WISE campaign proactively foster interest in STEM subjects from women within the education system. The WISE campaign believes breaking down this barrier and increasing the number of women working in IT could generate an extra £2.6 billion for the UK economy each year.\(^\text{190}\) The Women’s Business Council also outlines steps the government can take to alleviate this problem and suggests initiatives to encourage more business leaders to become STEM Ambassadors, “promoting best practice in schools and engaging with businesses to ensure they provide help at a school and college level”.\(^\text{9}\) Whilst this is a positive trend, a further increase is possible and necessary and can be achieved through the combined support of the government and industry in the educational system.

19. **The educational system is not nimble enough to react to changes in industry patterns**

Significant and fast paced changes in industry can take years to filter down into the curriculum. This serves to heighten skill gaps in the workforce as the education given to the future labour force becomes even more misaligned and out of touch with the industries it is preparing students for.

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\(^{188}\) “STEM: Country comparisons International comparisons of science technology engineering and mathematics (STEM) education” Brigid Freeman, May 2013
http://www.academia.edu/3664766/STEM_Country_Comparisons_International_comparisons_of_science_technology_engineering_and_mathematics_STEM_education_Marginson_Tytler_Freeman_and_Roberts

\(^{189}\) “Government and industry join forces to help get more women and girls in STEM”, Government Equalities Office & Jo Swinson, 2013

\(^{190}\) “Women in Science, Technology, Engineering and Mathematics: from Classroom to Boardroom”, Sue Botcherby & Lisa Buckner, 2012
20. The nature of the educational system means that without a change in structure, it will never be able to match the continual change within industry. Adoption of an approach which embraces technology as an enabler, along with establishing cross-industry initiatives, will help overcome this. For example:

- Having the full national STEM curriculum online, with access to online modules, will support a refresh of curricula at regular intervals and will enable updates to material and content to be made quickly
- Industry led initiatives can also facilitate the most current learning in the classroom. Organisations such as Raspberry Pi provide accessible resources to teach children valuable digital skills such as coding and tech hardware. We explore this further in section x
- Creating links between SMEs and schools and fusing the provision of STEM education between the two could be mutually beneficial to both parties: students are provided with real life examples of digital capabilities in the workplace and SMEs benefit from building links with talented young individuals in their area

**Barrier 2 - Business Culture**

21. Culture is another chief barrier that businesses face in the knowledge driven economy; both in limitations within the existing business culture and resistance to changes brought by the digital era.

22. **Incentives and training must play a more prominent role in business culture to retain skilled employees**

In today’s knowledge economy talent is one of the main sources of competitive advantage but retaining the most skilled employees often remains a challenge for SME’s for the following reasons:

- The promotional opportunities, incentives and remuneration within SMEs often cannot match that of larger organisations
- Investment in training from SMEs is limited as investment is diverted to other perceived priorities
- Investment in training from SMEs is limited due to already high employment attrition rates (due to the challenges above), exacerbating the issue further

23. A recent survey by Towers Watson revealed that 41% of organisations have problems retaining critical-skilled employees. The most cited reason for leaving in the survey was “career advancement opportunities”, highlighting that companies with limited employee mobility are those most likely to see their top talent leave. To combat this, companies need to invest in career management strategies to ensure that their top performing and skilled employees are appropriately rewarded.\(^\text{191}\) By making use of initiatives such as retention bonuses, spot awards and increased workplace flexibility, managers can increase the retention of their most digitally skilled employees.

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http://www.forbes.com/sites/victorlipman/2014/03/28/study-explores-how-companies-can-better-engage-critical-skill-talent/
24. SMEs can also increase retention through targeted training opportunities for their most valuable employees, as well as wider up-skilling of the business. Creating a sense of investment amongst individuals and their careers, will often lead to a return in that investment through greater employee loyalty. Elix-IRR has seen first-hand the value of investment in training initiatives through our work at Morrisons. We have supported the supermarket in designing and developing a learning academy aimed at increasing knowledge, technical skills and employee engagement to deal with the challenge of discounters and multi-channel customers. The academy marked a visible step change in people investment at Morrisons, post-training scores have been exceptional and colleague engagement indicators have improved by 13%.

25. ‘Corporate rigidity’ leads to resilience within the internal cultural to change

Corporate rigidity, or the resistance to change, can hinder many organisations when it comes to adapting to industry trends. We have already seen very real examples of corporate rigidity in HMV and Jessops and the inability to adapt to new digital trends, resulting in the demise of these businesses. For HMV, its single biggest mistake was a lack of investment in its online offering – it chose instead to diversify into electronics (a business that was already faltering on the high street)\(^{192}\).

26. The shift to a knowledge driven economy not only means that change is inevitable, it also means the pace of change is far more frequent and relentless. Rigidity, whether it is a product of culture, as frequently seen in big organisations, or simply the inability to keep up, due to other factors such as high investment, is a significant cultural barrier for firms. To overcome the barrier, organisations must not allow themselves to become complacent and rely on strategies that have been successful in the past; they must learn to accept change and embrace the shifts that are occurring almost overnight within industries. Leaders in business need to be willing to deploy often unpopular change programmes to diversify into digital technologies and resist the temptation to continue with a business model which may be successful now, but may not be fit for the future. As such, incentives amongst business leaders and at an Executive level have a role to play in promoting digitisation within business.

27. Similarly, businesses should also consider the creation of a specialist role which is solely concerned with creation and operationalisation of digital strategies – a Chief Digital Officer (CDO). Companies that have created a CDO position include McDonalds, L’Oreal, Starbucks and The Guardian. Generally their previous business experience lies in e-commerce and transactional expertise (driving traffic, conversion and revenue), online marketing and social media and transformative product and technology capabilities. In creating such a role, a firm can develop a more digital mind-set, promote a culture that embraces innovation and ensure that digital becomes part of everyone’s job within the firm.

28. The digital potential of existing employee skills needs to be fully utilised

The principle of corporate rigidity can also be applied to the way job roles are formulated and skills are used within an organisation. As drawn upon previously, skills under-utilisation is one of the biggest skill related issues that companies face in the knowledge driven

\(^{192}\) “Why did HMV fail?”, Philip Beeching, theguardian.com, 2013
http://www.theguardian.com/commentisfree/2013/jan/15/why-did-hmv-fail
economy. Unclear job roles and a reluctance to adapt an employee’s role to support emerging digital capabilities required by the business can often result in under-utilisation of an employee’s full potential. A survey conducted by Accenture found that only 34% of respondents report that it is easy to move to another job within their company where their skills would be best utilised, and slightly less than 49% of respondents report that their employer does a good job of providing a clear understanding of the skills needed for different roles and career paths.\(^{193}\) Given the pace of digital change, the corresponding statistics for digital only roles are likely to be higher.

29. Similar to the way in which businesses tackle the problem of retaining their skilled employees, a cultural change is needed to overcome the problem of skills under-utilisation. Employers need to put consideration into career management strategies, which not only focus on retaining their employees, but also ensure that the employee’s skills are being maximised in the job role that they are performing day-to-day. An employee who feels like his skills are being utilised is an employee who feels valued and is less likely to leave.

30. The government needs to play a greater role in setting up an environment for digital success

The government can play a huge role in setting up businesses for digital success by creating an environment where digital capabilities can be easily fostered. Elix-IRR believes there are key ways that the government can support this:

- **Full national internet broadband**: Statistics show that ‘superfast’ broadband is only available to 78% of properties in the UK\(^ {194}\). Increasing coverage, speed and reliability of broadband provides opportunities for more SMEs in any location to create a digital proposition. It allows a firm to provide a digital offering and allows its nearest customers to purchase and service products through digital means.

- **Free online STEM and digital training**: The government can support a digital business culture by offering free online STEM and digital training. As the previous section outlined, training and education of employees is important, and the government can support a growing digital culture in business by offering free or subsidised online courses in these fields. Open University courses for instance provide a range of digital technology modules that are flexible in length and timings and are just one example of an online resource that SME employees could benefit from.

- **Wi-Fi offered on trains**: Encouraging all rail companies to offer Wi-Fi services on trains would also have the same effect by providing employees and business owners with digital access on the move. The time re-cooped on the train, particularly commuter trains, would provide beneficial opportunity for business leaders to continue to develop their digital offering.

- **Municipal wireless networks**: Universal free Wi-Fi in large cities would support the development of digital capabilities in the same way that free Wi-Fi on trains would. Cape Town and Singapore are just two of the cities that currently do this for economic and social benefit.

\(^{193}\) “Skills gap: companies short on talent, but stingy with training”, Joe McKendrick, 2011

\(^{194}\) Ofcom – independent regulator and competition authority for the UK communications industry
http://media.ofcom.org.uk/facts/
By playing a role in each of the above, the government can help foster a more conducive environment to digital enhancements within business.

iv. Barrier 3 - Operating model

31. An operating model is a representation of how an organisation operates across process, people, technology and organisation in order to accomplish its strategy. Digital change is challenging firms to review their traditional operating model structures and to respond to growing customer expectations.

32. Today’s economy has been moulded by a flux of digital market leaders such as Amazon, Apple and Google. These digitised organisations specialise in meeting consumer needs - online service chat, click and collect and personalisation are all a common service. For customer expectations to be met in a digital or knowledge driven economy, an organisation is required to develop a much more ‘customer centric’ operating model.

33. In spite of this, many well-known brands, including the likes of Blackberry and Nokia, have been unable to respond by successfully digitising their operating model. With customer expectations set extremely high by market leaders, and with other large corporate firms unable to fully grapple in the digital arena, it is no surprise that developing digital solutions may seem beyond the reach of a SME, meaning they choose not to deploy digital capabilities.

34. We outline why building digital capability may be viewed as an intimidating objective for SMEs by exploring the impacts on channel strategy, supply chain and customer service.

35. The traditional view of ‘digital’ requires that large changes be made to a firm’s channel offering

When most people think about digital capabilities, they think of the development of new routes to market via online and mobile solutions. Having the skills, desire and investment to develop these channels is an undertaking for any business in itself, but achieving the full scale of digitisation involves much more than simply developing siloed digital channels. Once developed, customers expect a seamless customer journey between mobile, telephony, online and stores. In the eyes of the customer, they are dealing with a single organisation – they expect channels to be fully integrated, and to be able to find out the same information from each channel.

36. Delivering this capability requires agile delivery models with flexible modular technologies. Developing, testing and delivering this technology on a large scale requires a significant investment of money and energy, alongside ongoing governance, maintenance of the solution and Management Information (MI) on channel performance.

37. If done badly, this can actually cause more harm to a business than good. Increased and varied channels facilitate greater access for a customer to a business, in turn exposing the business to greater opportunities for customer disgruntlement if not correctly executed. This fear is perhaps why SMEs tend to develop a website only approach, without going further into the digital arena. A recent publication by Lloyds Banking Group suggests that only 50% of SMEs in the UK have a website, and only 18% of these SMEs allow customers to purchase products from their website.  

38. Wholesale digital change may also require significant changes to a firm’s supply chain
For retail companies particularly, how a firm distributes its goods and services is extremely important. Digital channels also have the potential to open up a firm to new locations, increasing its geographical reach and diversifying its customer base. However, for this to be truly effective, a business needs the infrastructure to be able to serve these customers effectively, a criteria that has knock on impacts for a firm’s supply chain and the role it plays in the operating model. Traditionally, the role of supply chain has been to reduce costs, but in the age of the knowledge driven economy, it requires greater agility to offer increasing fulfilment opportunities to a wider expanse of customers. It may also require investment in new distribution centres to offer the speed of delivery expected by customers.

39. SMEs do not always have the appetite or capital required to fulfil such expectations. For these capabilities to be operative, and to provide adequate return on investment, a degree of business scale needs to be in place. Without the operational reach, an SME may find it difficult to employ digital strategies to increase its customer base, and without the customer base, an SME will not have the investment case to increase its digital strategy, thereby creating a ‘chicken and egg’ type scenario.

40. **Digital is also driving competition in new areas of a firms operating model**

In today’s knowledge driven economy, customers look for much more than price as a competitive feature. Price comparison sites, online shopping and mobile apps have made pricing much more transparent, leading businesses to differentiate themselves in other ways. The concept of value is being redefined from the transactional level (i.e. a customer pays a business for a good/service) to an exchange of an experience or outcome. For example, customers now understand that when they hand over their money they are also handing over data about themselves as a customer. In return they expect to be provided with value beyond the mere physical product. The concept of product therefore is also being completely redefined. For example, a phone is now a health monitor, map, and gateway to your social life – it is not just a device for making calls. As such, personalisation, is now one of the biggest competitive weapons in a business’ armory. Shop Direct are the UK leader in this area – their website is personalised to the customer each time they log on, providing an endless list of recommended products based on their customer features, demographics and previous purchasing history.

41. Firms therefore need to be prepared for increased susceptibility to competition in untraditional areas of their business model, and to be open to developing new customer retention and acquisition strategies. Firms will have to go beyond just the transaction point with the customer, to build up an emotional and personal connection with the brand. These strategies are only viable in the modern economy through understanding your customers, which in turn means investing in customer data collation and analysis, with the associated data mining aptitude required by employees. Processes and technology have traditionally been built around efficiency and ease, but for investment into digital capability to be worthwhile, a business operating model needs to be transformed to be much more customer orientated. This will create a necessary reliance on service management throughout organisations, to drive efficiency gains and most importantly ensure consistent levels of customer service provision throughout.

42. Employing a model that is knowledge based, or a digitally orientated strategy, therefore has wide ranging and significant impacts on the operating model. Smaller businesses may
see a foray into the digital world as opening up a proverbial ‘can of worms’, leading to large operating model changes they have not got the appetite for.

43. **SMEs need to be selective in the digital capabilities they employ, and find a range of capabilities that best suit their business model**

SMEs clearly will not have the scale, appetite or investment available to make the large changes to channel strategy, supply chain or customer service functions that larger companies are currently deploying. However, employing digital capabilities within an SME does not necessarily have to mean radical transformation to all aspects of the operating model. Knowing where to play in the digital field can be just as important.

44. As will be discussed in the next section, investment options are not readily available for SMEs looking to create digital capability. Therefore they need to be savvy with the capability they choose to employ. SMEs may not have the reach of larger corporates, but they can be more responsive to change and more agile in meeting customer expectations and habits. For example, SMEs can choose to offer the ability to purchase a product online, but they don’t have to necessarily build an app to offer the same capability. They can choose to make processes both customer centric and cost effective, and they have the ability to implement change much more quickly than large corporates do. By identifying the digital levers available to them, prioritising those that will drive sustainable growth, and then implementing and monitoring their performance, SMEs can employ digital capabilities to enable growth without large transformation or investment. In doing so, SMEs can continue to adapt to the digital economy at the pace and scale affordable to them.

**Barrier 4 - Investment and Finance**

45. Research by Booz&Co in 2012 showed that SME investment in digital technology could unlock as much as £18.8 billion in incremental revenue⁴. The research also shows that SMEs investing in digital strategies are growing on average by an additional 8%.

46. Limitations preventing this investment in digital capabilities occur at an individual firm level and industry wide level. By their very nature, smaller enterprises do not have the economies of scale to warrant large investment in digital development given the short-term returns that need to be generated. At an industry level, high sunk-costs required in expanding technology through to the availability of lending from banks, reduce investment options available to them.

47. **Macro-economic factors have also inhibited SMEs ability to gain the required level of funding for digital capabilities**

On a macro level, the wider economic environment will influence the ability of SMEs to operate in a knowledge-driven environment, in part, simply due to the rapid rate of change witnessed across the economy. The question that SMEs are asking is whether their investment levels can keep up with the constant evolution of digital strategies, and whether the sunk cost of investment in such elements as infrastructure change, will require notable ongoing expense to maintain. This is illustrated by only 20% of UK SMEs (out of a 1,988 entity sample)⁷ being said to be actively looking to increase their overall digital investment spend.

48. Wider still, the conservative and regulatory-driven economic climate has vastly increased bank lending costs, slowing the access and availability of credit to SMEs and as a direct result
investment is hindered. Just 4 banks in the UK account for over 80% of all SME banking relationships\(^{195}\), with a finance rejection rate of 38%.\(^{196}\) This is not to say that the majority of applications should be accepted in a perfect economy, but with such a limited breadth of realistic lending options, SMEs face a roadblock around accessible finance for further investment in areas such as digital infrastructure and associated training. Despite the economy maturing into a knowledge-driven economy with incredible ease of access to information, numerous investigative reports, including a report by the Institute of International Finance (IIF)\(^{197}\) that state “information about SME creditworthiness and potential, is too costly and difficult to obtain”. This demonstrates how the 38% market rejection rate\(^{16}\) is founded on assessments made using imperfect, regulatory restricted information.

49. **Competing priorities in the short term often divert attention away from development of digital capabilities**

The importance of shorter term liquidity and cash flow, which is so vital for an SME, could explain the lack of investment in digital capabilities at a firm level. While there is often an awareness of the benefits of long term investment, the relative instability that smaller enterprises have and a focus on short term company targets, or even survival, will override expenditure on a long term digital vision. Where investment is available, it may be targeted to areas of the business that are seen as more immediately vital, given limited liquidity and variations as a result of cyclical expenditure. This is supported by the Lloyds Bank UK Business Digital Index, which shows that 75% of the 1,988 SMEs sampled\(^{7}\) aren’t investing directly at all in improving digital skills within the workforce.

50. **SMEs need to appreciate that investment in niche capabilities can drive long term gains**

For an SME to overcome these barriers, it is paramount that they understands their limitations. SMEs can be successful in exploiting niche markets, and by using less capital intensive, specifically tailored digital strategies they can realise the benefits that larger corporates enjoy. For example, innovations built on cloud infrastructure provide businesses with a method of deploying the latest technology without excessively heavy capital expenditure and long-term investment. Despite concerns over security, the broad (and ever-increasing) range of add-in applications that cloud platforms can subsequently support, with little or no overheads has created a very viable alternative to investing in physical technology infrastructure.

51. **Overcoming systemic economic barriers is clearly an area where government intervention is also vital. Influencing or shifting bank lending behaviour undoubtedly won’t be a short-term solution, however government awareness of the above mentioned barriers, is key for the formulation of relevant policy. That given, it is still vital that SMEs do more to**

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\(^{195}\) “SME finance: help to match SMEs rejected for finance with alternative lenders”, Department for Business Innovation & Skills, 2014


\(^{196}\) “SME Finance Monitor Q1 2013: The uncertainty of demand”, BDRC Continental, 2013


\(^{197}\) “‘Restoring Financing and Growth to Europe’s SMEs’, IIF (Institute of International Finance), 2013
secure finance in the first place. It was recently stated that 71% of businesses who seek funding only approach one provider\textsuperscript{15} despite the extensive literature looking at SME financing and numerous government policies that are in place today.

**Part 2: How to equip the workforce with new skills in a rapidly evolving environment**

**Introduction**

52. In the remaining section of this paper, we explore how businesses can best equip the workforce with the skills required to succeed in the knowledge driven and digitally savvy economy.

53. Investment in employee’s education and training is vital in equipping the workforce with the skills required in a rapidly changing environment. It is important for businesses to equip themselves with the skills they need to compete in the industry they operate in and to future-proof themselves to survive the pace of change that operating within a knowledge driven economy brings. Increasing training can increase productivity, help strengthen an organisations culture and assist in attracting and retaining the best talent.

54. Equipping the general, not just the specialist, workforce with sufficient digital skills to operate effectively in a knowledge-driven economy, is not a new concept. Despite this, research shows that on average, companies are spending no more than 20% of their training budgets on purely digital development.\textsuperscript{198}

55. We see the following four methods of education and training by business as key to up-skilling the UK workforce and transforming the UK into a global leader in digital utilisation:

- Evolution of ‘on-the-job’ training
- Training outside of the ‘day-to-day’ job
- Investment in industry, the community and the current workforce
- Businesses influencing training of the next generation

56. Each of these four methods are explored in the following sections, however as mentioned in the first section, it must be noted that the education system has a part to play at the grass roots level also.

**Evolution of ‘on-the-job’ training**

57. In both large and small companies, HR led ‘self-service’ employee training has prevailed since the nineties. Kiosks and intranet sites have been used as the low cost, mass rollout option for both mandatory and optional training units, with associated credits awarded where relevant. However, this method has not necessarily been appropriate for training on digital capabilities. With training modules individually created by each business and tailored specifically to their company, the content swiftly becomes out of date, virtually as soon as it is written and published. This method also has limited flexibility, with desktops often required, allocated terminals often used and a network connection necessary for security. In this respect, self-service training is not a forward-thinking solution for digital training and education.

58. **Self-service training needs to move into the digital era**

Self-service training should by no means be seen as fully obsolete. The key to revamping this method is to provide software as a service (SaaS) to improve the agility of education, moving towards on-demand and easily digestible chunks of information (modulated curriculum), as opposed to three hour long obligatory courses. Massive Open Online Courses (MOOCs) offer some capability in this area. Courses like Kahn Academy, Codeacademy, Lynda and Udemy provide an easy way to educate your workforce in technology skills. These however bring their own challenges in that employees often start but do not finish the courses.

59. With the development of mobile and social technology, schemes such as Bring Your Own Device (BYOD) can be used so that digital training can be undertaken at anytime, anywhere. This will help erode the infrastructure barriers firms have historically faced in providing training. In addition, the difficulty and managerial fears over security of data, although still relevant and an ongoing threat, should not be a substantial barrier, given the default and advanced encryption levels through which mobile devices now submit and receive data.

60. One of the most significant benefits of this form of online training, is the openness and ability of firms to pick-and-choose, personalise and develop training plans as extensively or restrictively as they please. For a fully tailored solution, costs for online development will clearly add up. The key for SMEs is to identify the areas where customisation is critical and those areas where it is not. The vast majority of digital up-skilling required is relatively generic across different companies and industries. An additional benefit of this form of training is the data analytics available for easily identifying the most effective solutions and also reacting to the least.

61. Making courses in digital technology recognised within an organisation would help increase the participation in these types of courses. Project Management is recognised by Prince2, Infrastructure capability is recognised through ITIL and Surveyors are Chartered. Formalising digital courses internally within a business, and externally through industry recognition, would help improve the quality of training and the numbers of those attending.

62. Social media incorporation is key to a modern training programme

Social media aids and influence should be of notable consideration in the training field, the collaborative use of multiple platforms can provide an all-encompassing training solution, with the capability to provide remote and flexible training options, as well as methods of communication to facilitate knowledge transfer. They also provide capabilities to link workgroups and ideas, to online materials and solutions with ability for managers to track real-time progress. Tools such as Huddle, Yammer and Tibbr should be increasingly explored by organisations aiming to increase their real-time feedback, levels of shared content and digital focus.

63. Untraditional mentoring roles can facilitate knowledge transfer upwards

Given that the younger generation are often more technologically and digitally skilled than other generations, ‘reverse mentoring’ could be explored in businesses as a useful training method. No matter how senior a member of a company may be, they are never too old to learn modern day digital skillsets, especially as they will ultimately make the decisions affecting a company’s strategic priorities and allocation of investment. In General Electric, in 1999 CEO Jack Welch ordered 500 of his top managers to find young employees to teach them about the internet. Since then reverse mentoring has become common practice at
Dell, Time Warner and Proctor & Gamble, demonstrating the value delivered by these initiatives.

Training outside of the ‘day-to-day’ job
64. Education outside of a business as usual role can considerably develop new skills which employees can relay back in to their day-to-day job, improving effectiveness and efficiency within an organisation.

65. Opening up employee perspectives through ‘cross-pollination’
There are numerous courses and generic employee training/team building programmes currently available, but effective digital training strategies are remarkably limited. As shown in the case study, P&G in partnership with Google initiated a programme to encourage development of both of their workforce’s digital skillsets and their digital footprint in preparation for future growth. The broadened perspectives gained from witnessing how companies operate differently in the digital space, in totally different product markets, has been said to have been mutually beneficial in expanding employees’ horizons and focus. This kind of forward thinking and planning for future growth will not only aid the workforce in building their skillsets, but prepare these multinationals to maintain their competitive advantages and can be used by SMEs.

66. Lessening historic inequality of specialist skillsets
Investing in all employees can help the overall workforce generate new, refreshing and innovative ideas which are vital to an organisations success. With this in mind there have been a handful of fledgling initiatives, whereby diversity in the progression of digital skills, has been encouraged. Microsoft for example has started sponsoring female employees to learn to code through events organised by a digital training company called ‘Decoded’. This initiative was introduced after a realisation that a disparity in the balance of this specialised workforce had grown. Combating this through sponsored events should be actively encouraged and shouldn’t be an avenue only open to larger corporations. Start-up organisations such as ‘Women Who Code’ also aim to reduce the digital skills gender inequality further, but need greater exposure in order to evolve into entities that can make a real difference. Only through companies encouraging and sponsoring their workforce to attend these courses, can these ideas reach their full potential.

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199 “Reverse Mentoring at Work: Fostering Cross Generational Learning and Developing Millennial Leaders”, Wendy Marcinkus Murphy, 2012
http://www.uky.edu/Centers/iwin/RT2012/Murphy_Revers Mentoring_HRM21489.pdf

http://online.wsj.com/news/articles/SB122705787917439625
Investment in industry, the community and the current workforce

67. It is evident in recent times that businesses are taking their social responsibility increasingly into account, by not only focussing purely on the development of their own workforces, but understanding and realising the advantages (in real terms) of investing in training and developing the wider workforce. These positive examples however, aren’t widely prevalent and the development of these strategies is key to developing skills in a rapidly evolving workplace environment.

68. Corporate responsibility needs to be reinvigorated and re-defined

There are a number of identifiable, yet relatively small scale examples of this ideology being enacted in industry today, however equipping the wider workforce with digital skills is dependent on the formalisation and mass rollout of these principles, which can only be achieved through direct corporate exposure. As the Virgin Case Study illustrates\(^\text{201}\), a handful of large corporates have taken the opportunity to invest time and resources in SMEs, to aid the education of small business leaders and their subsequent workforces on practical digital skills and the direct benefits that a more complete digital strategy can have. This example was only a pilot case and isn’t yet a widely seen practice in the UK. CSR initiatives need to be widened and re-defined to encompass responsibility for the UK workforce and business development, not just other social responsibilities such as the environment.

69. The commitment of businesses to investment in the wider workforce, should not be viewed as a purely charitable transaction. The incubating of start-ups and subsequent building of relationships, allows companies to tap into a broad repertoire of new ideas, products and markets, with potentially substantial upsides. Business in the Community (BITC) is the largest of the current initiatives helping to create “more productive employees”, with a strong social responsibility edge and over 46,000\(^\text{202}\) volunteer instructors and helpers last year. Support to initiatives such as the ‘Business Connectors’ programme, connecting business leaders to communities in great need of skills training, including digital capabilities is gaining momentum. Through greater publicity and awareness, the outputs from businesses investing time and effort in the existing workforce can be realised. While this remains a priority for BITC, they also have strong focus on training the next generation.

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\(^{201}\) “Digital Skills for Britain”, Virgin Media, 2013
\(^{202}\) “Annual Report 2013”, BITC (Business in the Community), 2013

http://about.virginmedia.com/blog-post/76/digital-skills-for-britain
Businesses influencing training of the next generation

70. Whilst it is vital for businesses to equip their current workforce with the skills they need to perform in today’s skills-driven industries, it is also essential that they consider investment in developing the skills of the next generation. This is increasingly important in the post-recession economy, as the focus is now on the private sector to drive economic growth going forward.203 Businesses are well placed to influence the skills required for future generations, as they are able to capitalise on their knowledge of industry to help tailor and shape the content and delivery of education, to ensure that future workforces are equipped to operate in the industries they seek to join.

71. Business influence is needed to define how the next generation can increase their ‘employability’

In a recent study conducted by the CBI (Confederation of British Industry), over 70% of businesses said they want to see employability skills made a top priority at schools and colleges. The same survey said that 55% of respondents are already involved in apprenticeship programmes, with a further 17% planning to be involved over the next few years.22 Some organisations such as BT204, which is known as one of the best investors in skills for the future, have implemented a number of programmes, including apprenticeships as well as piloting many new initiatives as mentioned in the case study.

72. Modern techniques and joint initiatives can proactively equip the next generation

Going forward, business investment and input into initiatives that aim to circumvent the traditional education system and become more proactive as opposed to reactive, should be further stimulated. Internships are a normal part of almost all businesses in the UK, so these initiatives should be seen as an extension of that theme, whereby immediate value isn’t necessarily realised, but the long-term potential is considered. Programmes developed by initiatives such as Apps for Good, which “equips students to research, design and make...

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digital products and take them to market” should be used more effectively and where possible; on a larger scale. With a focus on joint visions with industry leaders, the skills taught and exposure granted could have a significant bearing on the equipping of the workforce of tomorrow. Examples such as the hugely popular Raspberry Pi computers initiative, where small, cheap and simple “single board” computers are used for teaching the basics of computer science, illustrate what a significant impact can potentially be realised through charitable initiatives. If these initiatives were to have a corporate partner, the benefits would surely be realised significantly quicker than the organic growth many charities are dependent upon.

73. Whether businesses choose to take a more traditional approach with their involvement in education, by running apprenticeship schemes, or whether they experiment with new and more direct initiatives, such as sponsoring and tailoring courses and the curriculum itself, their involvement is key. There are numerous examples, such as the creation of a Master’s programme in Food Engineering at Sheffield Hallam, developed in conjunction with a number of other food and drink companies including Arla Foods where direct business involvement and the subsequent industry insight they can provide, has created an infinitely more relevant education curriculum. Business involvement in education and training remains imperative to the growth of the economy and the future ability of the UK to compete on a global scale in today’s knowledge driven environment.

Conclusion

74. The pace of digital evolution in a knowledge economy shows no sign of slowing and the importance of a strong digital capability in an organisation’s market competitiveness, is only going to increase. Customer expectations, which are currently shaped by leading corporate organisations will eventually permeate all levels of business, including SME markets. It is increasingly important that SMEs participate in the digital arena and that the workforce is fully equipped to support them in participating in this change.

75. From the four barriers outlined in this paper (education, culture, operating model changes and investment), the largest barrier to businesses increasing their digital capabilities lies within education and training. If SMEs had access to skilled and knowledgeable talent pools through appropriate grass roots education and training of employees, the transition to a digital business model would be a much smoother and confident choice. Coupled with an appreciation of the value of digital capability at the leadership level and greater awareness of existing support available to SMEs, this would significantly enhance a firm’s ability to build and deploy effective digital strategies.

76. There are a handful of instances where businesses have identified a deficit in digital skills within the workforce and have proactively built strategies to influence this and overcome these barriers, be it with their existing employees, within the wider workforce or for the next generation. Schemes employed by the likes of BT and Virgin are examples of just how beneficial the impact of big business on human capital development can be. The majority of these schemes to date have been entirely self-incentivised, and so the government has a vital role in encouraging more large businesses to play a wider role in educating the UK.

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205 Apps for Good
http://www.appsforgood.org/public/about-us
workforce. If schemes like those evidenced in the case studies used in this paper were prevalent across the majority of large corporates, digital skills curriculum and industry schemes could be moulded to be mutually supportive and beneficial. In doing so, businesses have an additional avenue in building a strong competitive advantage, to outperform the ever-increasing global competition.

77. Digital technology is only becoming more dominant in the way we communicate, purchase products and in the way we work. A new generation is growing up having known nothing else but smartphones, apps, online purchasing, personalisation and digital entertainment. Corporate companies will only become more digitised and SMEs need to do the same or their failure is inevitable. The value of digital capability in economic terms for the UK is enormous, and this does not even consider the value delivered by providing further educational and developmental opportunities. The government and big business each have a role to play in setting the UK up for digital success. Failing to act now will compromise our future business sustainability and leave UK PLC trailing behind other countries.

5 September 2014
The European Azerbaijan Society – Written evidence (DSC0038)

1. This is a written submission to the House of Lords Digital Skills Committee in response to the call for evidence on ‘Digital Skills in the UK’ from Lionel Zetter, Director of The European Azerbaijan Society (TEAS).

TEAS is a London-headquartered pan-European organisation which seeks to forge closer political, cultural and trade links between Azerbaijan and the rest of Europe.

Introduction

2. This submission shows how the provision of public services in the UK can be changed through innovation and advancements in digital technology. The case study used to show this is the State Agency for Public Service and Social Innovations (ASAN) in Azerbaijan.

3. Although not a British case study, TEAS believes that there are lessons the UK Government can learn from the delivery of public services from the ASAN model. Given that central and local government budgets are being reduced, whilst the public still expect a high standard of services, there is a need to use innovative methods to drive efficiency and save costs. The below case study provides the background information on ASAN and outlines how digital technology has transformed public service provision in Azerbaijan.

Question 1

*What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?*

Background

4. ASAN was established in Azerbaijan on 13 July 2012. ASAN is a body for public services and social innovations and aims to make government services more easily accessible to citizens, using modern technology. The example of ASAN outlined in this submission shows leading innovative techniques in local government. Leading innovations such as ASAN could increase the amount of data sharing between services to make efficiency savings and meet the demands of local communities in the UK whilst local authority budgets are being reduced.

5. ASAN is a network of centres where public services are delivered in a unified and coordinated manner by skilled and motivated public servants. This is highlighted through the broad range of services that are provided through ASAN services. There are currently five centres which are fully operational, but the ASAN project is being rolled out across the whole country.

ASAN centres

6. The ASAN centres are founded on the belief that modern technology and digital innovation can be used to increase efficiency for the provision of public services. The centres function on the principles of efficiency, transparency, ethical behaviour, responsibility and comfort.
7. The following services are provided by ASAN centres in Azerbaijan, and shows how digital innovation can lead to efficiency in provision at the local government level. All of the services included below can be accessed by people online:

- Ministry of Justice
  - Birth registration
  - Death registration
  - Marriage registration
  - Registration of child adoption
- Ministry of Interior
  - Issuance of passports
  - Issuance of driving licenses
  - Notes of convictions
- Subsidiary services
  - Bank services
  - Insurance services
  - Translating systems
  - Registration of property and land rights
  - Currency exchange

8. As stated, there are currently five ASAN centres in Azerbaijan, three in the capital Baku and another two in Sumgait and Ganja city. Further centres are scheduled to be built throughout the country. For those people who may not be able to access one of these centres, there are mobile ASAN buses which bring the services to those individuals who may be elderly or isolated.

E-services

9. All payments for services in ASAN centres are made online, which means the quality and speed of services is faster than it would be in the UK. Through digital innovation, services have become much more responsive and cost effective, and opportunities for corrupt transactions are eliminated. The method of using only online payments is a system that has been reflected in the UK through Universal Credit transactions. Although still in pilot stages Universal Credit has used elements of the same principles ASAN is founded on. ASAN shows that the UK has the ability to use digital transaction systems as the default model for benefit payments over the next ten to fifteen years.

4 September 2014
Megan Richards, Principal Adviser, DG CONNECT, European Commission, and Andreas Schleicher, Director for Education and Skills and Special Adviser on Education Policy to the Secretary General, Organisation for Economic Co-operation and Development (via video link)

Q221  The Chairman: Welcome. Thank you very much indeed for joining us this morning. You probably know the background of what we are looking at as a Committee. There is a bit of housekeeping first before we go into the questions. You have a list of interests that have been declared by Committee members. They have been declared at previous meetings. This is a formal evidence-taking session of the Committee and a full shorthand note will be taken. This will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you can revise any minor errors. This session is on the record, is being webcast live and will subsequently be accessible via the parliamentary website. You are very welcome to submit written supplementary evidence after the session.
Indeed, we may request that you do that where we have particular areas we want to follow up. We will speak as clearly as we can. Shout if you are not hearing us properly.

I will ask you both to introduce yourselves. If you wish to make any opening remarks, that would be fine and very helpful. If you do not want to, we will go straight into the questions. It is entirely up to you. I will start with you, Ms Richards.

*Megan Richards*: I am delighted to be here, of course, particularly as a representative of the Commission. It is always nice to see that the UK still wants to hear from us. I am Principal Adviser, primarily responsible for internet governance issues, and I was previously responsible for digital skills issues in DG CONNECT of the European Commission. Would you like me to make some opening remarks?

*The Chairman*: Yes, please. That would be great.

*Megan Richards*: I was planning to speak to you about a number of things, but now that I have heard the last 10 minutes of your previous session I have more. One is that, as you may have seen, the new Commission, which was formed on 1 November, has appointed not only a digital Commissioner, in the form of Mr Oettinger, who was previously the Commissioner responsible for energy, but a vice-president who is responsible for the digital single market. Mr Juncker has also said in his mission letters to these Commissioners, but also in the way in which he has organised the Commission, how important the digital economy is and he has taken a particular interest in it. That is already an interesting political sign from the European Commission, and one thing I wanted to put into context for you.

The other is that I wanted to speak to you about briefly about what we call the Grand Coalition for Digital Skills and Jobs programme. I think it addresses a number of the issues that you were speaking about in your previous discussions and that I have seen from your previous Committee hearings, and that is to bring together politicians, government, industry, educators and other interested parties to try to make sure that digital skills are promoted and encouraged and that the number of young women in these areas is increased, particularly in ICT skills. One of the things that is particularly important is to bring industry and government together. We have seen the claim many times from industry that there are huge numbers of jobs that it cannot fill. If you look at the job listings of any company online, you will see long lists of computer scientists and a whole list of different ICT-related jobs that are not yet filled for lack of skills. Secondly, there is the importance of bringing it to the very top levels of politics and government to make sure that the skill sets that are established and developed at school are those that are interesting and useful for industry but also to make sure that they work together to attain these goals.

One interesting example of success in this respect is Romania, where the Ministry of Education has worked hand in hand with the Ministry of Information Society and industry. Many European industries, and multinational industries as well, have now started to bring some of their ICT workers there. They have not brought people from the Philippines and India, obviously, but they have moved some of the jobs that were previously carried out in those countries to Romania because they found that people in Romania have the right skill sets and they speak European languages. In addition, Romania does not have the time zone difference, and the Government has introduced much more actively the skill sets that industry needs. In eastern European countries there also seems to be a higher number of
Andreas Schleicher: Thank you and good morning. A couple of points to make would be that overall our analysis suggests that the UK is comparatively well positioned when it comes to access to communication technologies. That is quite well established, and deficiencies in the skills people have to use those technologies is probably the main barrier to productivity growth, particularly among the young population. When you look at the number of computers in households and the number of people having access to the internet, on all of those measures the UK would fare favourably compared with the EU and OECD averages. You do not get close to countries like Sweden, Norway and Korea, but that is not the main barrier. We also see that the use of technology is quite well established too. For example, 77% of adults in England use e-mail at least once a month, which is better than the OECD average. We also see in the workplace that the UK economy is quite good at extracting value from the ICT skills that people have. Better skills translate into significant earnings outcomes, which I will talk about in a moment.

That is the positive side. Looking at people’s skills, in 2013 for the first time we measured the ICT problem-solving skills in populations in most OECD countries. When you do that, overall you can see that the UK’s performance is more or less average but that only about 35% of adults in England could be considered reasonably well skilled for today’s digital economy. They score at what we call level 2 and 3 on our ICT test, which means that they can operate everyday applications such as opening a spreadsheet, sending e-mails, linking applications and so on. This is not rocket science. Those are the kind of skills you need to get the benefit of the digital world. That is about 35% in England, similar to the OECD average of 34%, but you have countries like Sweden, the Netherlands, Australia and Canada with significantly higher shares of people being able to do that. England is particularly strong in the older generation. When you look at 55 to 64 year-olds, you have about 18% performing at levels 2 and 3 and that compares to the OECD average of just 12%, so the UK is well positioned in the older generation.

But the counterpart, and this is probably the most troubling finding, is that in England, and even more so in Northern Ireland, young adults have much poorer digital skills on average than across OECD countries. Only 42% of 16 to 24 year-olds score at levels 2 and 3 on our ICT test. That is more than the older generation, but in most other countries the younger generation will be considerably better positioned than the older generation, so this is where the UK lags behind. When you look at top-performing countries it is 63% in Korea, 62% in Finland and 62% in Sweden. Those countries have a young population that is much better positioned to benefit from and contribute to the digital world. That is the main barrier to productivity growth at the moment. It is not an isolated deficit, by the way. We can see a similar skill deficit in numeracy and literacy among the younger generation, so those things do correlate. When you think about what you can do to remedy that weakness, it probably comes to foundation skills in general. One point to note is that we do see significant gender gaps. You see them in all countries but in England they are more pronounced than they are across OECD countries.

Why do all those things matter? We see that digital skills are very significantly associated with higher labour force participation and lower unemployment. In fact, one of the things
that you can see is that the only employment growth we have seen in the EU area, and also in the OECD area, has been at the high end of the digital skills distribution. But that is the only area where employment growth is happening. If you have very poor digital skills, there has been little change. Many jobs in the UK economy do not require great problem-solving or digital skills, but the biggest loss has been in the middle half of the distribution. For example, office workers who are not catching up with the technologies are paying the biggest price. It is very important to keep in mind that there is a kind of skills-based polarisation of the UK labour market.

In terms of earning outcomes, this is not just an employment story; it is also a significant wage story. What is interesting is that the link between digital skills and productivity or earnings is often stronger than the link with formal qualifications, so having better digital skills at a lower level of formal qualification can turn into a bigger earnings advantage than having a university degree but poorer digital skills.

Q222 The Chairman: Can I pause you there? You have raised a whole lot of very significant issues. I think we want to drill in more detail into some of those broad headlines that you have given us with some really useful statistics. First is the issue of economic growth. Mr Schleicher, you have just talked about that a bit anyway, but the Committee wants to get a feel from both of you about the importance of the digital sector and of digital skills in the wider sense. How important is that for economic growth? Perhaps you could give us some examples from across Europe where the digital sector in particular is doing well and flourishing, and what is being done to try to develop competitiveness in that area. I will come to Ms Richards first.

Megan Richards: I will give you information that is EU-wide but, of course, there are huge variations between countries, between Greece and Romania, the Nordic countries et cetera. Overall in the EU—I am sure the OECD can give you more detailed statistics specific to the UK—we see that the ICT industry’s share of GDP is around 4.4%. That is overall, for all of Europe, and of course, as I said, it differs quite significantly from one country to another. But the overall contribution of ICT to GDP growth through production and use in the economy is much larger, and that is sometimes estimated to be even up to a third of the value of GDP growth.

Again, there is a whole series of statistics and studies—I am sure the OECD will give you all the detailed information; I can provide you with the information later but I will not go into the details now—where we see quite significant differences between the way ICT is integrated and used in companies in the United States, for example, or in some of the Nordic countries, and the way that ICT skills and activities have been integrated into other industries compared to just ICT-specific industries. I think there is an important distinction there on that particular aspect, and your previous speakers were talking about that.

Andreas Schleicher: I do not have much to add to that. I would just say that at the level of individuals, the kind of wage increase that is associated with digital skills gives you a good indication of how significant the benefits are of being equipped for the digital economy. You can look at this at the aggregate level in terms of economic growth, but at the individual level, in terms of greater pay-off, these numbers are very significant. They are bigger in the UK than they are on average across countries, which tells you that having the right conditions in the UK means that the economy is very good at converting digital skills into better jobs and better economic outcomes for people.
Megan Richards: May I add one thing relating to education? Looking at the Nordic countries, and taking Finland as an example, ICT as a topic per se is not introduced so dramatically in schools, because they have quite a different schooling system and the teachers have a lot more independence. However, Finland always comes out at the very top of the PISA scales. The results are very good. They have a huge gaming industry. Companies like Rovio, which is behind Angry Birds, could not possibly have developed without the skill set that they have. There are very different ways that these activities are carried out in each of the different EU countries, but the Nordic countries are quite interesting as examples.

Q223 Earl of Courtown: You have already mentioned a number of the different countries round Europe, but do you have anything more to add about the countries and cities where they have got digital inclusion right and perhaps, specifically, about where the best digital tech clusters are? Also, combined with that but just as important, what have Governments done to help these clusters exist and achieve so much?

Megan Richards: The highest rates of digital inclusion in Europe are in the Nordic countries, as I have mentioned already, the Netherlands and Luxembourg. Of course, in the Netherlands and Luxembourg you have a very high density of population. Luxembourg has a relatively small population but it is still quite dense, so you have relatively easy broadband rollout and access to the internet, and the school systems are perhaps easier in some ways to manage. With the digital tech clusters, it depends on whether you are comparing within EU or comparing the EU to areas outside Europe. In the US, of course, Silicon Valley and the MIT Boston clusters are classic examples, but then also in the UK you have Cambridge and—what is it called in London?

The Chairman: Tech City.

Megan Richards: Tech City. Is it called the Fen Valley in Cambridge? There are others. Berlin, of course, is very active. There are areas around Munich, Paris, also Sophia Antipolis in southern France, so there are other areas where this is developing. Again, I think it is a combination of Governments taking an active interest in making sure that facilities are made available and industry taking advantage. In Berlin there were a lot of empty buildings and the Government were quite supportive in encouraging these activities. There are a lot of high-tech universities around Berlin. Of course, in Germany too I think the attitude towards education and the use of vocational education is a particularly important aspect, so you did not necessarily have to do a degree in computer science at university in order to be able to work in a job that requires digital skills.

Just as an aside, there is a wonderful case in Ireland of a group—whose name escapes me for a second but I will send it to you—that has taken a number of long-term unemployed people and taught them coding skills. That takes three weeks or a month—really not very long—and then they have all gone immediately into jobs, because there is a huge demand for these kinds of skills. A number of them were single mothers, who were then able to work from home, so there is a whole series of great advantages.

One of the issues you were discussing with your previous speakers was the role of women and trying to encourage young women in these areas. My personal view, is that trying to tell girls they should be more interested in computer science is not going to work, for all sorts of reasons. But I think that using the back door to get in will be more successful: telling them
that you have to have ICT skills in order to be involved in the fashion industry, in media, in publishing, or in whatever other area it is where they need those skills is more likely to work.

**Andreas Schleicher:** I think it is important to look also beyond Europe. The countries with the steepest progress in this area, like Korea, Singapore, Japan and even some provinces in China, consider the digital infrastructure like they consider roads and piped water. It is something the Government take care of and is universally available. In Korea it starts with school. Every school can access high-speed internet and the curriculum is fully on the digital domain. You can do your homework on your mobile phone. It is an integral part of the infrastructure there; strong government investment in the infrastructure and the expectation that citizens will use it. Most services are in e-government, so it is really interesting to look at it. Unfortunately, we do not have data on the level of individual cities. It would be an interesting comparison. We just have them at the aggregate of countries.

The Nordic countries in Europe have a long tradition in this and also have a very strong skill base, or they have universal literacy skills so the access to technology is not a big barrier for most people. Looking at Asian countries that have very recently established their infrastructure and the capacity to use it is very instructive too.

**The Chairman:** In your view, has that come directly from the Government setting out a very clear direction of travel?

**Andreas Schleicher:** Absolutely. If you look at countries like Korea, Singapore and China, it is basically a clear investment strategy on the part of the Government, making sure that everybody has access to the infrastructure and then drawing out the benefits from that. As you can see from the numbers on the returns, it is probably the best investment that you can make. Keep in mind, in the case of England, the skill base barriers are significant. If you do not address them you will not get the benefit out of the infrastructure. That is an area where these countries in Asia and in northern Europe are simply better positioned than the UK, particularly in the young population.

**Q224 Lord Holmes of Richmond:** Good morning. We have touched on this a bit so I will just develop some of the themes you have pulled out. What sort of business-friendly approach best supports the digital economy and what does effective digital government look like?

**Andreas Schleicher:** This is not an area I am particularly specialised in. I would have to check with my colleagues.

**The Chairman:** Okay. It would be very helpful if you can send us anything on that.

**Megan Richards:** I am glad you asked the question. I do not have an exact answer, of course. However, I think that this is an area where Governments have a wonderful opportunity to improve and roll out e-government, which is a great benefit for citizens. If you have citizens who have digital skills so they can fill out their tax forms online from a distance without having to go into the office you reduce transportation and increase efficiency. The OECD was also saying that the older population in the UK has greater digital skills compared to other EU countries, which is a great advantage. Those are people who are going to want to use better government facilities online; but also think of all the health benefits. If you have remote help in your home for an ageing population, which we all have in Europe, and that ageing population has sufficient skills—it does not usually take huge skills—this kind of activity can bring wonderful opportunities and benefits, by reducing transportation time, cutting costs, and making things much more efficient.
One of the arguments always being made is that digital skills should be concentrated on the young and we should forget about people over—I do not know where the cut-off is. Obviously you want to concentrate on youth but I think there is still an advantage in educating elderly people. Perhaps the trick is to make sure the young people educate the older and vice versa rather than the other way round.

Q225 Lord Kirkwood of Kirkhope: There is an inclusion dimension to that, which Governments also need to solve, which I would like both our witnesses to comment on briefly. If low-income households, for example, do not have access to the internet, what is the duty, if any, of Governments to enable that access so that the inequality divide does not get worse in the near future? Could I ask both witnesses to comment briefly on that?

Megan Richards: In some cities, it has been the policy of the city to provide internet access, which has been extremely useful. The mayors of Manchester and Birmingham, for example, have been extremely active in ensuring that broadband rollout is carried out within the city, pushing the smart city agenda. They have been particularly active. Those two come to mind immediately but there are other cities that have also been very active.

The statistics I have seen are contrary to what the previous speakers said. In the United States, it has been shown that the inner-city children and youth are developing increased IT skills. There are more young minority people in inner cities in the United States who have these ICT skills and are developing them for all the reasons that you know: it is relatively easy; you can do some of them online; some cities have been providing internet access; and there are public libraries that all have internet et cetera. I suppose also to a certain extent in the United States some of these products and devices are probably slightly cheaper than they are here. Almost everyone has a mobile phone, as they do in Europe. But the statistics I have seen show that those minorities are beginning to have a higher incidence of ICT skills, and an increase in ICT skills. They are having problems getting jobs for a whole series of other reasons, but if I can find those statistics I can send them to you.

Lord Kirkwood of Kirkhope: Devolving to cities is one potential answer.

Megan Richards: That is one answer.

Lord Kirkwood of Kirkhope: Thank you. Mr Schleicher?

Andreas Schleicher: We have quite good data on the link between social background and digital outcomes. The distribution of the infrastructure it is much more accurately distributed than the distribution of the skills to use that infrastructure because the home use of digital technologies is not the final criterion. It is access to digital technology at work, and if you look at who gets those kinds of jobs, it is people who have the better skills to use the technology. The inequalities are amplified by the UK labour market. I do not think it is a matter of just equipping every household with broadband access. That is a good thing to do but it is not going to address the inequalities. The inequalities come from the inequalities in the skills of people, which are much stronger in the UK than they are elsewhere. It is not so much, in my assessment, an issue of technology as it is about addressing inequality in schooling and access to jobs.

The Chairman: Can I check something that you said in your previous answer? I think you were saying to us—I just want to make sure I have this right—that part of the problem about our younger population being relatively unskilled digitally is because their basic skills,
presumably literacy and numeracy, are of too low a level as well. Is that right? It is part of the whole piece.

Andreas Schleicher: That is correct. The poor digital skills in the youth population are mirrored in below average numeracy and literacy skills. We have done some simulation of where you could get the biggest short-term return and there is some truth in saying that it is about basically equipping people with better digital skills at a low enough distribution. You could get some short-term wins on that, but in the long run it is basically an issue of foundation skills, which are quite weak in the young generation.

Megan Richards: May I just add one point on that? I think that is a very interesting observation from the OECD specific to the UK. In our Digital Agenda Scoreboard, which is published every year and has more information than you could possibly want to see, one thing always comes out that is particularly interesting and relates to the digital divide. If you look at urban and rural, rich and poor, educated and uneducated, you see quite interesting divisions between those groups. But in the under-25 group—this is EU-wide, not specifically here—you do not see those distinctions. The group under the age of 25 do not have those distinctions and that divide to the same extent that you see everywhere else in the population. But the OECD says that in the UK poor digital skills among youth is a factor, and I think that is a very important element to take into consideration.

Lord Giddens: Does any other Member want to ask about inequality, because I wanted to just bung something else under this heading.

The Chairman: Yes, go on. You bung away.

Lord Giddens: Could you comment a bit about the digital agenda and SMEs? Over 90% of businesses in Europe are SMEs, and we know that if you run a small business now you can immediately become a global business because of the internet. We know also that a lot of SMEs do not do that and they are not trained up to do that. I know it is a big part of your work. Maybe you could comment on how you fit it into the wider agenda since Europe’s economic future might depend in some large part on that.

Megan Richards: First of all, in the Grand Coalition for Digital Jobs that I mentioned, we do involve SME. It is one of the areas where we try to bring in SMEs and encourage them to participate and make sure that they have the necessary information. A huge effort is taken in the European Commission to develop and encourage SMEs in general but also with respect to ICT skills: helping them to get access to information, to improve the way they hire and fire and to use better skills.

There is also Startup Europe, where we try to drive further assistance for SMEs in the digital area. In addition, in the new Horizon 2020 research and innovation programme, which goes from 2014 to 2020, there is a much greater emphasis on assistance to SMEs, in particular in introducing them to R&D assistance and innovation support. The innovation support in particular for SMEs in that context has been underlined much more in this particular programme than it has in the past. It existed in the past but there is a much greater emphasis on it in this current programme.

I think all those other factors are important and, again, I could send you reams of paper on this particular issue. I am sure you do not want reams but we can send you some detailed information about the specific programmes that are available to SMEs.
Baroness Garden of Frognal: You have already referred to the OECD evidence that highlights education, gender and age, which have a relationship with problem-solving capability. How do you see education and digital technologies being used to level the playing field for disadvantaged groups and what role is there for government in helping that to come about?

Andreas Schleicher: There is a lot Governments can do on that. It is not just a matter of digital technology. You have countries that use digital technology very effectively in spreading classroom practice, connecting schools, connecting students and giving students in disadvantaged communities access to great educational experiences. It is also a matter of the way these countries generally use their resources. If you go to the Nordic countries, they do so well because they attract great teachers in disadvantaged schools. They allocate their human resources in such a way that the challenges are matched with the skill distribution. They typically have much more demanding standards than you have in the UK. Typically every child, irrespective of their social background, is expected to demonstrate great skills. I would say those aspects would matter at least as much as the direct use of digital technology in the classroom.

Great technology can leverage great teaching practices, making it accessible and spreading the knowledge and so on, but there are very few examples where you use good technology to replace poor teaching in classrooms. That is not something that we can see in many places.

The Chairman: Can you tell us anything about teacher training in the best countries?

Andreas Schleicher: We looked at this from the demand side. It is the second most wanted field from teachers themselves. Teachers do not feel equipped to use technology and integrate it into pedagogical practice. There is a lot of teaching of ICT skills in education but the key is to integrate it into the teaching of every skill in every school subject, and that is something where I think teachers themselves express a great need. That is true in England—we do not have data for other areas of the UK—and it is true for most of the OECD countries. Investing in integration—giving the ordinary teacher, not the ICT teacher, that experience and better access to technology—could make a world of difference.

The Chairman: Is there anywhere that does that very well? Where do we look that does that very well?

Andreas Schleicher: Number one is probably Singapore on that score, and in Asia there is also Korea and Shanghai in China. The Asian countries have made a lot of investments in this area. They encourage digital skills in the sense that they combine it with the professional development of the teaching force.

Lord Janvrin: Just to follow up on this one: looking at your knowledge of different countries’ performance, what about lifelong learning? Who is getting that right and how are they getting it right throughout people’s careers and so on?

Andreas Schleicher: In Europe you would probably look to countries like Sweden, followed by Norway and Denmark. First, they modularise education a lot more than in the UK. You can accumulate qualifications over your life cycle, you can alternate education and work, and employers are a lot more open to people continuing their education. When you look at the age distribution of when people get their university qualifications or their PhD, you see lots of people in their 40s and 50s completing their education. This integration of education...
and work is very effective in terms of skill development. When it comes to qualification frameworks, Governments are a lot more open to lifelong and, I would say, “lifelike” learning. In many aspects of life you can build human capital.

The UK is not badly positioned in terms of access to continuing education and training. The incidence is above average but the intensity is very low. Employers in the UK invest in filling short-term skill gaps but they do not invest in the kind of sustained development that upgrades human capital. If you look superficially at participation rates, the UK would score quite well but you would not get anywhere near countries like Sweden when you look at intensity.

The Chairman: That is very interesting, thank you. Do you want to come in, Ms Richards?

Megan Richards: I just want to pick up on one thing, which is one of the issues you were discussing with the previous speakers as well, on the role of MOOCs. Would this not be an area that could be of potential use? You have the wonderful example of the Open University, which is kind of a MOOC before they existed.

The Chairman: Yes, an early version.

Megan Richards: I would have thought that in the UK that is something that already exists, and people know what it is. It is an area you could perhaps develop further and find that it was adopted and accepted much more easily than in some other cases.

One other point that I wanted to pick up on from the OECD comments is the availability of equipment in schools. I am sure you have all seen those wonderful YouTube videos of Sugata Mitra with the hole-in-the-wall computer. In this area, which is developing so quickly and so rapidly, those of us in this room—none of us are under 25, I am sure—have a different way of looking at these things. Young people seem to somehow have a capacity to learn these things. I have a suspicion that if you just throw certain equipment into the room they will learn to use it themselves. If you had 3D manufacturing equipment in a school I bet that the children would learn how to use it.

This is a real barrier in some schools where teachers have no idea how those things work. It is unfortunate that they are then forced to be teaching these skills to students who, in fact, are probably better and handier.

Andreas Schleicher: I will add one word of caution. I am a great supporter, fan and user of MOOCs, but the biggest MOOC providers—FutureLearn in the UK or Coursera and edX in the United States—have completion rates of between 3% and 5%. I think this tells you that technology without policy or qualification frameworks will not get you anywhere. If you were to build the MOOCs into your national qualification systems and have an approach that recognises the qualifications or the skills that are built there, you would probably get a lot out of it, but currently it goes nowhere.

Q228 The Chairman: Can I take you back to a comment you were making about lifelong learning in other countries, particularly the Nordic countries, being very successful and in more depth than is done in the UK? How is that funded? Do people fund themselves, does industry fund or does government fund? Obviously we have a fair amount of money going into our further education sector, although there is a question about how well it is used, but I am interested in the role of the different partners in that.
Andreas Schleicher: That is a very interesting question. Of course when it comes to formal education and training in the Nordic countries it is all government funded. But the true costs are not in the tuition; the true costs lie in forgoing earnings. So you can how people finance their continuing education and training. One interesting finding that we have is that the labour market in those countries, particularly in Sweden, is very sensitive to skills. If you invest in your own skills, the kind of degrees and qualifications that you get are very fine-grained, so the labour market picks it up. Most of the cost and the burden is paid by the individuals. People are willing to invest in their skills because they translate into access to more jobs and ultimately better earnings. I would put more attention on that than simply finding ways of how you can subsidise that kind of education and training.

What you also have is very flexible work environments, so basically people can decide when, how and where they learn, and employers are very open to that. Typically you can negotiate a reduction in work time with your employer to pursue a course. The whole environment is very conducive to that, but I would argue that the direct cost is largely borne by the individuals themselves.

Megan Richards: May I add a point on that, if you do not mind? In the Grand Coalition for Digital Jobs group that we have brought together with government, industry et cetera, one of the issues that industry constantly complains about is that even university graduates in ICT do not have the skill sets that they need to bring people directly into a job. So one of the areas where we have tried to encourage them to do more is the introduction of more certification of particular skills, skill development within the industry and transferring people from one industry to another for short periods of time. I think that is an important element as well. Even if you were to invest everything in education, you would not necessarily meet all the skill requirements that industry requires, so it really has to be done together.

The Chairman: If you do not mind, can I take you back? The Nordic countries are particularly interesting for us in some of the areas. How do you think the population know that investing in their own improved skills is going to give payback? How do they know that? Where does that information come from?

Andreas Schleicher: It is a good question. There is no formal system that tells you that that kind of education pathway is leading to those kinds of returns. In fact, there is a lot of misalignment between skills. There are a lot of young people studying media science because they find it very interesting without necessarily getting access to better jobs. The one thing that you can be pretty confident of in the Nordic countries is that if you invest in skills it is going to translate into a better job. That knowledge is very deeply rooted.

The Chairman: It is cultural, yes. Thank you.

Q229 Lord Giddens: Despite all the hype, the EU has not done very well in terms of integrating its energy systems. How is it going to do better with digital infrastructure? This is a core part, as you said, of Mr Juncker’s proposal. He put the digital agenda right at the very top of what he said when he gave his first speech, so it is very important to the Commission and to Europe more generally. But how are we going to do it? How are we going to up infrastructure at a pan-European level, because actually Europe seems to be falling behind other parts of the world rather than leading?

Megan Richards: It is not just Mr Juncker who is going to have to do it. Of course the member states have an important role in this too. You may remember that in the last
financial framework there was a proposal for a Connecting Europe Facility, of which €9 billion was foreseen for IT infrastructure. That was effectively cut out, to be perfectly blunt about it. I think they were left with less than €1 billion over seven years. Now I think Mr Juncker is going to try to come back with this. There is another proposal to try to encourage and support digital infrastructure in Europe and to try to improve interconnections between countries. There is the Connected Continent proposal, which was already developed under Neelie Kroes, that is going through the Council now. So there are a number of initiatives that have already been started. Poor Mr Juncker has only been in office for three days so we will see, but I am absolutely convinced this is an area where he is going to want to push further. We have seen this already in the mission statements that he has sent to Commissioner Oettinger and to the vice-president for the digital single market. This is an area where he has asked all to work hard and he has given quite clear timelines for pushing through that. Again, it is not something that is done at EU level in Brussels, it is done by everyone. This is really important.

Q230  The Chairman: We have heard general evidence that Europe is falling behind in terms of investment in other parts of world. From the OECD point of view, from your research, can you give us some insights into who is moving ahead and why, and what you think is needed in Europe?

Andreas Schleicher: This is an area that my colleagues from science, technology and innovation would be better positioned to respond to. Overall I think, in all of those measures, Asia is moving a lot faster than Europe. The United States is moving in pockets faster. Overall I think the US is in a worse position than much of Europe if you take the average, but the pockets are moving much faster. They have the combination in those pockets between the venture capital and the skill base to make big headway. In Asia it is an infrastructure investment on the part of government. I would encourage you to not just look at Europe; the most interesting and rapid improvement is happening currently in East Asia.

The Chairman: If you could get your colleagues to send us any more detail on that it would be extremely helpful. Thank you.

Lord Giddens: If I could just follow up, Europe is currently divided between north and south, and we need to help southern countries. Can we use investment in digital infrastructure to try to help Greece, Italy and those countries again become more part of Europe? Can we do that?

Megan Richards: I think so. I would have thought that this is where you can make a lot of progress. You have more than 50% youth unemployment in Greece, for example, and you do not even need a laptop computer, you just need a mobile device to be able to start working and innovating. As very anecdotal example, the Dutch embassy in Athens had empty space on its ground floor. It was not quite sure what to do with it so the current ambassador said, “I will open it up and make a little technology park”. He has opened it up to all sorts of young Greek digital innovators who have come in and used the space in four, five, six-month periods—even for a few weeks—to develop new applications or new innovative ideas. It has been extremely successful. Of course some of the Dutch companies are helping to support it as well and they are interested in buying these results. That is a very anecdotal case, but you have a huge potential for development in those areas in particular. But it is not just infrastructure.
Andreas Schleicher: Actually parts of southern Europe are quite well positioned in terms of digital technologies. Portugal, for example, is a country that compares very favourably to the UK and much of Europe. Even Greece compares a lot better on the technology park than on the capacity to use those technologies. I think this is where the bottleneck is: translating the availability of the infrastructure into better jobs and better lives for people. I would be rather sceptical about more technology in those countries.

I can give you another example. In terms of formal qualifications, Greece has more people completing high school than the completion rate in the UK, but the problem is that those degrees are not worth very much in terms of the actual skills people have. We know that for Spain and other countries. One would need to have an integrated package that combines the infrastructure—

The Chairman: The skills, the digital skills.

Andreas Schleicher: With a skill base but also with an industry that is receptive to those skills, an area where I would rate the UK very highly. Your economy is very open to skills and very good at extracting value from skills. That is certainly not the case in southern Europe.

Megan Richards: If I could add something on that aspect, the legal and financial framework is very important in this respect too. You need labour laws and bankruptcy laws, as well as other financial and tax incentives, to be able to further the industrial element or the business element of these skills. That is something that we in Europe lag behind in—I am sure you have all the details at hand. Some countries are better than others—the UK is one—but overall the EU is not as good as other areas.

Q231 Lord Lucas: Could you give us one single suggestion for what we should be doing to improve UK digital skills, or indeed European digital skills, if that is something we can make a real contribution to? How would you make it happen and at what cost?

The Chairman: In a sense, we are asking for the advice we should be giving as a Committee to our Government. In terms of what you have seen and what you have described to us today, what is the one aspect of it that you think is most important?

Andreas Schleicher: In the long run it is teaching young people better mathematics skills. Those are highly correlated with digital skills. That would be the investment that would give you the biggest return. However, that of course does not solve today’s problem. I would think that investment in those foundations, particularly in disadvantaged communities, is probably the biggest barrier in the UK. In the short run, you can gain a lot by investing in infrastructure. We have published a paper where we have simulations of what we gained from improvements in ICT areas, which I will send to you, but I think the big one really is the foundations.

The Chairman: That is to move the whole population up, in a sense?

Andreas Schleicher: Yes.

Megan Richards: Of course that is a very good proposal. I will repeat one of the things that I said at the very beginning, which is about making sure that these problems are known at the highest political level and that government works hand in hand with industry and with the educational system. I cannot see how any one group can succeed in this without working together with others. Your responsibility and the opportunity for you to take this on is a wonderful one. You have heard all sorts of testimony from people and you know this issue
probably better than anyone else in the UK, so you telling other people how important it is and showing them what can be done is very important.

How to do it? I can leave that in your hands. How much it will cost? I could not tell you. I also agree that it is not just infrastructure, it is not just skills; it is everything. It is the whole package together, including the legal framework. That is very important.

Lord Kirkwood of Kirkhope: I do not want to delay proceedings, Chair, but could I confirm that Mr Schleicher is going to send us some data on the relative poor performance of the under-25s?

The Chairman: Absolutely.

Lord Kirkwood of Kirkhope: The most striking thing this morning has been learning that, so perhaps we could get chapter and verse on it. Someone said it was a UK figure and not just an English figure, but I would like that clarified as well. It would be very useful if we could have that data in writing.

Ms Richards, you said right at the very beginning that there was some new thinking and, indeed, that the vice-president has now been allocated responsibility for that. Does that mean that, for example, if we were able to understand better the fact that our under-25s were underperforming compared to the rest, that some new programmes might be emerging at a European level that we could take an interest in, participate in and perhaps seek some funding for?

Megan Richards: Yes, quite possibly.

The Chairman: Watch this space, I think. Thank you both very much indeed. That has been very helpful and we will follow up with a couple of specific items where we would like some more information. That has been very useful. Thank you very much indeed.
Federation of Small Businesses, Coalition for a Digital Economy and techUK – Oral evidence (QQ 53-65)

Federation of Small Businesses, Coalition for a Digital Economy and techUK – Oral evidence (QQ 53-65)
Transcript to be found under Coalition for a Digital Economy
I am writing to you in response to the Digital Skills Committee’s inquiry into digital skills in the UK.

In our most recent survey of our members we found that almost a third of our members report skills shortages as hampering growth. The Federation of Small Businesses (FSB) believes employability skills must be embedded from an early age; the labour market has changed dramatically in recent years and businesses are adapting to that change but the education and skills systems need to catch up. This is particularly true when it comes to digital skills.

In a separate 2013 survey of our members, 46 percent of employers did not believe that schools and colleges are providing young people with the skills they need to be successful in the workplace. As 67 per cent of our members believe that their reliance on fixed internet connections will increase in the next year, this gap in skills will only serve to hinder the growth of these businesses.

A key part of your inquiry is whether the UK has a competitive infrastructure to support a knowledge-driven economy. The FSB believes that broadband is an essential utility to support economic growth. A 2013 poll, which surveyed nearly 9000 of our members, revealed that 94 per cent considered a reliable internet connection as critical to the success of their business. Unfortunately many of our members say they do not have access to a reliable and fast connection with our survey data showing that 25 per cent of small firms are unsatisfied with their current internet connection. Once more, 14 per cent of small businesses consider a lack of reliable and fast broadband connectivity as their main barrier to growth.

In July 2014, we published a report, ‘the fourth utility: delivering universal broadband connectivity for small businesses across the UK’, that sets out our vision for improving business access to broadband services. The report calls for the following:

- An ambitious national broadband strategy to deliver universal connectivity throughout the UK, regardless of location.
- By 2018/19, delivery of a minimum ‘service level floor’ of 10 Mbps to all premises in the UK. This compares to the current target of delivering 2 Mbps to premises in the remaining 5 per cent of hard to reach areas by 2017/18.
- By 2030, the Government should set a target of guaranteed minimum speeds of 100 Mbps to all premises. Setting an ambitious target will provide critical policy signals to investors and the market.
- In the short term, the Government should prioritise the delivery of fibre optic broadband to new and existing business parks and ensure enterprise zones are fully connected.
- The Competition and Markets Authority (CMA) should, at the request of Ofcom, conduct a review of the broadband market to examine options to boost competition with the aim of delivering more affordable options to small businesses. This should include more
support for new entrants in the infrastructure market, including local community initiatives.

- The Government should consider reforms in the mobile market including the viability of moving towards national roaming between Mobile Network Operators (MNOs). While there would be challenges associated with this, this would ensure that small businesses and consumers can access broadband on the move across a greater geographic area and provide choice in the event of blackouts.

- Finally, to ensure policy stability and consistency, the FSB believes all aspects of broadband policy should be tasked to one department with a single Minister assuming responsibility for overseeing the delivery of universal connectivity.

16 September 2014
Future Workforce

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

My response:

The need for digital literacy across the entire workforce has increased over recent years in response to a range of drivers: rapid changes in technology, changes in working patterns, the need for a 24/7 visibility for many businesses in this global economy, the need to reduce operational costs, the need for increased business responsiveness and, in many cases, the need for workers to take on additional responsibilities that might or originally have been carried out by others within the organisation through contraction of the workforce and the loss of some dedicated skills. This has meant that more and more workers need to be digitally savvy. When developing digital skills for workers it is also no longer simply the case that we can separate users (eg using applications like word processing, spreadsheets or databases) from technical workers who would be developing the systems using the applications as there is evidence that basic use of applications doesn’t use much of the functionality of the applications themselves.

The skills required for technical roles and the wider workforce do therefore overlap to an extent and many of the basic digital skills are acquired through the existing education system.

The main issue with the current supply chain in terms of digital skills development is that with rapid changes in technology, once a skill is learned it can very quickly become outdated. The current education system with qualifications updated on a cyclical basis does not allow for the development of skills with the most up to date technology, simply because the qualification content has to be fixed to ensure comparability. In digital learning specifically, there needs to be more opportunity for learning about future technologies. This clearly is difficult to write into a specification because the digital technologies are at that stage unknown.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

My response:

The use of technology in teaching has been evident for many years and it has essentially become the norm and there is much good practice in schools and colleges in this respect. The problem is the way that the assessment is undertaken can be uninspiring simply because the qualification assessment strategy and process has to be fixed to ensure comparability. It can also be difficult for awarding organisations to check the validity of assessment when
some aspects of digital technology have been used. There needs to be more investigation into how this can be improved – this in itself will be more motivational if learners can enjoy the assessment process as well as the learning.

Also – whilst digital technologies are part of the national curriculum, there is no expectation that learners will go on to achieve any certification demonstrating any competence as this is optional and therefore many of them engage only at the most superficial level. Whilst working in FE colleges and attending open days to attract new students, frequent conversations included comments like “I don’t want to do any course that has anything with computers because I hate them”. Regardless of the subsequent qualification(s) chosen, however, learners found themselves doing just that because digital literacy is needed everywhere.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

My response:

I will not send a response to this question as this is outside my recent experience having had no recent contact with schools.

7. How can the education system develop creativity and social skills more effectively?

My response:

In terms of digital skills – learners should be given the technical underpinning that is required for them to develop the confidence to be creative. In addition to this they need to develop high quality social skills alongside.

For the last 10 years or so, employability has been separated from the vocational and academic programmes and has been offered as stand-alone qualifications. Most schools and colleges have done their best to deliver these and some have done so with success – but it has often been the case that learners vote with their feet – attending their substantial programmes and either not submitting employability coursework evidence, or not even attending classes in the first place. This is because the qualifications themselves are seen as irrelevant and uninspiring. By embedding (and assessing) the social and work skills in context shows learners how essential they are for future employment. Awarding bodies should offer Level 3 Technical qualifications with embedded and assessed transferable skills (such as Team Working, Research, Communication, Problem Solving) as part of the qualification – skills which have been identified by employers as essential (and currently lacking).

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not exist yet? How can this be improved?

My response:

What is lacking in the current system is the opportunity to explore, to try things, test things and thereby build confidence in looking outside the immediate surroundings at the bigger
picture and what is on the horizon. If learners have the fundamental understanding of digital technologies, combined with an enthusiasm to explore they will naturally be more ready and more inclined to consider new opportunities.

1 September 2014
Frog Education – Written evidence (DSC0071)

About Frog Education
Frog is one of the UK’s leading education technology solution providers. We are passionate about using technology to improve school performance and make learning fun. We work with primary and secondary schools across the world to help them engage students and raise education attainment.

We have 14 years of experience in developing technology that improves learning and engages pupils. Our technology is currently used by 12 million students, teachers and parents worldwide, and we have a 94% client retention rate. This includes around 2 million students across 850 schools in the UK.

Through the Malaysian Ministry of Education and the 1BestariNet project, our technology is used by 10,000 schools and 10 million users who now have access to a single coverage 4G network, with our new learning platform FrogLearn the glue that makes online teaching and learning possible.

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

The exponential pace of technological advancement and change means that technology is likely to rapidly expand in areas that it could not previously reach, and in areas that we are not necessarily able to foresee or predict. Software is increasingly delivered through browser and web based technologies and devices are becoming increasingly more personal – mobile, tablets and things that we haven’t even seen yet. Open source “platforms” allow for specialist, narrowly focused appliances to be developed at a very low cost.

The challenge for the education sector is therefore to absorb and maximise the impact of new technologies on pedagogy. We have only scraped the surface but significant barriers exist within existing cultures. For example, there is resistance to a paperless school, with the argument that students will need to be able to handwrite in examination.

This is difficult to challenge when it is the prevalent approach to formal assessment and with only minor challenges to it from exam boards and Ofqual. For most of our students exams will be the only, and possibly the last experience of responding in the written word in their lives. The combination of personal devices and web based interactions means that people will increasingly be communicating with shops, suppliers, customers, their colleagues through these portable devices, and not in the written word, nor face to face. While this sounds alarming to many, it is already happening; how many people keep in contact with their friends through Facebook instead of face to face? This will happen with the majority of our personal and work interactions over the coming years.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?
There is a great opportunity for the UK to embrace technology to secure its position at the forefront of innovation in education, and to equip entire generations with the skills and ability to gain high-skilled employment in the new knowledge-driven economy.

However, there are a number of threats to this ambition, and the role of educators in this is currently in a period of challenge and confusion. The pace of change has been such that within just 4 years we have transitioned from a skills-based curriculum to knowledge-based. For this to succeed, there is an urgent need for greater collaboration between the education sector, industry, and policy makers.

A major concern is that there seems very little consultation at this point in the midst of significant reforms to assessment of students, as well as the schools they attend, and without such consultation the education system will not be able to effectively prepare each and every one of its students to succeed in the new economy.

3. What is the employment impact on the UK’s labour market? What are the regional differences?

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

The shift towards Computing Science and an increasing emphasis on STEM subjects are a significant step in the right direction to address this issue.

While not every student will choose a career in software development, computer programming is a useful subject to teach all children because it teaches problem solving skills very well.

What is perhaps more important is a learners ability to distil meaningful information from large data sets; to be able to recognize patterns, to make better decisions from the data presented to them, and to know what additional data is required to improve their decisions further. The quantity of data available to us as a society is growing exponentially and will continue to do so. Society needs to learn better how to distil and take advantage of this information.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

The absolute emphasis in our education system upon outcomes over process is having a negative impact on our young peoples’ ability to develop key skills to protect them and the nation in a future competitive market. Bean counting has led to a mangle-turning approach to education, with schools more focused on what will lead to the best statistics in the performance tables than what will encourage our young people to become deeper learners, understanding the importance of analysis, collaboration, synthesizing knowledge and facts, and applying learning outside the test.
We need to teach accountability. Today’s younger generation are increasingly expecting life to be handed to them on a plate. They are not even taking accountability for their own careers, it’s seen to be the employer’s problem. Teaching to tests is indoctrinating children from their earliest learning experiences that you get on in life by waiting to be told what to do, and then just doing enough to tick the box presented to them. This attitude, unsurprisingly, seems to stay with them for the rest of their lives. We should focus more energy and investment in getting children and their parents to understand their learning, to take ownership of it, and to gain a belief that taking accountability for themselves, their work, and the world around them is how they will “succeed” in life.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

It is important to recognise that there is some excellent practice already available around the country, even before the switch to computing. Applied opportunities offered by groups such as Apps4Good are engaging students in the whole process of identifying need and coding solutions.

However, the new computing curriculum has also placed new demands on teachers, who in a lot of cases do not feel prepared to deliver it. Many schools are operating in a vacuum filled only by the Department for Education and exam board releases, and it is likely many will struggle to deliver the new computing curriculum in an innovative, or indeed, successful way.

7. How can the education system develop creativity and social skills more effectively?

The stark truth is that our exam driven system quells both creativity and social skills. The lack of commitment at all levels to genuine, deep research into pedagogy and the learner’s experience is something that prevents this domain from being adequately explored.

A wholesale shift and a bottom to top overhaul in attitude to education would be needed, which is a daunting, and perhaps even ugly, prospect. Creativity and social skills must be considered the equal of academic results, and indeed should also be assessed to give them an equal status. Our education system currently appears to be structured around the belief that all that matters is facts and knowledge, but these things are rarely a barometer for success in the real world.

Successful individuals tend to be creative, resilient, fearless, focused, energetic, and have strong social skills and empathy. “Show me how a person is measured, and I’ll show you how he/she acts.”

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

The best thing about our current post-16 system, and in particular A-Levels, is that does offer a significant level of challenge and preparation for future study and research. The step from level 2 to level 3 in England is the greatest in the educational journey. It introduces students to the level of depth and analysis that is missing from level 2 (GCSE) and for this reason is significantly less “gamed” than level 2 statistics.
The biggest challenge is the preparation and challenge at level 2 to ensure that more of our students can make and cope with the transition to post-16 education at the highest levels, and that we don’t ‘lose’ talented students through a lack of care and support at that crucial stage when they are transitioning to adulthood and greater responsibility for their own future.

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

It is very difficult to get hold of good quality staff in specialist areas, particularly in regions outside of the bigger cities. Off-shoring is often cited as a cost saving exercise, but in many cases it is more a reaction to lack of ability to get staff in the UK. Off-shoring is also increasingly less, if any, of a cost saving vs. doing this work in-house (due to increased rates abroad, rework, management layers, fluidity of communications, and so on). UK businesses are not moving forward as quickly (or effectively) as they could because they don’t have technical teams that they can rely on due to lack of skills.

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

Whilst the above cannot be ignored, the greatest challenge remains the absolute division in terms of educational performance and academic success between students from economically and culturally deprived backgrounds and the rest of the nation. Pupil premium has merely scratched the surface on this issue and its success is questionable.

The digital sector offers an ideal opportunity for individuals with disabilities to be just as effective as their able bodied counterparts. The older generation of people are finding it increasingly difficult to engage with the technology industry. This is likely to be a temporary situation due to the huge shift in the use of technology during the current generation, but it is also an opportunity that should not be missed – there is vast untapped expertise, skills and potential output among the older generation that is not currently being tapped into.

The technology industry is largely run by a younger generation, a generation that has grown up in a different era and has different views that are increasingly removing the barriers to women gaining appropriate employment. It appears that we are largely now placing the best person for the role in post irrespective of their gender.

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?
Businesses have a huge role to play here, but are actually pretty good at teaching skills to their staff. It is not skills that tend to be the problem. The issue is more often the attitude of the person that is being trained and their lack of accountability for their own careers, their lives, or their place of work, which links back to the aforementioned point about what skills and competencies our education system is teaching young people, and the prevailing attitude amongst those young people once they have left the education system.

There are plenty of schemes that exist for businesses to upskill their own staff, but there needs to be greater collaboration between industry and the education system to ensure young people are ready for the world of work when they leave school, and not leave businesses to pick up the vast slack in terms of skill development and attitude when recruiting and expanding their workforce.

5 September 2014
George Spencer Academy, Miles Berry, Kingsmead Primary School and Naace – Oral evidence (QQ 158-172)

Transcript to be found under Miles Berry
George Spencer Academy – Supplementary written evidence (DSC0127)

Our system involves the school having a transmitter on an existing mast (cost approx. £800) and each transmitter can distribute wireless internet access to up to 100 receivers (cost approx. £45 each) that are placed on the houses of the people who are part of the scheme. These could be the homes of our own disadvantaged students who we have provided a device for (all free of charge) or members of our community that pay for the service. The system does away with the need for a landline connection which for the first time makes home internet access a possibility for any households that find themselves unable to get a landline.

Our 6 month pilot is just finishing with the results being better than expected so we will be increasing the available speed in our next wave of installation. Our system will then allow speeds to the home of over 150Mbps at distances of up to 15km. Currently our pilot system delivers 80Mbps capped download speed over a range of 10km which compares favourably to the national average broadband speed of 18.7Mbps (13.6Mbps in rural areas) (source: http://www.telegraph.co.uk/technology/broadband/11138376/Average-UK-broadband-speeds-up-as-digital-divide-narrows.html).

23 January 2015
Are schools, further and higher education, businesses and other sectors ready for the implications of the changing digital landscape?

The challenge for educators is to utilise the digital landscape and see it for what it is, not worse than it is or better than it is, but ‘as’ it is. The so called net-gen, those who have experienced all of their education and training having access to the Internet and ever improving technology, respond to educational material differently according to research. Evidence suggests a greater willingness to engage with education and learning material, and the term wiki-learning is gaining traction within some education and training circles (including my own). This manifests as students having access to learning material on line with opportunities to directly contribute to it rather than just accept it ‘as is’. Typically students join on line discussion groups around a topic PRIOR to it being formally presented, so that opinions and experiences of the learners become incorporated in the learning experience. This is an unusual approach and therefore a missed opportunity, particularly in formal workplace learning and development. It is possible that the gap between the life experience of the net-gen and the older people teaching has resulted in the methods being applied being ‘best practice’ as known and understood by the older generation, and as specific education in relation to the net-gen and changing learning approaches is unlikely, they continue to apply methods delivering poorer results than necessary. This also manifests in the teaching methods and teaching materials used; most business organisations still produce or engage training organisations to produce for them, printed materials for training purposes. Our experience is that this is no longer necessary nor desirable and iABCt students (www.iabct.org) are issued with tablet computers with learning materials recorded in digital formats to allow for traditional visual reading, auditory Mp3 presentations and short video clips. These are also linked to on line file storage facilities into which learning material is added, including recordings of their own learning experiences, in real time. Results and feedback from students indicate that this is far more effective than traditional printed workbooks, photocopied hand-outs or requests for them to engage online using their own tools in their own time.

Open online courses are gaining popularity and potentially extend the learning experience more widely than ever before. Our own experience is limited to the launching of our own ‘Foundations of Coaching’ programme to be launched later this year, however our research indicates that educators must respect the learning styles and approaches of a generation with possible different expectations to their own i.e. very short learning lectures with immediate follow up action and opportunities for discussion and interaction with fellow participants. One of the great benefits is of course access to people who might otherwise be unable to attend at a learning institution. In our case the English speaking locations around the world with access to high-speed internet access.

What will be the implications for the Government? Are the Government prepared for these changes?

It is worthy of note that some parts of the world poorly served in many other ways have considerably more and faster access to internet based learning than parts of the UK. The emphasis on physical communication as opposed to the facilitation of technology led
training and education methods appears to us as international educators as somewhat questionable. Research into environmental neurology suggests beyond any reasonable doubt that significant immediate environmental factors have a direct and lasting impact on the approach to learning and to doing business.

Hence the provision of technology in home-offices or home learning spaces is not necessarily going to be supportive unless it is managed as such. However as an alternative to any opportunity to manage fixed learning environments has obvious potential benefits. It is therefore suggested that an emphasis on high speed internet provision in conjunction with ‘Positive Environmental’ guidelines will yield benefits faster than improvements in physical communications designed to bring people together for similar business purposes. It is useful to note that the psychology of doing business is based on the establishment of relationships and not merely on the potential to link purchaser to supplier. Business engagement is established by relationships, hence the past need to move people from one place to another via road and rail. However changes to relationships with technology mean that high speed access to video and audio connections allow similar emotional relationships to be established virtually. Our personal experience is specifically in the use of action learning sets. These are a well-established means of peer learning that traditionally require participants to meet in person. We now utilise action learning sets using virtual technology and are limited only by the access speed and quality of access. Students from the UK in locations where internet speeds are poor, even when close to large conurbations, limits their participation and hence their potential. We are aware that plans are in place to improve this situation however suggest that both the pace and scope of this albeit welcome intervention is limited. We respectfully question the priority of large scale road and rail projects versus the benefits that potentially accrue from significant improvements in technology access and support on how to shape an environment to maximise that potential. Should such environments be established, e.g. an administrator working from ‘home’ will achieve better results by having a dedicated space with natural light, access to hydration and multiple screens with real-time visual and audio access to colleagues. Such an environment mirrors the benefits of workplace relationships and the following of organisational cultural norms while also improving on aspects of personal comfort and control. This offers a win-win situation for organisations and employees – and significant potential for the achievement of Government plans to reduce the need for resources, the impact of travel on carbon emissions and waste in general. It holds the potential for large quantities of office space to be reassigned, significant reductions in already overloaded commuter travel and higher levels of productivity from employees who no longer ‘waste’ time travelling to and from work. It also has the potential to balance the housing market – if virtual connections are guaranteed as high quality anywhere in the UK without the need for travel then the market is likely to respond accordingly.

None of this is possible without a significant shift in intent and significant shifts in attitude from the controlling generation to reflect the real and emerging potential of the net-gen.

**Does the UK have the infrastructure to remain competitive with these new technologies when compared to other countries?**

Being based between the UK and the Canary Islands we are aware of the growing potential of the West African NAP (Network Access Point) and the difference this is already making to the way international trade is being undertaken. Countries without the infrastructure of
land-lines and wire based technology have no need to upgrade, they simply leap forward to
the implementation of the very latest technology.

We are also aware of global research that points out that improved technology does not
save declining industry sectors. However applied improved technology in genuinely growing
industry sectors appears to yield improved results. It is not clear that such distinctions are
being applied in the UK. If they are we are not aware of them, nor does there appear to be
able significant research easily accessible.

At its most basic we refer back to our previous comments regarding the provision of a high
speed easily and cheaply accessed network now and not in two or three years, as appears to
be the case. At its most advanced an analysis of business potential by industry and the level
of applied advanced technology is likely to yield benefits to the UK.

The changing technological landscape

1. What is the pace and change of the future digital technology landscape over the next five,
10 and 15 years? What are the leading innovations?

It is likely that technology will become integrated even more into daily life. We are aware of
mobile phone applications being used to do everything from making a doctor’s appointment
to scheduling part time employment. We are not futurists but psychologists and educators
and as such can see the link between ease of use and frequency of use. Issues such as voting
at local and national elections, referenda etc. are obvious applications, as are organisations
using personal technology owned by workers to forward their organisational agenda.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-
driven economy?

Knowledge workers behave differently to those in a ‘modern-traditional’ command and
control hierarchy. We believe they are far more likely to be productive when coached as
opposed to managed, and when technology is used as a means to remove barriers top
achieving potential, and not as a ‘new toy to be played with’ or ‘new company system to be
employed’. This requires involvement at every stage in the development and application of
technology and a change in the way students learn. This has implications for the education
system as well as business.

Knowledge workers add value to their organisations and themselves by acting in a
spontaneous and dynamic manner. They respond to challenges by researching and utilising
resources, challenging how those resources are used at each juncture. There are no
circumstances in which they will be placed in large groups, expected to take instruction and
then work on that instruction, ready to be graded after completion. This preparation was
absolutely necessary for production workers as it undeniably reflected the realities of the
workplace. This is no longer true, nor is the system particularly conducive to enhanced
learning. It is maintained simply because it has become the norm, and as such small
distinctions and ‘tweaks’ are rarely more than that considered when engaging with change.
It is suggested that other cultures who are not wed to this cultural norm may utilise more
appropriate means of education and training from their earliest age to mimic the likely
knowledge working situation.
It should be noted that if large scale high quality changes were to be made in the provision of home based work ecology and combined with flexible working hours, made more likely of course by the removal of any need for commuting, that an increase in home learning hours for students may act to reduce the pressure on educational resources while achieving changes that reflect the knowledge worker situation.

3. What is the employment impact on the UK’s labour market? What are the regional differences?

Please refer to previous response regarding the unbalanced coverage of technology facilitation.

Future workforce

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

Knowledge workers acquire digital skills as they progress in their career. Knowledge educators are already learning, with the introduction of Internet based on line open courses and resource material that participative learning is more effective than the traditional model. Social networking sites provide ready-made facilities to host action learning sets and larger learning groups. The issue of digital skills acquisition starts before joining a particular organisation and the provision of an ‘information technology’ study topic is likely to be ineffective simply because it does not develop the psychological learning patterns in the student. It is similar to attempting to learn advance swimming techniques without the experience of being immersed in water. Patterns of learning are more important than curriculum content as the latter is dynamic while the former has longevity.

The introduction of student led teaching and action-learning sets of mixed aged students engaged in digitally based knowledge acquisition will better preparation for becoming a valuable employee asset. The fundamental issues relating to the competitiveness of future workers are the achievement of maximum potential of each person by the removal of barriers and interference that might limit that potential. To embed learning patterns predicated by the pressure to learn being applied by the teacher acts as a barrier to establishing a globally competitive digital workforce. The most effective knowledge workers are those with a drive to acquire new information and problem solve without direction, this is a behaviour pattern and not a package of learned information and is acquired by practice. Therefore the education system must be adapted to match the outcome.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

Current teaching methods rarely allow for new distinctions to be established by the students that then become part of the learning material for those who follow. In most cases the ‘answer’ is already established and students are taught how and why that answer is correct. An inspired and inspiring workforce do not simply repeat what has already been established,
they co-create with their leadership in the development of new and improved distinctions – distinctions that now become the foundation for a new cadre of the workforce to build on. It therefore appears reasonable to question what might be done within the education system to radically overhaul some aspects of teaching and learning. One wonders what might happen to UK global competitiveness if instead of young and highly inventive minds were presented with ‘facts’ that they were instead presented with ‘best guesses at this time’. From a psychological standpoint if a person is able to participate in the creation of an outcome it is more likely that they will consider the problem in a different way and that it will become more meaningful to them. It is human nature at whatever age that when being ‘told’ – this is true - the tendency is to push back or dismiss, however when presented with the same information in the form of a ‘question’ – is this true? – the tendency is to engage and consider. This requires a shift from didactic teaching to the coaching development. This is a very different skill set and one that, at best, teachers are only introduced to in a perfunctory manner and not one recommended as the preferred educational approach for today’s potential knowledge workers.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

This is not part of our experience. Our students report only traditional learning methods, as previously alluded to.

7. How can the education system develop creativity and social skills more effectively?

As previously detailed, the development of coaching teachers supervising mixed age and experience action learning sets, all tasked with the achievement of an outcome that includes new learning distinctions. This will deliver improved social skills and more appropriate patterns of behaviour.

Creativity can be improved by the introduction of proven psychological approaches to successful creativity. It has been long established that ‘new’ creative thoughts can only be generated in the absence of previous thinking. Hence linear approaches to creativity such as popular approaches like ‘brainstorming’ do not actually promote creativity. They do assist with confidence and team development by being open to other people’s ideas, however from a creative aspect they act only to build on whatever came before. Much like an old fashion word based parlour game where one person says a word and the next must say a word that links without repeating what came before, they are not exercises in creativity but actually exercises in conformity. They are restricted by what exists and not open to what does not yet exist. Creativity will be improved by the introduction of time to think and reflect without expectation. Students currently have packed timetables with teachers filling each allocated space with information and exercises. A more creative approach would include meditative time. It is recognised that pragmatically this is a challenge because of the behaviour patterns of students currently and the necessary emphasis on ‘crowd control’ by teaching staff. However should action-learning sets of mixed age groups be established then introducing creative approaches such as meditation or mindfulness will be easier to achieve.

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?
The current emphasis on higher education does not necessarily support the development of effective knowledge workers. The development of an ‘education industry’ including student courses, a campus, vast swathes of student accommodation and the association social support of student bars, cafes and the like may act as a temporary economic boost, however in terms of longer term benefits to the future economy our experience is mixed. In any other ‘industry’ this would lead to the condemnation of that industry and its ultimate downfall. The UK car industry’s production became ‘mixed’ in the 1970’s and 80’s producing self-evident results. The arguments at the time relating to job production and employee rights became utterly redundant when the end result was recognised as being unfit for purpose. It is respectfully suggested that mixed results from the UK higher education sector may be deluded to expect a different result if their outcomes are ‘mixed’ and their outputs are declared by potential employers as unfit for purpose.

Improvements must start with outcomes. The distinction between professions, trades and academia exist because of what they are and not because of some aspect of social engineering. The growth of on-line open courses if supported by the establishment as a viable alternative to high education, open to everyone and without prohibitive costs or ‘rites of passage’ hold the potential to educate those who are desirous of learning and may be linked directly and dynamically to the changing needs of a knowledge based economy.

**Short- and medium-term support to the digital sector**

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

Short term immediate changes to ramp up the provision of high quality high speed digital access across the country as a matter of urgency and made accessible to all is the single biggest challenge to taking a global leadership role. The ‘economy’ will not provide for this as the lead and lag time between provision and results is difficult to determine as is the link between provision and results. If extremely poor people in developing economies are able to build new international businesses with nothing more than a mobile phone and lap top computer then such creativity and drive probably exists here to. The difference is that expectations here are driven by what people are told is possible whereas elsewhere they are not. The dynamic and chaotic development of business is something the UK may participate in but not if huge parts of the country have poor access and may not have such access improved until 2016 or 2017, by which time the world will have turned.

In the medium term a change of ‘intent’ by the establishment will deliver the improvements to the digital sector by making ‘working and learning from home’ a priority. The shift of administrative and knowledge working jobs to being primarily home-office based rather than a commute to a workplace and of learning being accessed from home on organised on-line open courses will dramatically increase the quality and quantity of people acquiring advance digital skills and using them.

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

No comment
11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

No comment

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

Intent needs to be clearly determined by the establishment. History, including current experience, suggests that an over emphasis on locally driven initiatives is that they become parochial and may be subject to undue economic pressure by interested parties with personal agendas. Equally the education sector may be wedded to existing policies and procedures, much like the car industry of the 1970’s, that have more to do with personal agendas than the achievement of a UK-wide goal.

Industry

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

Industry needs to do what it does best and be industrious. As with individuals the potential of any business organisation, large or small, is precisely equivalent to the potential of their employees minus the interference that gets in the way of their personal performance. Hence an increase in highly motivated, creative and inspiring workers desirous of contributing to the success of an organisation is the ‘Holy Grail’ of organisational recruitment. This may be achieved by taking action as specified in the previous responses.

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

As with teaching, businesses that employ a ‘questioning’ as opposed to ‘telling’ approach will engage and inspire their employees to become more productive. This is the main function of our organisation and therefore I declare an interest in this response. This in no way diminishes the value of the input, it does however represent what the iABCt seek to help achieve – the introduction of organisational coaching cultures. We detail the benefits of this on www.iabct.org and http://coachingculture2015.com/

3 September 2014
Google, Microsoft and UK Forum for Computing Education – Oral evidence (QQ 40-52)

Evidence Session No. 4 Heard in Public Questions 40 - 52

TUESDAY 22 JULY 2014

Members present

Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Lucas
Lord Macdonald of Tradeston
Baroness O’Cathain

Examination of Witnesses

Hugh Milward, Director of Corporate Affairs, Microsoft, Chris Mairs CBE, Chair, UK Forum for Computing Education and Chief Scientist, Metaswitch Networks, and Mike Warriner, UK Director of Engineering, Google

The Chairman: Thank you very much for joining us this morning. You may have heard this preamble before the last session but I need to do it again in case somebody did not hear it. You have a list of interests that have been declared by Committee members. These were declared orally by members at the previous session on Tuesday 8 July, and can be found in the transcript. This is a formal evidence-taking session of the Committee and a full note will be taken, which will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you will be able to revise any minor errors. This session is on the record. It is being webcast live and will be subsequently accessible via the parliamentary website. You are very welcome to submit supplementary evidence after the session. In fact we would very much welcome that. Just to remind
everybody here, we should speak up so that everybody can hear properly, although I think the acoustics are quite good in this room. I will come to you in turn just to introduce yourselves, and if you want to make any brief, opening remarks, that is fine. Otherwise we will go straight into the questions. Mr Mairs.

**Chris Mairs:** I am Chris Mairs. I am Chief Scientist at Metaswitch Networks and I am also Chair of the UK Forum for Computer Education, which is focused on practice and policy challenges around the new computing curriculum.

**Mike Warriner:** I am Mike Warriner. I am Engineering Director at Google here in the UK where we have about 700 engineers building products like YouTube, Android, advertising products and other things. Just for clarity, we also have an interest in the Google campus here in the UK, which is a start-up hub in Tech City that we run.

**Hugh Milward:** My name is Hugh Milward. I am the Corporate Affairs Director at Microsoft here in the UK. As well as Microsoft we also have Microsoft Research, our research facility based in Cambridge. We also have Skype, which is part of Microsoft too, Xbox, and an interest in Microsoft Ventures, which is our accelerator based in Tech City as well.

**Q40 The Chairman:** Thank you very much indeed. We will start with a wide-ranging open question. Can you try to sketch for this Committee the pace and change of the future digital technology landscape over the next five, 10, 15 years, and try to describe for us in the broadest terms the impact that is going to have on the UK, both socially and economically? Shall I start with you, Mr Milward?

**Hugh Milward:** It is very difficult to predict in this sector. I think we are all agreed on that. But we see there being perhaps three trends. At least, that is the way that Microsoft looks at the world. Three trends at the moment, which we think will help to define the way the technology is developing. The first is more natural, and we look at this as being able to move freely across different devices and different areas. We expect these devices to co-exist and to share information, to have intuitive and consistent designs and to interact in similar ways in which we interact with people, using speech and gesture as well as touch and type and making devices much more accessible.

The second trend is more contextualised. With our permission services will link our data to friends and to the wider world around us, making our experience richer and more relevant to the context that we are currently in. With technology such as 3D printing, we will be able to print objects to our own specifications, pointing to a future where we can tailor the physical environment around us as much as our virtual world.

The third is that technologies will work harder on our behalf and that means machine learning, enabling computers to process data and predict or anticipate needs so that, for example, your car will reroute your journey to avoid traffic, your thermostat will adjust automatically depending on the weather, or your supermarket order will be prepopulated based on your calendar for the next week or next two weeks.

**The Chairman:** Will it do the ironing? That is what I always ask in these situations. I am always told that it can do all these things, but that would be the final test for me.

**Mike Warriner:** I can only say that I wish the answer to that last question was yes. There is a whole tonne of technology trends. The one that is very clear is mobile technology. On a global scale at the moment something like 2.5 billion people are internet-connected, and
over the next five or six years that is predicted to go to 5 billion people. You imagine what that does; it is an opportunity for people across the world to get connected and to start having the same access to information and services that we take for granted here. If you invert that, it gives us the opportunity, as a highly advanced nation, to be able to sell services information, and what have you, back to those new people on the internet. I think that is an exciting trend.

Another trend I would highlight is Cloud and Cloud computing. I highlight that mainly because it has reduced the barrier to entry for people to set up a business and to get online. Historically you would have to buy yourself a data centre. Now you can take your credit card and have a business online that has a global scale—a global internet business. That is a profound change and has enabled a whole bunch of small start-ups to get global scale very quickly, and is something that we should take into account.

Another trend, which I think is the same as Hugh’s, is the idea of the internet of things: that as things become more and more connected as we can make computers that are small enough to put into a thermostat or a fridge, and we can start to think about a much more intelligent way of living our lives. The classic example would be looking at your thermostat and controlling the heating in your house. In a football match’s break at halftime, the people watching that football match would historically always run to their kitchen to put the kettle on and you would see these spikes in electricity usage. Now the electricity company—they are already doing this in America—can turn off heating systems for that few minutes so that they can manage their electricity more intelligently and provide a better service to us all. I think that is exciting.

Chris Mairs: I am going to start off with a general comment, which is almost a statement of religious belief rather than anything that is hard evidence-based. There is a guy called Hofstadter who has a very interesting principle relating to projects in technology: that every project in technology will take longer than you thought it would, even after taking Hofstadter’s principle into account. I am going to apply a similar principle to the pace of technological change, which is that I believe that technology will change society at a faster pace than we believe it will, even after taking this principle into account. I think that is important because things like Moore’s law mean that things are going to change so fast that we cannot yet know what will happen.

I agree with everything that Hugh and Mike said about significant technologies. I am going to use a couple of examples to illustrate what I think are some of the potentially very significant social changes that will happen. One of the companies I work with at the moment provides a service, which is not complex, as a digital service. They put people who want their houses cleaned in London in touch with people who clean houses. It is not quite like technology doing the ironing but it is the next best thing.

The Chairman: It gets it done, yes.

Chris Mairs: This is interesting because this is a digital market place and it allows individual cleaners to acquire customers and manage their reputation in a way that has not previously been possible. That changes the whole cost dynamics, so as this product grows and becomes more successful you will see individuals—micro-SMEs, if you like—being able to compete effectively against cleaning agencies, for example. It shifts the balance of power down to micro-SMEs.
Another example, which I think is quite interesting, is that the reinsurance industry is incredibly arcane. It is a trillion-dollar business and right now it is run primarily using paper, so it is ripe for disruption. It will probably get disrupted by somebody who understands the reinsurance business and has probably been a reinsurance broker but also happens to have a PhD in big data science and has good business skills. What I think is going to be very important over the coming years is a combination of technology skills and skills in other businesses, because it is that ability to understand how technology can apply to a particular industry that will allow you to be a disruptive player.

There is one further technology that I do not think the other two guys mentioned, which is potentially a massive game changer. I do not know if that is true or not, but it is cryptocurrency. Some people believe that cryptocurrencies such as BitCoin can fundamentally change the banking sector, and if that happens it will again have a significant impact on society.

**Q41 Lord Haskel:** Thank you for that. They seem like very exciting opportunities, but how well are we prepared for this change in technological landscape? What does the general population understand about this, and how are we going to adapt to these changing technology trends?

**Chris Mairs:** Unsurprisingly I think it varies hugely depending on which segment of the population you look at. In general, young people are better able to envisage the changes than older people, and people who are in the technology sector are obviously at an advantage. The biggest challenge is particularly in smaller businesses. If you take a FTSE 100 company, as the chief executive you can surround yourself with people who understand the technology, understand the opportunities. If you are an SME, you are probably not so able to do that and so, as a country, we need to think about how to empower SMEs to take advantage of this.

This comes back to the question of lifelong learning, and we have historically always viewed apprenticeships as something that you do until your early or mid-20s. Maybe we should be thinking about later life apprenticeships as one way to address this.

**Mike Warriner:** On one hand we are very well prepared and on another hand we are very ill prepared. In terms of us as an economy, our e-commerce economy is predicted to be £140 billion by 2016. The internet exports from the UK are over $1 billion. We are significantly ahead of our nearest competitors in Europe on the internet and in e-commerce electronic-related exports. That in itself is a huge testimony to how successful we have been.

On the other hand we still have 7 million people in this country who have never used the internet—a truly terrifying statistic. That means that something like 15 million people over the age of 15 are not internet literate, if you like—another terrifying statistic. The idea of things like later life apprenticeships is fundamental. There is an opportunity for us to invest in things like Code Club and Teach First, where we help the teachers—both of school children and adults—to teach these subjects, to get people inspired, to get people aware and to help people themselves to learn how they should learn. That is the only way we are going to scale that and make that work.

**Hugh Milward:** I have perhaps one more thing to add to that. It depends on whether we are talking about the end user or the sort of intermediary that is going to leverage a new technology for the benefit of the end user. If we get this right as technology companies, we
should be able to create or do a lot better in making the designs much more intuitive to the end user.

When you look at the developments that all our companies are pushing, you effectively do not use manuals any more; you expect to have an intuitive understanding of the way technology works. The end user is one thing, and perhaps the level of training required to take advantage of these trends is less than you might expect. That is not the case for the intermediary, perhaps a business that needs to take advantage of one of these trends in order to offer a service or to deliver more to the end user than they currently are able to do. I think that is a risk and an area that needs focus.

To pick up on Chris’s point, we certainly see there being a need for developers, for example. We have various tools, which I can go into, which help us to look at the future needs. There is definitely a need for developers among the start-up community, but that is not enough; they also need to be developers with HR skills, marketing skills, finance and various other aspects as well. But unless we are building those fundamentals in at the beginning, I do not think we are going to be as effective as we could be in increasing the skillset at that intermediary level.

Q42 Lord Haskel: What should we be advising the Government to do to prepare the country to take advantage of all this?

Hugh Milward: I will continue on that, if I may. One of the great changes recently, and it is a long-term play rather than an immediate play, is the removal of the requirement to teach ICT in schools, replaced by the option to teach or the requirement to teach computer science. Bear in mind that computer science is not the same as coding, and it is very important that we do not confuse or conflate the two; they are very different. Teaching computational thinking, which is effectively what it is, will with any luck have a profound effect on that, so we need to increase the mix of the ability of companies to take advantage of the technologies while continuing to focus on other things that are not technology-focused.

I cite not quite as evidence but nearly as evidence of this the initial work that we have been doing with schools in teaching computer science, which has shown that kids do much better in all other subjects as a result of learning computer science, particularly literacy. So it has this profound effect.

The Chairman: Yes, it is a brain enhancer.

Hugh Milward: That is right. The UK is very progressive in this area, which gives us a good, strong, competitive advantage or opportunity for the future as we go on, so I offer that as an answer.

The Chairman: Lady O’Cathain, you wanted to come in with a supplementary and then Lord Lucas.

Baroness O’Cathain: Just quickly, is there any way we can get another country to look at that? I am just wondering particularly about Microsoft and Google. I went to a presentation in Brussels, on unemployment as it happens, but there was a presentation from Singapore about how they manage to get their schools literally computer literate from the time they are financially literate. Is there any way we could exchange best practice? We have a good history of learning in this country, with the universities and so on, and we have sent it all
Chris Mairs: One country that I would recommend you look at is Estonia.

The Chairman: Yes, we have heard that. That has been raised.

Chris Mairs: Very interestingly, they have an extremely strong technical university, and one of their strengths is that quite a few of their politicians came up through a technical background. That is pretty significant.

The Chairman: That is interesting.

Baroness O’Cathain: The same may not be said here.

The Chairman: Lord Lucas, you wanted to come in.

Lord Lucas: Chris and Mike, you both mentioned later-life apprenticeships. Are you aware of any tech companies that are pushing the availability of such things and looking actively for women who are coming back after raising children and wanting a new career? If not, could the Government be doing something to encourage you?

Mike Warriner: We ourselves in some of our offices are already running programmes. In Israel, for example, we have a programme, whose name has completely escaped me, to encourage people who are coming back from maternity leave to come back and be prepared for the fact that they have taken a year out of industry, and to help them get back into their jobs.

Lord Lucas: But into tech jobs? I assume you are talking about HR or something like that.

Mike Warriner: No, it is absolutely to do with anything that Google does. We do everything from engineering to HR, but this is very much an engineering focus. We have very publicly released our diversity numbers: 30% of Google is female. That is shocking. It is not far off the industry average in our industry but it is still pretty bad. Seventeen per cent of our engineers are female, which is even worse. We are drawing on a pool where something like 15 times as many people doing computer science A-level are boys compared with women, so we need to fix this right from the beginning of the curriculum.

Lord Lucas: But you ought to be taking women who have never done IT and training them as if they were new apprentices. They need new careers. They never learnt about IT when they were at school because it was not offered.

Mike Warriner: That is done through things like Code Club and Decoded, and a lot of those organisations. We are not teachers, so from our point of view we can help fund the organisations that do know how to teach people, and they then can help provide this teaching to people out there across the whole country. Decoded do a great job, Code Club do a great job, as does Code Club Pro teaching teachers. There are a lot of these initiatives.

The Chairman: Without putting words into your mouth it sounds to me as though you are saying that if there is a clearer framework from the Government on this, employers might be prepared to do this. You have talked about the return from maternity leave, but you have not told us that you are taking in older workers and doing what you just said was needed, which is providing older apprenticeships. We are not particularly picking on you. You are here in front of us, so it is good to ask you what is needed to make that happen. Mr Mairs?
Chris Mairs: Mike at Google has a particular challenge in that Google is at the very hard end of technology, and I think we should not focus too heavily on people coming back who have not done any IT at all and then suddenly becoming big data scientists. There are many, many other jobs in the economy where good digital skills will augment other skills. Being able to use technology in a reasonably sophisticated way is beneficial to someone who is working in HR, in finance, whatever. I do think that through government policy or funding we could encourage more of those sorts of mixed apprenticeships along those lines.

Q43 Lord Macdonald of Tradeston: A point for Microsoft. You spoke very encouragingly of the route that would make everything simpler and more intuitive, but did your move from Windows 7 to Windows 8 not plunge millions into confusion? I do not just make a cheap point; I am asking how we can believe that it is going to get simpler when you have obviously made it much more difficult.

Hugh Milward: That is a lovely point. The parliamentary estate has recently moved to Office 365 and I am aware that there have been some bedding-in problems around that.

The Chairman: We are a digitally challenged group.

Hugh Milward: We can go into some specifics around that if you like, but I am not sure if the Committee is the right place to do it.

The Chairman: No.

Hugh Milward: The move from Windows 7 to Windows 8 effectively spearheaded a change in the way computers/PCs were built in that it ramped up the use of touch for your primary device. So in effect you are not using your browsing device but your primary functioning device to touch in a way that I would not call revolutionary because it is all part of an evolution—it forced Intel in particular to rethink its growth strategy for touch devices and to re-predict how the market was going to change quite fundamentally.

Yes, it has had a mixed reception, particularly because you are trying to have two different ways of communicating with the device at the same time built into the same device, which is never easy. As Windows 8 evolves and those two worlds—the old world of the mouse and the desktop—merge with the new world of touch and a kind of seamless transference, things will improve dramatically. I should also point to the fact that there are significant changes going on at Microsoft at the moment with a new chief executive who comes from an engineering background rather than a sales background, which I think will make significant adjustments to the way the business operates and sees its role and the role of the individual at the heart of what we do, which has not necessarily been the case in the past.

Q44 Lord Haskel: Coming back to what the Government can do, in other evidence we learnt that there are something like 75,000 young people studying hair and beauty. Yet that industry will be able to absorb, shall we say, 15,000 or 20,000 of them. Is there any way in which government could then say, “Okay, for the rest we will run a conversion course and try to convert the rest of the people who do not get into that industry in digital skills so that they can work elsewhere”? Rather than start with education and nine and 10 year-olds, we have a whole lot of 19 and 20 year-olds. What are we going to do with them? Can we run a conversion course or something like that?

The Chairman: Who wants to kick off on that?
Mike Warriner: I will give it a go. I think we have problems from age five to probably 95. It is never too late to start. I cite the example of my grandfather who at the age of 85 bought himself a computer and wrote two books. It is never too late to start. We need to be encouraging people at the age of five to see technology as something that they can aspire to and love doing. One of the previous members here was talking about it being a part of art, a part of your normal life. I think that is very, very important.

We need to be giving great careers advice at the age of 15, so that people study subjects that do not take them into dead-end careers. There are hundreds of thousands of jobs coming online now in the digital industry. There are hundreds of thousands of vacancies, but people do not have the skills to fill those jobs, so people from careers advice should not be putting them in this crazy place.

In terms of age groups, we should absolutely be looking at people coming out of schools, at 18 to 25 year-olds, and saying, “Yes, you have been given bad advice but here we can help you”. I do not have the solution for how we should do this, but we should try to work with industry and with government to solve that problem and to help to provide training so that they can come back into the skills that we do need.

The Chairman: Thank you. Mr Mairs, you want to come in now, and then I will go to Lady Garden.

Chris Mairs: I absolutely agree with Mike that there is a huge issue about career signposting in schools at the moment, and industry can do a lot to help that. I think government can do something to ensure that schools work more closely with industry to provide that signposting.

This brings us on to an interesting question about the gap for people who are starting on the new computing curriculum now—five year-olds. If that goes well it is a fantastic way of giving them the right skillset, but they are not going to come through until 2020. So between now and 2020 we have a digital economy that is moving on, but we are not going to get the benefit of this new curriculum, so should we be thinking about doing more to provide, for example, computer science modules for non-computer scientists at university as a way of upskilling some of the people who are currently doing subjects that are not necessarily so relevant?

The Chairman: That is very interesting. That sort of refresher or concentrated little course or whatever has come up from a variety of witnesses now. It is quite interesting. Lady Garden.

Q45 Baroness Garden of Frognal: You have touched on this already, but I wonder whether you have anything to add on the current high level skills shortages, and the skills needed to be developed to meet the demand for producers of digital technologies. Perhaps could I ask Mr Milward specifically. How do you create synergies between Microsoft and your Accelerator, and are different skills required for that?

Hugh Milward: Good question. We work with the IT Job Board to analyse the job postings in the IT sector and look at various aspects of what kind of IT jobs are available over a period of time, and that allows us to predict a bit to see on trend where things have been going and where they might continue to go. It reveals some very interesting aspects of skills requirements within different sectors. There is a transference across between the start-up and accelerator community and the much more established businesses. All of them are looking for developer skills—there is no doubt about that. Certainly, from our experience
from Microsoft Ventures, start-ups are looking almost as an equity start-up partner. They are looking for developers but with a bit more HR, marketing and everything else. They are looking for developers at that apex. Having a set of skills that they have learnt through the education system that allows them to think more entrepreneurially and combine that with developer skills is something that every company wants. In our company—I am sure Google is the same—we are trying to push the boundaries of innovation within our own businesses, and the mindset that encourages and develops innovation is the same mindset in a start-up of two people. Those skillsets are the skills that we are chasing as much as the start-up community is chasing. If we intervene to try to improve the level of those skills—a kind of “rising tide floats all boats” sort of approach—it has an impact on everyone.

Baroness O’Cathain: Is it called the IT Job Board? Is that the website?

Hugh Milward: Yes. It is called IT Job Board.

Baroness O’Cathain: Do you advertise that? Have you sent that round to every school in the country as part of a careers advice type of thing?

The Chairman: That is not run by you, is it?

Hugh Milward: It is not run by us, no.

Baroness O’Cathain: I see. Who runs it?

Hugh Milward: It is a separate business and they advertise IT job vacancies in any sector. We work with them to look at the data that they have and the nature of the advertisements. It allows us to look at trends within different sectors: the finance sector, the law sector, marketing and so on. It allows us to look at the IT qualifications or IT demand within different sectors.

Baroness O’Cathain: You can let us have the link to that, can you?

Hugh Milward: I can, yes.

Baroness O’Cathain: Right, because we did the youth unemployment report recently and that was the major thing that came out: that there are nearly twice as many jobs available than there are skilled people to take them into the digital area. Careers advice has been hammered because they say it is no good, but if every school could have that, or if it was more generally known, I am sure it would be a great aid into education.

The Chairman: We will delve into that.

Baroness O’Cathain: Yes, I think we should follow that one up.

Hugh Milward: To go further than that, I think there is a definite opportunity for better advice and guidance at school level about the IT skills that are required in every sector, not just the IT sector.

Baroness O’Cathain: That would be great.

The Chairman: Yes, I think that is absolutely right. Mr Mairs?

Chris Mairs: There is also a public awareness issue here. It is not just the kids themselves getting the advice, it is the parents believing that this is a good career. I think the BBC could have a huge role to play in this. You will know that they are doing their push into this whole area in 2015, and making sure that parents realise that this is a great career and is just as good as becoming a doctor or a lawyer will help.
The Chairman: Yes, indeed. Let us move on. Lord Aberdare.

Q46 Lord Aberdare: Staying on the skills area, one of the things we have been looking at is whether there are different needs for the producers: digital producers versus the consumers. I think we have covered that a little. One of you introduced a new category of intermediaries, so perhaps there is a third category there. Perhaps going beyond what the actual shortage areas are, are there new ways of learning these skills that we need to think about? My five year-old granddaughter is certainly entirely familiar with an iPad. Are there ways of building on more informal learning methods, rather than just relying on courses in schools to deliver some of these needs?

Mike Warriner: Absolutely yes is the short answer. If you look at the way my nine year-old and seven year-old learn how to play Minecraft—apologies, you have probably heard Minecraft mentioned—they watch YouTube in order to learn how to play Minecraft, and they are watching other people play Minecraft. They are learning incredibly sophisticated things by watching videos. That is a whole new kind of genre of learning that we should embrace and look at and say, “How can we use YouTube in schools?”. First, how can we make sure that schools have the ability to have YouTube in schools, because it is blocked in an awful lot of schools or they do not have the infrastructure for it.

Secondly, how can we make sure that they are aware of the great content that is on services like YouTube but also across Coursera, the Khan Academy and the multitude of other online learning environments, and help teachers. There is a pivot, almost, in classes to help teachers think about perhaps getting schoolchildren to go home, watch the videos at home and then to use the classroom as a place to discuss those videos and talk about what they have learnt from them, rather than the teacher teaching them the material and hoping that they will somehow discuss it elsewhere.

Chris Mairs: I think this gets to the real heart of the single biggest challenge that we face here, which is that we have a new curriculum that I personally believe is going to be really, really important. However, we probably have about 200,000 primary school teachers who are being asked to teach this, and this is a huge, huge ask. Although we are doing some good stuff with CPD, which is being funded by government, I do not believe we are doing enough. But I also do not believe that even if we threw £100 million at future CPD we would get there. So we have to think about how to use technology to teach technology. As Mike said, the kids with peer learning will make progress faster than teachers, so we need to find a way to make the teachers comfortable with that method of learning, which is a bit scary if you are a teacher. There are potential opportunities to think about, such as having a new breed of learning technologists who go into classrooms and work alongside the teachers. It will not necessarily be cheap, but I think that is something we should look at as a serious way of empowering the teachers.

The Chairman: That is really helpful, because one of the things we try to do is say to everybody, “Give us a recommendation”. That is a very helpful specific recommendation. You can see technologists coming more and more in the health service to widen the medical range, but in education we have not done that. Mr Milward?

Hugh Milward: It does not necessarily need to be government that makes that happen. We have thousands of employees within the business who want to make a contribution in their local communities and do the things that they know how to do and do it in schools.
The Chairman: Do the Government not need to help make that happen? Does there not need to be a little bit of organisation for this to happen, because otherwise, why is it not happening now?

Hugh Milward: I think there is a slight corporate fear of treading too hard on schools or getting too involved in schools. Certainly from Microsoft’s perspective we have perhaps been on a path that is not necessarily the right path with ICT. The last thing we want to do with computer science is turn it again into a system that teaches kids how to use Microsoft products. That is absolutely not what we want. But it makes us a bit nervous when we go into schools that the legacy of that will somehow undermine what we are trying to do here, so if government can do that that would be helpful. There may be other players who are more important in helping to do that, including the teaching unions, for example.

The Chairman: Thank you. Lord Lucas, do you want to come in, because in a sense you follow on from this, do you not?

Q47 Lord Lucas: You have answered the next question. I would only ask Chris Mairs whether the projects that the Engineering Development Trust runs, getting industry to run real live projects in schools, might be a way of educating both teachers and kids.

Chris Mairs: The short answer is yes. I think that getting industry to come into schools is fantastically powerful not just for educating the kids but enthusing the kids. If you get the right sort of projects, like BLOODHOUND for example, that is a fantastic way to get kids to go, “Yes, this is exciting”.

We have to be a little careful that it is not just about subject knowledge. There is also pedagogy associated with this, and we have to be careful to make sure that we do not assume that just bringing in someone who knows about the subject can then deliver that knowledge to the kids. It does need a combination of the two.

Mike Warriner: Can I just echo a point on that?

The Chairman: Yes, certainly.

Mike Warriner: It is important that government does not see industry as a wonderful bunch of teachers. I would make a terrible teacher, but what I can do is to help to advise people who do know how to teach what we should be teaching and how they could be teaching, but in no way do you want me, or probably most of my team, sat in front of a class of schoolchildren.

The Chairman: Yes. Understood.

Q48 Lord Macdonald of Tradeston: I want to ask you about how we might prepare individuals, businesses and so on for the digital shock that is going to happen to labour markets and to occupations. Of course we are reporting to Parliament in the hope of political action, and one of the concerns has to be that there would be a lot of social unrest related to this. Half a dozen times in my own working lifetime I can think of when that social unrest turned into disruption and serious violence. Are there ways in which your big data analytics can start to warn us where these misgivings are starting to become dangerous and will arise? Are there ways in which you can help predict in advance where the more sensitive areas might be, so that you could advise politicians on how best they could do it? Because with your social media you are probably adding to the volatility of many sections of society,
were it ever to develop into unrest. Do you have a role for yourself in trying to help make sure that there is a smooth transition?

The Chairman: Who wants to try that one?

Hugh Milward: I think there is a responsibility among technology companies for helping society to navigate through the results of the innovation that they are driving. If you look at what Shaftesbury did for the Luddites, perhaps there is a parallel here with technology companies. In some respects what we do with technology has evolved rather than revolutionised, I think, so there is a shift in the job market rather than the collapse of one and the rise of another. As many opportunities arise out of technology development as sectors that decline. I do not know whether that answers your question.

But as to whether or not the big data can be used to predict and help navigate a way through this, I think the answer is a hesitant yes, in as much as data can be used to predict trends in other areas, in voting intention for example.

Lord Macdonald of Tradeston: But you are not aware of any projects at the moment to try to monitor that potential problem?

Hugh Milward: I am not.

The Chairman: Mr Mairs, you want to come in.

Chris Mairs: Yes. I was going to say—and it does not directly answer your question—that I do think that it is incumbent on government to become extremely skilled at using social media, because the person who is probably best positioned to monitor and do something about this is government itself, so it needs to become a really skilled user of these technologies. I do think that as a nation the best way we can mitigate these things happening is by doing as much as we can to educate our new upcoming workforce to benefit from the technology changes, because the changes are going to happen, and if we do not educate our own population, people will come in as migrants with the expertise and take the better jobs. So we just have to mitigate as much as we can.

Mike Warriner: The only part of your question I slightly take exception to is this idea of a technology shock. To me that implies that on one particular day suddenly a whole industry is going to fall off a cliff, and I do not see that happening. This is a change that could take many generations. We are seeing very, very rapid change in some areas and very exciting change in some areas: creating tonnes of new opportunities and enabling hundreds and perhaps hundreds of thousands of small businesses and people to have new jobs. I think we should be focusing on making sure that we accelerate that side of things and accelerate the new jobs that will get created from this change, and on making sure that through education anybody who is affected, as they get affected, can take advantage of these new opportunities. But I do not think we are going to see a seismic shock in the same way that we have seen with changes in the past.

Q49 Lord Kirkwood of Kirkhope: I am particularly interested in how Governments should be responding to the digital-divide implications particularly of the clustering at the moment, because that is an important part of our inquiry. Before I tease my way into that, I am a non-executive director of the Wise Group in Glasgow, which gets people off benefits into work using programmes. As part of that I see very bright 18 or 19 year-olds who are very skilled gamers. They get high scores on all these games, and they come in and say, “I cannot get a
job”. My question is: is it completely stupid to think that if the technology was crafted skilfully by educationalists, you could not say to somebody, “Look, here is a package that starts from zero in terms of computing science. Go away for 18 months and spend as much time on this package as you do on whatever the game at the moment is”? How realistic would it be to encourage an 18 year-old who is not frightened of computers because they use them to get themselves into a better place merely by self-tuition inside the module? Is that a daft idea?

Mike Warriner: No. That is a fantastic idea and I think we should be doing it. I think it is a fantastic idea. I think we should be doing it through and through. Microsoft, to give them a plug, have a wonderful piece of software, which my nine year-old is using, for learning programming at school. He is very fortunate to go to a school that teaches programming and ICT separately, or computer science and ICT separately. In computer science lessons they are learning Scratch, which is a very visual way of programming. They are also moving on to a Microsoft platform—Hugh will have to remind me of the name—which is a Microsoft game within which you can learn to programme within the game.

Hugh Milward: Kodu.

Mike Warriner: Kodu. Thank you. It is an absolutely fantastic piece of technology. He loves it. As a nine year-old that is a wonderful way to learn. Also they are playing things like Minecraft. Somebody has built an 8-bit computer in Minecraft and you can type in questions and do math and stuff. You can use these games to play, and I totally think we should be doing more and more of that.

The Chairman: And more that is enticing for an older age group.

Mike Warriner: Absolutely, yes. Totally.

Chris Mairs: I was going to mention an organisation called CoderDojo, which is an interesting organisation in this space of self-taught skills. They aim at five to 19 year-olds, I think, so it is possibly younger than the group you are talking about. CoderDojo looks like chaos apparently because it is all self-taught. It is all about creating an environment where all the kids teach each other and teach themselves. There is this little bit of facilitation and they only have one rule, which is “Be cool”. They started out with 10 rules about what you were not supposed to do and then got down to the one rule, which is just “Be cool”. It creates a learning environment where some kids progress fantastically quickly and there is no formal training but nonetheless the kids acquire a deep set of skills and then go on and become professional programmers.

The Chairman: Thank you. Mr Milward?

Hugh Milward: I have one additional point. The thing about being self-taught is that you have to teach yourself. That requires a certain level of motivation.

The Chairman: That is the question in a sense that we were asking, yes.

Hugh Milward: Yes. It is the same with everything across technology: the better the design, the more thoughtful the design—this is the creativity that the UK is so good at—and the more a particular piece of kit will be used. The gamification of learning is what we talk about. It can be very powerful, but at the same time if it is too wordy or leads too directly to learning rather than fun they need to stay with it, and that is a challenge.
Lord Kirkwood of Kirkhope: That is exactly the point. I see the brighter ones. A light goes on in their head and they think, “I am done with this indolent life”, if you want to use pejorative language. They want to do something, so they come to the Government and the Government say, “Well, the work programme is where you want to go”, and that is not always an enlightening experience. If we had a package of the kind that you have just been explaining to us, that would be good. That is a very helpful answer.

I am running out of time, but I need to ask you about the cluster effects and whether Governments should even be thinking about trying to direct how some of this is rolled out in the future in order to try to deal in some way with the societal effects. Politicians will always be frightened, particularly, as Lord Macdonald was saying, if the disparity gap gets too big. There will always be a temptation for government to say, “Let us take it to Easterhouse”, or whatever.

I would like to be comfortable that if we make a recommendation in this field we know what we are talking about and it makes sense. How does clustering and other effects—the things we are talking about this morning—have an impact on inequality, and how should we be remedying that if it is at all possible?

Chris Mairs: Just repeating slightly what was said in the previous session, I do think that clusters are a good thing, and you are not going to stop them because the small companies around the larger companies get huge benefits in terms of spin-offs to start new companies, recruitment and cross-fertilisation of ideas. Clustering has always happened in every industry. Going back to the car industry, for example around Birmingham and Oxford, you get massive, massive numbers of SMEs setting up around the big players. Establishing new clusters is entirely possible with the right infrastructure, the key things being good transportation links, very good communication links and one or two key players in there to start, which is either a strong university or a very strong tech company, and that can regenerate an area quite significantly. In the north-east, for example, they are doing great stuff up there.

The Chairman: Unless you have anything different to say we will leave it at that, because in a sense we had that in the last session as well. Thank you very much.

Lord Kirkwood of Kirkhope: That is very good, thank you very much.

Q50 Baroness O’Cathain: Coming back to the gender problem, how can we get girls interested at a very early age so that they will take their place right alongside the chaps? I will not say make it sexy—I do not think that is really what I mean—just that it is a normal thing to do.

Hugh Milward: It is such a challenge. I think we are all agreed that we could do so much to close the skills gap if only we had more women involved in technology. It is more significant than that inasmuch as innovation requires people who do not all agree and it requires a different set of ideas to be brought to the table. Diversity is extraordinarily important within the technology sector.

There is also evidence to suggest that girls who learn computing in a single-sex school tend to stick with it a bit longer than in a mixed school, partly because they begin to take a seat at
the back of the class and tend to let the boys push themselves forward in this area. Inherently it is not a gender-specific role at all, but it has this perception.

There is a lot that we can do as a sector by coming together and communicating a bit more effectively on the value of technology as a career option or as a skill that could be used throughout life and can be picked up and put down as people progress through life. There is a lot we can do through marketing. For example, in our apprenticeship programme we have only managed to lift the numbers of girls applying by marketing quite specifically to girls. Maybe there is a role in that as well, but it is a challenge and it is something that we are spending a considerable amount of time thinking about.

The Chairman: Does anybody want to add anything to that?

Mike Warriner: Possibly three things. We need great role models, and historically there has been a dearth of great female role models who you can reference and say, “Look at this person, they are showing how fantastic things are”. We now have things like the Anita Borg scholarship. We increasingly hear stories from people who were at Bletchley Park. It was run by women, it was set up by women, and the people who come out of that environment are at last telling their story. I think that is very, very important.

Secondly, we need to take the way we think about technology and transpose it so that it lines up with the way small girls think about technology—and I use the expression critically. My son loves Lego and plays it the whole time. My daughter, who is seven, was never really into Lego. Then someone found some Lego that was appropriate for her and suddenly she has really got into it. It was for building boats and houses instead of tanks and machine guns, which is stereotypical but you understand. The skill we are trying to teach is how to build things with Lego, not how to think about aeroplanes. That is important: making it appropriate.

The third thing, again, comes back to careers advice. We have some great female engineers at Google. I was talking to one of them the other day and she said that her parents are still—she must be 30, I am guessing—asking her when she is going to get a proper job. That is not right. The role of organisations such as the BBC are going to help us change the game.

The Chairman: Yes, that is really interesting. Thank you very much. Finally, Lord Janvrin.

Q51 Lord Janvrin: You might have heard us ask this question at the end of the last session. We have to come up with a set of recommendations to government as to how we can improve the UK’s competitiveness in this sector. What would be your top recommendation? If you want to have three, tell us your top one but give us the other two as well.

The Chairman: Yes, who would like to kick off? We already have the one about the technician in the schools, so that is good. You have time, Mr Mairs, if you want to think of a second one while we go to the other two, because you have already come up with one. Mr Milward.

Hugh Milward: Okay. What about Ofsted measuring the take-up of technology or the use of technology in schools as a formal measure for performance at schools? A thrust in that direction might encourage schools to think about it a bit more broadly. It is possible.

Mike Warriner: The number one thing that can make a change is investing in our teachers, whichever type of teacher we are looking at, and helping them to understand how they can
teach technology to those aged five to aged 95 and use technology to change the way they teach it. Building on that framework is absolutely critical.

**Lord Janvrin:** You mentioned ages five to 95. It is a cultural shift for everyone, us included, to think in terms of lifelong learning. How are we going to achieve that? Through teachers, as you mentioned, but there is a wider issue about how you change social attitudes to lifetime learning.

**Mike Warriner:** It is very difficult. I do not have the answer. One thing I observed while thinking about today was that if you do a science subject, typically you leave university knowing how to learn and how to do your first job. If you do let us say law, typically you leave your first law qualification knowing how to do your first job. That difference is the cultural difference that we need to instil. It is teaching people how to learn at work and to be agile so that they think, “Things will change. I will not be doing the job I started at age 21 at age 65”.

**Q52 The Chairman:** Is there a role for business in that as well, because in a sense we have talked about the role for government? Mr Warriner and Mr Milward in particular, what is the role for you as businesses and with your workforce? How do you already, if you do, make sure that it is a continual education?

**Mike Warriner:** The way we recruit people and the skills that we are looking for in the people we are recruiting is interesting. For our engineers there is a baseline: we like the people who have done a computer science degree. We are looking for people who have done a computer science degree because that has taught people how to think and how to learn about new technologies and new ideas.

We are much less interested in whether someone can use programming language A or programming language B, because we know that in the first project they go on they will be using programming language C. We know that in 20 years’ time none of the languages they have learnt will be relevant. We are looking for that ability to learn and we want to encourage people—we spend a lot of time investing in people—to help them develop those skills and that agility. That is where business can come in: to help that.

**Hugh Milward:** Maybe you could fold out some of the internal training and make it available externally. At the moment we have every possible level of technical training, although not so much entry level, available to staff effectively through an internal MOOC. We have now folded it out so that anybody can access it, do the training modules and help. It does not get them on the ladder though; it supports them once they already have a basic level.

We all know that China is producing 40 computer science graduates a day, Poland is producing four and the UK is producing less than one. We need to do more to start it off at the beginning, but once they are there, companies like ours are doing an awful lot of folding those out.

**The Chairman:** Mr Mairs, do you have any other ideas? We are very happy with the one you have, but this is your final chance.

**Chris Mairs:** Just building very slightly on what Hugh and Mike both said, I cannot stress enough how much of a challenge the teachers at primary schools and at KS3 in particular in secondary schools, are facing with the new curriculum. A lot of these teachers have never been taught computing themselves, so it is a big challenge. They need to be demystified and
helped. It is so important, for the reasons that Mike articulated, that this is not about teaching people to code, per se, but about using that as a vehicle for teaching them flexibility and a way of thinking that will help them in the new world.

Coming back to what Hugh said about Ofsted, there is a specific thing that Ofsted can do, which is that, probably in about 18 months’ time, it might be extremely valuable to do some research and surveying in schools, not as a stick but as a means of understanding how well they are now managing to deliver this new curriculum. In 18 months’ time we might find that significant intervention is required.

The Chairman: That was really helpful. Thank you very much indeed. That was a really useful session.
About Go ON UK
Go ON UK is the UK’s Digital Skills Alliance. Our vision is to make the UK the world’s most digitally skilled nation by 2020. We want every individual, small business and charity to have the skills and confidence to benefit from online services and opportunities. To achieve this vision we need to inspire and support people and organisations to share their digital skills with others. We accomplish this through our cross-sector alliance of dedicated national, regional and local partners working across the UK to help bring basic online skills within everyone’s reach.

Our Board is composed of Chief Executives from Age UK, Argos, BBC, Big Lottery Fund, E.ON, EE, Lloyds Banking Group, the Post Office and TalkTalk – organisations whose collective networks offer us incredible reach into every high street and community in the UK. Go ON UK also co-Chairs the Government’s Digital Inclusion Delivery Board (alongside the Government Digital Service) with the objective of coordinating the 58 charities and businesses who have signed the UK Digital Inclusion Charter to build on Go ON UK’s partnership model to cut the number of people who are offline by 25% by 2016.

Since October last year Go ON UK has launched regional programmes in the North East, Northern Ireland and the North West with the support of over 750 local partner organisations designed to embed and expand the delivery basic online skills across public, private and third sector activity in those regions. We also champion and support organisations such as the Tinder Foundation, Digital Unite, public libraries, Chambers of Commerce and community groups who are already motivating and supporting people to improve their digital skills in communities across the UK.

In support of online enterprise, Go ON UK has launched its own SME Digital Capability Programme in partnership with the Department for Business, Skills and Innovation. We estimate that in the last year this initiative has inspired 300,000 SMEs to investigate online business opportunities, of which 5,500 have taken further action to transition towards transacting and marketing themselves online.

Go ON UK is also committed to working with partners to identify, collect and aggregate the latest qualitative and quantitative data and metrics on the socio-economic benefits of digital skills and inclusion to support the development and delivery of targeted evidenced-based policies and initiatives.
Response to Call for Evidence Questions

The changing technological landscape

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

3. What is the employment impact on the UK’s labour market? What are the regional differences?

What lies ahead

Over the next 5-15 years, new and emerging digital technologies, platforms and services, accessed across an increasingly hyper-connected and globalised information environment, will continue to exert a disruptive and transformative impact on every aspect of our lives. Innovations such as the Internet of Things, Big Data, Open Data, Online Education Resources, the digitisation of public services and the convergence of digital media delivery channels will all unlock a kaleidoscope of new opportunities, products and platforms with the capacity to transform the UK’s capability for future job creation, innovation, economic growth and competitiveness.

And yet, the UK’s potential to benefit from these emerging opportunities will be critically dependent on the ability of policy makers, businesses, charities and individuals to address the UK’s growing digital skills gap. Crucially, this involves tackling our well documented deficit of high level and intermediate digital skills – alongside ensuring that every business, charity and individual in the UK can achieve the basic level of digital skills they need to benefit from these new products, platforms and services.

Where we are now

Nearly 20% of the UK population (9.5 million people) do not have Basic Online Skills (46% of which are from less advantaged socio-economic groups). According to the European Commission, 90% of jobs will require basic digital skills by 2015, and recent research suggests that 25% of UK job opportunities are now only advertised online. Without concrete steps to bridge the growing divide between the engaged and digitally literate majority and the disengaged and digitally excluded minority – the UK will continue to face serious challenges to its future prospects for economic growth, prosperity and innovation.

According to the 2013 OECD Survey of Adult Skills the number of adults aged 16-24 in England who failed the level 1 core digital skills test was double the number of 16-24 year olds in Germany and triple the number in France. In the 25-34 age bracket three times more adults in England failed the basic test compared to adults in the Czech Republic and

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206 Ipsos MORI BBC Digital Capabilities, September 2013, pages 3-5
207 European Commission, Digital Agenda 2013: ICT for Jobs, page 1
208 UK Online Centres, UK Jobs and the Internet, 2012, page 5
209 12.9% of adults in England aged 16-24 failed the OECD core ICT test, compared to 6.4% in Germany and 4% in France (behind Australia, Austria, Czech Republic, Estonia, Finland, South Korea, Spain and Belgium) – 2013 OECD Adult Skills Survey, page 421
the number of adults scoring below the minimum standard in France was less than half the number of 25-34 year olds in England.\textsuperscript{210}

It no longer makes any sense to see digital skills as a separate niche discipline reserved for technical experts or enthusiasts. Basic online skills have now become universal and essential components of the social, economic and political circulatory system of any effective modern society. A coordinated cross-sector approach to building basic digital skills is no longer merely an aspirational objective – but an urgent necessity.

**The future is here – but not evenly distributed**

In its 2012 Communication on Rethinking Education the European Commission set out the key challenges to be addressed by Member States in building skills for the 21\textsuperscript{st} century. The Commission emphasised that “the first step must be that foundation or basic skills are achieved by all” as they represent “a gateway to employment and social inclusion.”\textsuperscript{211} For the benefits of our increasingly hyper-connected digital society and economy to be both realised, exploited and evenly distributed we need to establish an underpinning foundation of basic online skills for all.

By way of illustration, the UK Government’s Information Economy Strategy published in June 2013 seeks to foster a wave of innovative UK start-ups generating new digital business models, products and services – and yet the potential UK market for these innovations will be limited to those who have the digital skills to access and use them. Similarly, the projected 1.8 billion\textsuperscript{212} in cost savings scheduled to be unlocked by the digitalisation of public services under the Government’s Digital by Default Strategy will be highly unlikely to materialise unless more citizens possess the basic skills required to access and consume services through these digital channels. By the same token, the full economic value of the Government’s existing £1 billion investment in improving and upgrading the UK’s broadband infrastructure will surely be constrained without a corresponding increase in the number of citizens with the knowledge and understanding to take advantage of this new physical infrastructure.

**The benefits of an inclusive information economy**

Go ON UK firmly believes that inclusive access to Basic Online Skills is a key enabler for maximising the UK’s potential for future economic growth offered by digital technologies – a dividend which is estimated to be worth up to £63 billion\textsuperscript{213} in additional annual GDP growth. This includes £18.8 billion\textsuperscript{214} of economic value which would be unlocked by digitally empowering the UK SME sector. Recent research also demonstrates that businesses that

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\textsuperscript{210} 21.9\% of adults in England aged 25-24 failed the OECD core ICT test, compared to 7\% in the Czech Republic and 10.5\% in Germany (behind Austria, Canada, Denmark, Estonia, Ireland, Italy, Japan, South Korea, Netherlands, Poland, Slovak Republic, Spain, Sweden, and the United States) - 2013 OECD Adult Skills Survey, page 421

\textsuperscript{211} European Commission, Rethinking Education: Investing in skills for better socio-economic outcomes, November 2012, page 4

\textsuperscript{212} Government Digital Strategy, Cabinet Office, November 2012, page 8

\textsuperscript{213} Booz & Co, This Is for Everyone: The Case for Universal Digitisation, November 2012, page 4

\textsuperscript{214} Booz & Co, This Is for Everyone: The Case for Universal Digitisation, November 2012, page 6
make the most of digital opportunities perform better financially, have better growth prospects and have more confidence in the future of the UK economy.\(^{215}\)

At a more granular level, Basic Online Skills represent a key enabler for individuals, both in terms of saving time and money, as well as enhanced access to new opportunities, services and platforms. A new return on investment survey from BT has identified that the value of Basic Online Skills and access to online services for individuals (who were previously offline) as £1,064 per year.\(^{216}\) For those individuals who progress to more advanced digital skills (such as the daily use of ICT in their job) the average annual benefit is £3,568.\(^{217}\) Further benefits include reduced isolation for older people, increased chances of employment (e.g. by applying for the 164,000 UK job vacancies\(^{218}\) which are now only posted online) and enhanced access to information and services across a broad range of areas including health, consumer issues and finance.

**National and regional challenges for businesses and charities**

The 2014 Lloyds Digital Business Index\(^{219}\) produced in partnership with Go ON UK surveys some of the key indicators of digital maturity for organisations across the UK. The report identifies that 75% of small businesses and charities are not investing in improving digital skills - and perhaps even more importantly that a third of business and charities believe that being online is not relevant to their day to day operations. This highlights that for many private and third sector organisations, the transition to knowledge-based economy will be particularly challenging without a sea change in current attitudes and behaviours towards the opportunities of the online world.

In terms of regional differences for the development of nurturing of digital industries going forward we look again to the Lloyds Digital Business Index mapping digital maturity and the prevalence of Basic Online Skills amongst SMEs and Charities. For businesses with Basic Online Skills we can see that regions such as the North West and the East Midlands are lagging behind, with 38% and 35% respectively. These are businesses and charities that lack the basic skills to safely and securely search, communicate and transact online. Conversely, London and the South East do the best defined by this metric. Similarly, the South East, South West and London also have the highest levels of business and charity digital maturity, whilst Northern Ireland, Scotland and Yorkshire & the Humber have the lowest.

The BBC Media Literacy Report\(^{220}\) offers some insight into the level of digital skills among adults across the UK. The report shows that Yorkshire & Humber has the highest levels of adults (86%) possessing Basic Online Skills, whereas other regions such as Scotland and Northern Ireland are further behind scoring 70% and 77% respectively.

Indeed, the digital maturity of businesses and charities, as well as adult skill levels are reflected in the location choices of existing digital industries across the UK. The NIESR

\(^{215}\) Lloyds Banking Group, Digital Business Index 2014, April 2014, page 32
\(^{216}\) BT, Value of Digital Inclusion, June 2014, page 13
\(^{217}\) BT, Value of Digital Inclusion, June 2014, page 16
\(^{218}\) 164,000 is 25% of the overall number of UK job vacancies – source: ONS Labour Market Statistics, August 2014
\(^{220}\) http://www.bbc.co.uk/learning/overview/assets/digital_capabilities_2014.pdf
mapping of digital industries\textsuperscript{221} shows significant clustering around London and the South East, with regions of significantly lower activity found in central Wales, parts of the North East, North West and Scotland.

Future workforce

4. What skills do future workers need in order for the UK to be globally competitive?

How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

7. How can the education system develop creativity and social skills more effectively?

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

The challenges of a new educational paradigm

Since the dawn of the Internet twenty five years ago, digital information and communication technologies, fuelled by cheaper, faster computing power and an increasingly hyper-connected global network of people, machines, infrastructure and devices are continuing to have a transformative impact on the concept of education and skills. This new hyper-connected information environment continues to unleash recurring waves of innovation and creative destruction creating radical new business models, industries and jobs.

As the OECD noted in a landmark paper published over a decade ago – the role of education has increasingly become a double-edged sword.\textsuperscript{222} As our societies and economies become progressively more knowledge-based the polarisation of opportunity between skilled and un-skilled individuals is set to grow exponentially, with rich rewards for those with the right aptitudes and skills and stiff penalties for those who find themselves without those capabilities. In this environment of permanent and accelerating innovation and invention, the days when schools and universities offered learners a portfolio of knowledge and skills which remained relatively up to date and relevant for the remainder of their lives are now definitively long gone. Instead the requirement for all individuals to continuously and iteratively update their skills and experience from “cradle-to-grave”\textsuperscript{223} has become an ever more pressing and urgent necessity, which formal education systems have struggled to metabolise.

\textsuperscript{221} http://niesr.ac.uk/sites/default/files/publications/SI024_GI_NIESR_Google_Report12.pdf
\textsuperscript{222} OECD Observer, Lifelong learning for all, No 225, March 2001
\textsuperscript{223} The Times, Higher Education, Vision of lifelong learning put at the heart of OECD target, 6th April 2001
The renewed importance of lifelong learning in a digital age

Since the concept of lifelong learning was originally developed in the 1960s, its importance has been steadily and cumulatively recognised in international policy making circles.\textsuperscript{224} And yet a 2014 EU consultation on future education and skills policy acknowledges that progress towards promoting the key competences for lifelong learning set out in the 2006 European Parliament and Council Recommendation which are “crucial for both employment and social inclusion” have been “disappointing”:\textsuperscript{225}

“One in five European adults has only basic skills in literacy, one in four has basic numeracy skills and lacks the skills to effectively make use of ICT. This further stresses the need for lifelong learning and flexible learning pathways, which – at any point in time – would enable individuals to update and upgrade their skills.”

In this context Basic Online Skills are a critical enabler for broader access to today’s opportunities for lifelong learning. Familiarity with the basic competencies required to locate, access, exploit and share digital information, tools and resources, enable individuals to embark on self-motivated and self-directed learning journeys in ways which were impossible a decade ago. These newfound opportunities are further amplified by the looming transformation of the global education landscape through the proliferation of Open Education Resources and Massive Open Online Courses (MOOCs). These new flexible digital learning channels simultaneously threaten to disrupt established educational institutions, whilst democratising access to knowledge and qualifications to anyone with the baseline threshold of Basic Online Skills to access these resources.

The link between Basic Online Skills and employability

Access to online resources and basic digital skills training offer disadvantaged individuals enhanced opportunities to increase their employability. This correlation is emphasised in the European Commission’s March 2013 Joint Research Centre Report on ICT and employability:

“...e-inclusion intermediaries play an important role in supporting those at risk of exclusion develop their digital literacy and employability... ICT skills can be seen as ‘gateway skills’ without which a person’s likelihood of finding employment would be significantly reduced. Moreover, ICT skills can also serve to enhance a person’s employability profile, particularly when combined with other skills and attributes, or as a catalyst for further skills development.”\textsuperscript{226}

Indeed ICT skills are valuable not just because they improve future chances of employment, but also because they help increase the self-confidence of individuals, as well as expanding their opportunities to search and apply for suitable job vacancies online. As the European

\textsuperscript{225} European Commission, Stakeholder Consultation on the European area of skills and qualifications, background document, page 4
\textsuperscript{226} European Commission, JRC Technical Report, ICT and Employability, March 2013, page 7
Commission’s Staff Working Document on demographic and social trends published in February 2013 illustrates:

“ICT skills have become crucial for the employability of individuals, supporting individual empowerment (development of self-confidence and self-efficacy) and the development of other skills, such as transversal skills (social networking, collaboration, problem-solving, language skills), job search skills, and e-learning skills... Moreover, ICT skills facilitate access to the labour market as they help people search for jobs more effectively and can reduce the duration of unemployment.”

Go ON UK’s partnership model is specifically designed to empower local e-inclusion intermediaries and digital champions across local government, local businesses and local voluntary and community sector organisations to embed the provision of Basic Online Skills across all their customer-facing channels and share their digital skills with local communities.

The Adult Skills Budget needs a more substantive focus on basic digital skills

In 2015-16 the Adult Skills Budget, administered by the Skills Funding Agency, will allocate just over £2 billion to support learners and employers - which represents a 19% reduction on current funding levels.

The Skills Funding Agency’s 2012-13 Annual Report states that its strategic direction is guided by two key Coalition Government Skills Strategy documents: Skills for Sustainable Growth (BIS 2010) and Rigour and Responsiveness in Skills (BIS/DfE 2013).

The 2010 BIS report acknowledges in a section entitled “digital skills” that “using a computer and the internet are now basic skills for employability, and for many other aspects of learning and living.”

Despite this encouraging start it is disappointing to note that the follow up strategy document produced by BIS and the Department for Education in 2013 contains no references to digital skills throughout its 44 pages. Similarly the Skills Funding Agency 2013-16 Funding Statement also has no references to digital skills, computer skills or online skills throughout its 60 pages.

We are falling behind mainstream EU approaches to basic digital skills

This represents a surprising disconnect from mainstream EU level policy thinking. For example the sixth pillar of the European Commission’s Digital Agenda for Europe, published in 2010 – Enhancing digital literacy, skills and inclusion – includes key actions for “Member States to implement by 2011 long-term e-skills and digital literacy policies and promote

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228 BIS, Skills Funding Agency, Skills Funding Statement 2013-2016, February 2014, page 26
229 Further Education Week, Adult Skills Budget in line for 19 per cent funding cut, 10th February 2014
232 BIS / Dept of Education, Rigour and Responsiveness in Skills, April 2013
233 BIS, Skills Funding Agency, Skills Funding Statement 2013-2016, February 2014
relevant incentives for SMEs and disadvantaged groups” (Action 66),\(^{234}\) and for “Member States to mainstream e-learning in national policies for the modernisation of education and training…” (Action 68).\(^{235}\)

Furthermore, the new EU Regulations which govern the priorities for the European Social Fund 2014-2020, Article 2, Section 2(b) call for “Enhancing the accessibility of, and use and quality of information and communication technologies through the development of digital literacy and e-learning, and investment in e-inclusion, e-skills and related entrepreneurial skills.”\(^{236}\)

**High level issues**

- While reading, writing and numeracy are justifiably essential skills that dominate basic skills funding, the fact that basic online skills have effectively become the 4\(^{th}\) pillar of literacy seems to be continually overlooked in this equation.
- The current Skills Funding Agency 2013-2016 funding statement refers to the importance of using ICT in innovative ways – but seems to ignore the importance of basic online skills and inclusion.
- Skills funding frameworks are increasingly moving to recognise that outcomes such as employment are equally as important as qualification completion. As digital skills will be a basic entry requirement for the vast majority of jobs going forward; these skills will clearly be key in successfully achieving these new funding outcomes.

**Specific issues**

- All current Adult Skills Budget apprenticeship frameworks include English and Maths as functional skills – but only some include digital skills.
- New Trailblazer apprenticeships standards make no mention of digital skills
- Current Adult Skills Budget delivery of short digital skills courses have been cut (any courses providing less than 15 credits are no longer fundable) and yet these are precisely the kinds of entry level qualifications which are urgently required to develop basic online skills.

**Shared Language – demystifying and democratising Basic Online Skills**

Much of the language used to articulate the benefits of digital skills and the online world can be alienating and off-putting to many of the people we most want to support and engage with.

In this context, Go ON UK and partners identified the importance of assessing which language most appeals (and which terms serve as barriers) to the 19%\(^{237}\) of UK adults and 31%\(^{238}\) of small businesses and charities without Basic Online Skills.

\(^{234}\) European Commission, Digital Agenda for Europe, Action 66
\(^{235}\) European Commission, Digital Agenda for Europe, Action 68
\(^{237}\) BBC Media Literacy: Understanding Digital Capabilities Follow-Up
\(^{238}\) Lloyds Bank UK Business Digital Index
Go ON UK – Written evidence (DSC0079)

Based on recent research commissioned by Go ON UK and the BBC, we have developed an easy to adopt glossary of shared language, making it super simple for anyone or organisation to better communicate with these audiences. As part of their Digital Skills Charter commitments, Go ON UK partners are now adopting the findings in their own communications plans.

**Common Definition of Basic Online Skills**

We have worked with key experts\(^{239}\) in the fields of learning and technology to identify the Basic Online Skills required for every individual, business and charity to be confident and secure online.

For a full description and details of the individual categories please visit the Go ON UK Basic Online Skills page

**Short- and medium-term support to the digital sector**

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

**The need for a holistic approach to the digital skills ecosystem**

At an overarching strategic level, future industrial policy needs to take a holistic approach to the entire digital skills ecosystem – encompassing basic digital skills alongside intermediate and higher level capabilities. There needs to be wholesale recognition in future policy making that the future supply of intermediate and higher level skills will be significantly

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\(^{239}\) Our Basic Online Skills categories were developed with input and guidance from the Oxford Internet Institute (OII), the London Business School, London School of Economics (LSE), OFCOM, the Communications Consumer Panel and e-Skills UK.
dependent upon the number of learners who can access opportunities to develop basic
digital skills today.

There needs to be more developed understanding of both the key interdependencies of the
digital skills ecosystem (the way the learning conveyor belt from basic to intermediate to
advanced skills functions) as well as the key distinctions between the different types and
levels of skills required in different social and commercial circumstances. A recent report
from a Digital Policy Alliance’s Working Group on 21st Century skills, Chaired by Lord Lucas
noted that at one level the majority of jobs now require basic digital skills; on a second level
over 50% of jobs need significant digital skills (for example editing a web page); whilst a third
level of positions require the technical knowledge to “develop, install, maintain and secure”
digital products and services. Blurring these distinctions does not help us assess which
digital skills are required under which circumstances – but ignoring their interdependencies
also limits our ability to develop a comprehensive strategy.

Keeping up with the pace of innovation and change

It is also essential to remember that digital business models, platforms, products and
services are currently evolving and innovating at an ever accelerating pace – which means
that our definitions and categorisations of digital skills must not be too closely wedded to
specific contemporary technologies, tools and applications. Given that what constitutes the
basic threshold of digital capability which enables an individual or an organisation to
participate in the digital world today may look radically different in just a few years – we
must ensure that our definitions our capable of embracing future innovation and evolution.
Instead our definition of basic online skills should be pegged to what the possession of core
digital aptitudes allows a person to accomplish or achieve (as illustrated by our common
definition of Basic Online Skills provided at the end of the last section).

With this in mind, Go ON UK continues to analyse and assess emerging digital skills
frameworks to identify scope for iterative improvements and adaptations to its own
methodology. A topical example of this is the European Commission’s Institute for
Prospective Technological Studies DIGCOMP project. Last year this initiative published a
report summarising its review of 15 international digital skills frameworks with the objective
of establishing a common European framework for digital competencies which covers all skill
levels. The resulting research paper developed a matrix which captures 21 separate digital
competencies divided across 5 core skill areas and three levels of attainment (foundation,
intermediate and advanced). For the most part these core skill areas are aligned with Go
ON UK’s current definition of Basic Online Skills – although we are currently investigating the
opportunity to integrate two of the core competencies identified (problem solving and
content creation) into a revised version of our definition.

Digital Competence in Europe, Anusca Ferrari, July 2013, page 16
Matching supply with demand for digital skills

Last year O2 published a report which analysed the Future Digital Skills Needs of the UK Economy. The report estimates that the UK will need 745,000 additional workers with digital skills to meet rising demand from employers and fuel the UK economy over the 2013-2017 period - of which up to 182,000 could be supplied by new entrants (e.g. young people under 25 entering the workforce for the first time or retraining from other roles). O2 projects that the loss of economic output associated with these unfilled job vacancies could amount to between £1.6 billion and £2.4 billion per year by 2017. In contrast, the report suggests that if these vacancies were to be filled by domestic employees (as opposed to these growth opportunities being captured by non-UK companies, or UK companies outsourcing these functions overseas) then the additional output unlocked could add a further £11.18 billion per year by to our economy by 2017.

This example illustrates significant underperformance in the operation of the current UK market for digital skills. Based on these findings the report calls for increased support from business and industry in the successful delivery of digital education in schools, as well as greater collaboration between Government and businesses for digital skills exchange programmes and incentivise small digital businesses to offer young people work experience.

Further steps to support a more effective matching of the supply and demand of digital skills include:

- **Raising awareness** among young people and school leavers of the multiple applications and opportunities associated with digital skills across all industries and sectors.
- Helping young people to **identify the skills that they already have** which are valuable in a commercial context. Creating and sharing content, running social media accounts, using apps and mobile services are now sought after skills for almost all business sectors. Younger job seekers should be supported in marketing these capabilities more effectively to employers.
- **Enhanced dialogue between employers and educational institutions** to provide students with links to the world of work, an understanding of the kinds of specific skills they require, and input from industry on current course content.
- Providing better information on how businesses can **train and equip existing staff** with the digital skills they need rather than outsourcing some of these functions to external suppliers – and highlighting how current public, private and third sector programmes and initiatives can assist in this area.

**Case Study – Go ON UK’s local partnership model**

At the heart of our partnership model is our belief that a shared problem needs a shared solution – and that the most effective way to deliver access to Basic Online Skills is through the engagement of cross-sector national, regional and local stakeholders with detailed

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242 The Future Digital Skills Needs of the UK Economy, O2, 2013
243 The Future Digital Skills Needs of the UK Economy, O2, 2013, page 2
244 The Future Digital Skills Needs of the UK Economy, O2, 2013, page 3
245 The Future Digital Skills Needs of the UK Economy, O2, 2013, page 6
knowledge the needs of their own communities. Our partnership model delivers a multiplier effect by creating a coordinated ecosystem of dedicated partners which offers a network for sharing and up-scaling innovative approaches and good practice. Go ON UK offers local partner organisations a range of resources, communications support, propositions, campaign and marketing tools, incentives and practical local support. These tools and resources can be tailored to local priorities and needs. Above all our objective is not to dictate a one size fits all solution, but instead to leverage the knowledge, expertise and resources across our diverse network to deliver access to Basic Online Skills to all individuals and organisations across the UK.

The Go ON UK regional partnership model implements a sequenced approach to super-charging Basic Online Skills which includes the following phases of activity:

- **Engage** – pre-engagement with local stakeholders and leaders committed to improving Basic Online Skills
- **Promote** – networking activities and events to recruit a wider ecosystem of local partners
- **Embed & Enhance** – establish regional steering group to enable local organisations to form delivery partnerships to deliver Basic Online Skills training
- **Sustain** – support existing partnerships with online digital champion resources available from DigitalSkills.com, maintain steering group oversight and review of partnership activities and deliver awards programme to recognise local successes

This model was initially successfully piloted in October 2011 during the Go ON Liverpool campaign which reduced the number of offline adults in the city by 55% in just 18 months. Building on the success of Go ON Liverpool, since October 2013 Go ON UK has rolled out this delivery model via regional programmes in the North East, Northern Ireland and the North West.

We also commissioned MTM London to conduct an independent evaluation of the North East regional programme which is scheduled for publication in September 2014. The independent evaluation concluded that “The North East Pathfinder is valuable proof of concept for the Go ON UK cross-sector partnership model” whilst identifying key elements of success:

The pathfinder was successful at mobilising a diverse group of partners behind the Basic Online Skills Agenda:

- All 12 local authorities signed the Digital Skills Charter
- Over 120 partners engaged in the pathfinder

There is evidence of successful and sustainable partnership forming and of the envisaged multiplier effect in action:

- 40+ partnerships formed to deliver Basic Online Skills

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246 Evaluation of the Go ON UK North East pathfinder, MTM London, September 2014, page 2 [link to be supplied]
247 Evaluation of the Go ON UK North East pathfinder, MTM London, September 2014, page 2 [link to be supplied]
Over 1,500 Digital Champions recruited
3,000 adults reached through Newcastle Central Library alone

In addition, the evaluation also identified a number of specific areas where the model could be refined to achieve even greater impact and supplied ten key recommendations – all of which have been implemented in the context of Go ON UK’s subsequent regional programmes in Northern Ireland and the North West.

Industry

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

Purely analogue businesses operate at a disadvantage in a digital market place

According to Go ON UK research, although 92% of SMEs identify themselves as being online, 40% do not have a website and only 33% actually conduct online transactions (buy or sell products or services online). A 2013 report by the Federation of Small Businesses “The Digital Imperative: small businesses, technology and growth” quotes a study by McKinsey which identified that SMEs with a strong online presence grow more than twice as fast as those with no or minimal web presence, generate more than twice as much from exports and create twice as many new jobs.

The overarching lesson is clear, organisations need to be online and invest in developing their digital capabilities if they wish to grow their customer base, access international markets or work with larger firms. In 2012 online sales in the UK reached £164 billion, which indicates the scale of the missed opportunity for firms who aren’t transacting online.

A poverty of skills, awareness and aspiration

One of the key barriers preventing many SMEs from operating successfully in an increasingly digital market place, alongside a lack of digital skills, are that many firms continue to hold unenthusiastic attitudes towards digital business opportunities. The Lloyds Digital Business Index, a national survey of 2000 SMEs and charities found that one of the primary reasons for businesses attaining low levels of digital maturity was a belief that the Internet was irrelevant to their business model, that their core customers were not online - or that they felt that they were unprepared for the increased customer demands it would bring. Additional barriers include the cost of setting up, managing and maintaining a website, a lack of expertise and capacity in exploiting digital marketing/sales channels, as well as concerns that an online presence may provide intelligence on services and pricing information to competitors.

To successfully mitigate these barriers we need consider how better resources can be provided to educate SMEs on what their skills requirements are. 75% of SMEs and charities currently do not allocate any budget to developing digital skills, so while many of these

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organisations are looking for extra support and capacity in this area, 25% are not aware of which specific skills they need. In addition, there is a need to raise awareness that the costs of establishing an online presence will usually be substantially offset by the future cost savings and increased profile, sales and revenue secured through digital channels.

Furthermore, while advertising your services and prices will provide information to competitors – without an online presence most firms will be unable to successfully compete with rival businesses which are effectively marketing themselves and selling themselves online.

Further recommendations from the 2013 O2 report on the Future Digital Skills Needs of the UK Economy highlight some useful approaches:

- **Increased support** to encourage greater numbers of digital start-up enterprises at a local level, particularly in local areas not currently well served by incubators or other support infrastructures
- **Mentoring** from established companies helping digital industry start-ups to grow and scale-up more quickly
- **Local finance initiatives** to help new digital start-ups and micro-businesses to establish themselves grow more quickly
- **The development** of stronger graduate-SME digital knowledge transfer partnerships

**Go ON UK’s SME Digital Capability Programme**

In 2012, a report from Booz & Co, “The Case for Universal Digitisation”, estimated that digitally empowering the UK SME sector could unlock economic gains of £18.8 billion. In line with that assessment, the Government’s Information Economy Strategy, published in June 2013, includes a commitment to work in partnership with industry to assist the UK’s 1.6 million SMEs in making the transition towards transacting and marketing themselves online.

In support of this important objective, Go ON UK has launched its own SME Digital Capability Programme in partnership with the Department for Business, Skills and Innovation – designed to empower SMEs across the UK to capitalise on the time and cost savings associated with transacting online whilst maximising productivity and growth. We estimate that in the last year this initiative has inspired 300,000 SMEs to investigate online business opportunities, of which 5,500 have taken further action to transition towards transacting and marketing themselves online.

As the programme enters its second year, our focus will be on developing enhanced corporate partnerships and engineering a scalable digital incubation network for SMEs in collaboration with Local Enterprise Partnerships and Growth Hubs. This will include:

- **Inspiring** – General communications-led outreach to inspire business to take their first digital step, sharing of peer-to-peer and segmented content and explanation of business benefits, using targeted incentives where appropriate to encourage engagement.

253 Booz & Co, This Is for Everyone: The Case for Universal Digitisation, November 2012, page 6
• **Educating** – Explain the available options and provide choices for learning and sharing of best practice, use online and offline activities to guide the digital development of SME’s.

• **Supporting** – Signpost and support training and skills development, create modules for the specific enhancement of transactional skills and enable user-defined journeys to acquire a range of advanced skills.

• **Promoting** – Promote case studies and tell peer-to-peer stories, encourage online community engagement to advocate, support and inspire action.

**Infrastructure**

15. **Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?**

**How long is a piece of string?**

To an extent, the question of whether the UK has a sufficiently competitive digital infrastructure to support a knowledge-driven economy depends on your chosen point of reference. According to the 2014 European Broadband Scorecard produced by OFCOM\(^{254}\) the UK compares favourably in terms of internet infrastructure, with 95% of all households having access to current generation broadband services – equal with the top five performing countries in the EU (France, Spain, Italy and Germany).

When it comes to superfast broadband, the UK also sees improved performance having significantly increased its coverage in recent years from 55-60% in the previous scorecard to 70-75% in the latest iteration. The UK now has the highest level of coverage of the top 5 EU countries, overtaking Germany which has 65-70% coverage.

However, a report\(^{255}\) published in March 2014 by the campaign group Digital Business First claims that 10 million UK premises (homes and businesses) are currently unable to access superfast broadband services – limited to only standard broadband, or in some cases no broadband at all. In addition, wider international comparisons paint a slightly less complimentary picture in a context where the Korean Ministry of Science and Technology announced in January 2014 its plans to deliver a national 5G wireless network offering speeds of 1Gbps by December 2020.\(^{256}\)

There is also a level of controversy over what constitutes standard broadband and superfast broadband. Current Government plans include providing all households in the UK with access to broadband with a download speed of at least 2Mbps, and 90% of the UK with superfast broadband (at least 24Mbps).\(^{257}\) However, according to OFCOM’s 2014 Broadband Scorecard, the European Commission defines standard broadband speeds as between 144kbps and 30Mbps – and superfast broadband as over 30Mbps. This would imply that by European standards, the Government’s current minimum target for superfast broadband would still be defined as standard speed broadband!

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\(^{254}\)http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/scorecard/European_Broadband_Scorecard_2014.pdf

\(^{255}\)Digital Business First, The UK’s Enduring Broadband Deficit: A divided nation – time for an effective plan, March 2014

\(^{256}\)Digital Business First, The UK’s Enduring Broadband Deficit: A divided nation – time for an effective plan, March 2014, page 4

\(^{257}\)House of Commons Library, Broadband – Update 2014, Standard Note SN06643, 21st August 2014, page 1
Nevertheless, the requirement to delivery faster broadband speeds also need to be balanced against the anticipated and likely future usage and uptake of high bandwidth services among individuals and businesses across the UK. This is a particularly challenging task given the rapid pace of innovation and change affecting current digital business models, services as well as evolving consumer appetites and behaviours. Underestimating demand will risk a lack of connectivity which will put a brake on innovation and stifle economic growth. On the other hand, overestimating demand and over investing in infrastructure will result in scarce resources being diverted from other valuable policy objectives.

**Access to infrastructure and digital skills – two sides of the same coin**

In many ways Basic Online Skills and broadband infrastructure represent opposite sides of the digital inclusion coin – with a potentially interdependent and symbiotic relationship between these two variables in terms of fully unlocking the socio-economic benefits of digital inclusion. Possession of Basic Online Skills has limited value without access to digital devices and digital communications infrastructure (although public libraries, schools and other community providers play role in mitigating this). Similarly, access to digital devices and digital communications infrastructure yields a limited benefit when individuals and organisations lack the skills or the inclination to exploit these opportunities.

Interestingly, OFCOM’s latest Communications Market Report published on the 7th of August notes that in quarter one of 2014 the number of adults with household internet access in the UK reached 82%258 and just under fifth (19%259) with no household access). It is hard to imagine that the correlation between the 20% of UK adults who lack Basic Online Skills, and the 19% of those without household access to broadband is entirely coincidental. The report also notes that 82% of individuals who reported that they had no plans to get the internet at home in the next 12 months cited “lack of interest” as the primary factor for that decision (nearly two and a half times the number who cited cost or service availability as the key barrier).260

In Go ON UK’s experience of partnering with regional and local stakeholders to deliver access to Basic Online Skills – lack of interest is most frequently a proxy answer provided when an individual or organisation lacks the digital capabilities required to appreciate the wealth of opportunities the online world has to offer. In such instances, taking steps to demonstrate how digital skills can empower and enable them to accomplish personal, social and commercial objectives whilst demystifying their fears of the digital unknown represent powerful drivers for igniting interest and building motivation to acquire new skills and engage with the online world.

Suffice to say, delivering inclusive nation-wide access to Basic Online Skills, digital devices and broadband services and infrastructure represent an essential prerequisite if we are to establish the UK as a leading digital nation and enjoy the social and economic benefits associated with innovation, job creation and growth. Indeed, the latest report from the UK Digital Skills Taskforce highlights the critical importance of matching the Government’s £1

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258 OFCOM, Communications Market Report, 7th August 2014, page 261
259 OFCOM, Communications Market Report, 7th August 2014, page 276
260 OFCOM, Communications Market Report, 7th August 2014, page 277
billion investment in improving the UK’s broadband infrastructure with a corresponding investment with digital skills and education:

“. . . extending broadband across the UK, to 95% of premises by 2017. Such a transition has been an important step to strengthening the UK’s digital economy. However, the next stage must be to have a similar roll out of basic digital skills for all. It would be a considerable waste of that large investment if well over 10% of the population continue to lack the skills to take advantage of an improved physical digital infrastructure.”

5 September 2014

The Chairman: Thank you very much indeed for joining us today. We are all absolutely
delighted to end up with three women in front of us because one of the themes that has
consistently come out throughout our evidence sessions so far is the paucity of women in
the sector. Now we have ended up with an all-woman panel, which is great.

Just a few housekeeping things while you are settling yourselves down. You have a list of
interests in front of you that have been declared by the Committee; they were declared
orally by Members in previous sessions and they can be found in the transcripts as well. This
is a formal evidence-taking session of the Committee and a full shorthand note will be taken.
Go ON UK, Tech Partnership and UK Digital Skills Taskforce and TeenTech CIC – Oral evidence (QQ 113-128)

It will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and will be able to revise it in terms of any minor errors that you see. The session is on the record. It is being webcast live and will be subsequently accessible via the parliamentary website. You are very welcome to submit written supplementary evidence after the session; in fact we would actively welcome that. I am advised to ask you to speak up. Actually the acoustics are not bad in here but please speak up reasonably clearly; we all need to do that. That is by way of introduction.

What I will get you to do is introduce yourselves and if you want to make any brief opening remarks that is fine. If you do not want to, we will go straight to the questions. Do not feel you all have to answer every question. It is much more flexible than that.

Karen Price: I am Karen Price and I am here today representing the Tech Partnership, which is thousands of companies working together, companies small and large and right across the economy, not just the tech sector itself but also financial services and retail. Those employers are working together to create the skills for the digital economy, so I am delighted to have this opportunity today.

Rachel Neaman: I am Rachel Neaman and I am the chief executive of Go ON UK, the digital skills charity that works with a range of partners across all sectors to ensure that everybody has the basic online skills they need to survive in the digital world.

Maggie Philbin: I am Maggie Philbin and for the past 10 months I have chaired the UK Digital Skills Taskforce. We have taken a look at what is needed to help everyone in society make the very most of the great opportunity offered by digital and perhaps to gain the skills that are necessary for the 21st century.

Q113 The Chairman: Thank you very much indeed. I with start with a pretty broad question to kick us off. Can you help describe for us what you see as the differences between delivering the skills essential to the tech industry and delivering skills that are necessary for broader society and particularly going forwards?

Karen Price: I am going to start by saying that I think it is excellent that you establish the distinction because it is very important. Both skills are equally important to us as a nation and society, and for our economic future. Every company is increasingly becoming a tech company and it needs a digitally capable workforce. I am sure my colleagues have a lot more to say. I think the main difference to recognise is that it is really important that we train people with relevant courses and qualifications. I am not sure we are at the moment and one of the most significant differences is that training people for the tech industry tends to take a lot longer and costs a lot more money—but we should not shirk doing it.

Rachel Neaman: We very much welcome the focus on improving high-end technical skills. However, I think it is important to understand that at the moment there are 9.5 million adults in the UK who lack basic online skills. That is almost one in five adults and of those, just under half are of workforce age—and there is becoming less of a divide between high-end skills and the basic online skills that are required. What we are trying to do is to ensure that everybody reaches their digital potential because by starting with a level playing field in basic online skills it is easier for people to continue to get the skills that they require—Karen emphasised that relevance of the skills to what they are trying to do.

Maggie Philbin: I wonder whether it might be more helpful, when we talk about digital skills, perhaps not to make a sharp differentiation between the needs of the tech industries and
the needs of other industries, and even the needs of digital citizens, because that can sometimes send the wrong message. Every company today should be a digital company and when it comes to messaging, to parents in particular and to teachers, they need to understand that it does not matter whether you work for Network Rail, Ocado, Google, a charity or a tiny SME, you need a level of digital skills. Within those companies, whether it is within an SME or a tech giant like IBM, there are going to be different levels of skills. I think sometimes the best way of looking at this is to ascertain how many people we need with the higher-level skills—we have described them in our report as the digital maker skills—how many people we need to have digital worker skills and then the digital citizen skills that we should all have. That is perhaps a more helpful way of looking at it.

The Chairman: Ms Neaman, the figure of how many people you think do not have presumably both the citizen and the employment skills is the 9.5 million, is it not?

Rachel Neaman: Indeed.

The Chairman: How would you break down the numbers of people in the categories you have just talked about?

Maggie Philbin: We took a look at the ONS data with Chris Mairs who did a breakdown using our criteria—this is very much a broad ballpark figure—and ascertained that if you looked at all the jobs at the moment, we have a digital muggle category that was for people who think all technology happens rather like magic and have absolutely no digital skills at all, which is 2.2 million; digital citizens, 10.8 million; digital workers, 13.6 million; and digital makers, 2.9 million. I think there is a real opportunity for some detailed work here because this is very much a broad ballpark figure. We found it very hard to get exact figures about how many people were actually needed. We believe that is critical because when you are informing parents and students and universities about the kind of courses that should be in place then those figures need to be accurate, otherwise perhaps you are misleading people.

The Chairman: Can we move on to education?

Q114 Lord Giddens: Thanks very much for coming. It seems to me that we live in a slightly dazzling world of the creation of new skills and destruction of old ones and this is probably going to be faster and faster. How are we going to prepare children through the educational system to meet up with such a world when, for example, if you have an apprenticeship that trade can be knocked out overnight? I used to own a company in publishing and that happened; compositors just disappeared within about 10 years. Everyone is doing things through computers. How should we best educate children in the schools and how should we retrain the existing labour force?

If I can add another question: what is it going to do to education itself? It seems to me completely obvious that in 10 to 15 years’ time schools will not look how they look today. They probably will not have the same hierarchy or the same teacher-pupil system. How are we going to do all this bundle of changes?

Karen Price: I think very much involving employers in the design of courses and qualification makes a significant difference. Secondly, I think establishing a strong, relevant foundation rather than training being very occupation-specific is very important to avoid redundancy because we do want to encourage a joy for learning, self-learning and transferable skills—but we are still teaching our young people at the moment common Office applications that are not that relevant. The Committee here this morning is on iPads. I think you are so right
about the transformation of education and we should seize it as an opportunity. With the introduction of the new computing curriculum, there is a lot of talk about how we train the teachers to teach the new curriculum. I think we should be looking at it in a different way. We should be providing them with the resources—and employers have a big role here—so that they can become the facilitators in the classroom, not the traditional font of all knowledge.

The Chairman: What is your experience of employers being involved in that?

Karen Price: It is patchy. There is a huge appetite from employers. They are frustrated by what they see coming out of school, college and university and they see it as a waste of money for the nation and a tragedy for young people and their parents who are investing in very expensive qualifications and education. I think they would like to do it, but to do it at scale is difficult.

Lord Haskel: Sticking with the question of employers, how then do you encourage employers to do this? At the moment a lot of the encouragement is by subsidising low pay, which actually does not do a lot for training people in digital skills.

Karen Price: Sorry, how do you encourage what?

Lord Haskel: How do you encourage employers to get people to adopt digital skills? You said that a lot depends on the employers.

Karen Price: I think there is an absolute business imperative behind it. Employers are at different levels of adopting technology to transform their business but increasingly a lot of companies are recognising that they need to become a digital business to survive and thrive. One of the most critical things they have to do is to take the workforce with them. Many are looking at investing in their workforce but when they look round into the training and development ecosystem it is not meeting their needs: it is off-site, long courses in Office applications when they actually want people to work off tablets and mobiles.

Q115 Baroness O’Cathain: I am really concerned about this because it looks as though there is a great mass of people who are just going to benefit from this and this is fine. But there are still an awful lot of people left out in the cold, and I am surprised by the numbers; I did not think they were as great as you have just indicated. Where is the emphasis being put on this and where are those people being looked after? Should it not come directly from local authorities or the Government?

I am going to tell you of two simple things that came to me last weekend, talking to people about digital skills. The first is that we have a highly contentious bypass problem in West Sussex. We have had it for years, ever since I have been there, which is 30 years, and now they seem to be getting to consultation. In the local rag there was an article this long, just one column, about the consultation on various parts of the bypass—that is fine—but the only way people could get on to the consultation was online. I think that is disgraceful and I am in the course of writing to West Sussex County Council about it, but it really is disgraceful that there is no alternative.

Secondly, a friend of mine wanted to cash some of her Premium Bonds and went to the post office to do this because she bought them there. She cannot cash them there. She has to do it online. She does not have a clue what online means. It is the Government and it is the local authority, and I think what you are doing with employers is great—
The Chairman: I am going to come to Ms Neaman because in a sense that is what you are doing, is it not?

Rachel Neaman: Absolutely. Yes.

The Chairman: Describe the challenge honestly for us. We want to hear the truth as well as the good news, but I know you are trying to work on it.

Rachel Neaman: Of course. It is important to look at the focus that this Government currently has on digital-by-default public services, which is very much what we have just heard described. That is all very well and very good and fine, except if there are 9.5 million adults who cannot access that then we need to be investing equally in skills provision and in access—whether that is looking at the cost of devices or at infrastructure and connectivity, and also at motivation. There are number of people who say, “This is not for me: I do not need this. Why should I do this?” So there is something about making clear to people what the benefits of the internet are for them. The fourth thing that we need to look at as well is people’s concerns around security and staying safe online. Those are all areas that we, at Go ON, are trying to look at but I think what we need is a much more co-ordinated strategy right across the sectors.

The Chairman: From the top.

Rachel Neaman: Absolutely—which joins up those elements, because at the moment it is quite siloed; individual people are looking at those individual elements but actually you cannot have one without the other.

The Chairman: We have heard this very strongly.

Maggie Philbin: I would agree with the point about incentivisation and the thought, “Why should I do this? Whether I am 82 or 52 or whatever age, why do I need to do this?” and helping people to see why they need to do it. This is a massive issue and, again, it needs massive investment. It would be well worth that investment because the cost of not doing it is going to be enormous going forward. It really has to be addressed. Other countries have addressed it.

The Chairman: Where would you suggest, because we are struggling to get good evidence on other countries? We have heard about Israel and Estonia.

Maggie Philbin: I have seen evidence from Norway? Norway has a really good track record, and it is not that there are no old people in Norway or people who have found it difficult but it has been addressed properly.

Q116 Lord Janvrin: In a sense you are talking about culture change, about lifelong learning. What is the experience of looking at Norway? Is it the Government who have led that or is it coming from industry? Who is going to lead culture change of this dimension?

Maggie Philbin: As we have heard, this needs to be a co-ordinated approach and there are a number of initiatives that could probably feed in with sometimes some quite simple ideas, because it is understanding the drivers that get people online. My dad is 87 and he has just managed to track down his great grandmother’s grave in Ireland—and he did that online. That was a real incentive for my dad to do that.

Other things switch on other people. My sister works for an organisation in Leicestershire that has a befriending scheme and she thought for a long time that the thing about the
Go ON UK, Tech Partnership and UK Digital Skills Taskforce and TeenTech CIC – Oral evidence (QQ 113-128)

befriending is that it’s a short term solution. They have 30 people who go out and work with people in the community but they spend an hour with them a week and they leave them in the same state, if you see what I mean, still without friends. She said that the stumbling block to connecting those people is that they cannot see the value of spending, £100 or £200 a year on an internet connection. Perhaps we need this sponsoring because it would make a massive difference locally. So, make it easy, take away the barriers and then, as I say, approach the problem rather differently.

Q117 The Chairman: Ms Neaman, in an earlier evidence session we talked about what was the basic technical package and how much does it cost, because clearly there is a cultural issue—and there is also an infrastructure issue. It would be really useful—and you can write to us afterwards if necessary—to give us what you think is the absolute basic package that enables people to go online and be comfortable with it. Is it a tablet and basic internet and, broadly, what is the cheapest way you can do that? We can have a picture in our heads of what the cost is to then deliver the cultural change for those people where the cost is an issue—and to what extent do you think the cost is an issue? We have had mixed evidence on that, I think.

Rachel Neaman: Yes.

The Chairman: Thank you. That would be really helpful.

Lord Lucas: I want to come back to a point made by Lord Giddens, which is essentially that you can improve education and that improves your supply in 10 years’ time. What can we do about the people who are out there now who would like to change career? What can we do to enable someone who has not considered software as a career and is in their 30s to understand that maybe that is something they can do? How do we open that door? Then to come back to something Karen Price said, how do we get the short courses that will enable someone to give that a real try? What are the obstacles and how do we remove them?

Karen Price: You have almost answered your own question there, if I may say so. I think we need to look very seriously at the role of further education and what our further education colleges can contribute to this. Traditionally, 10 years ago, they were running programmes that were about basic digital literacy. There is less demand for that from the communities now and so they seem to have stepped out of the space. Universities are doing a lot with the high end; you can go and do a three-year degree in computer science and you can become a software engineer. But every business is an online business; every business wants to hire somebody with some online capability who can put together websites, can help with mobile apps and what have you. I think our further education colleges could step into that space; they are well connected in the community.

To cause that to happen I think you need industry-designed and endorsed courses that are relevant so people will have the confidence that if they study and get a certificate in it, at the end of the day it is going to lead to a job. Then you will need to support the FE colleges because they will have to hire in the staff with the capability and set up the courses, but I think that mass market penetration is needed in this space. Lord Lucas’s comments are very pertinent: there is enormous growth here and you do not need to go to university for three years to develop the capability in software to support a business.

The Chairman: That is very clear.
Go ON UK, Tech Partnership and UK Digital Skills Taskforce and TeenTech CIC – Oral evidence (QQ 113-128)

Rachel Neaman: I would like to add to that. We probably need to start thinking and talking about technical and digital skills in a slightly different way. I think a lot of people are put off by the idea that software is highly technical, highly specialised and has a very narrow application; it is a very deep but narrow application. What is important now is for people to understand how digital and technology is permeating every aspect of life. Going back to the point about the culture change, I think it is very important that we start to present these skills, not as a specialist add-on that only a few people are skilled enough to take on but as something much more generic and something that has much more value to all aspects of life.

Maggie Philbin: That is really important, not only for the people gaining those skills but also for UK plc, because it means that you are going to be developing and creating completely different kinds of businesses because you are going to be engaging all of society rather than ignoring the sector not currently online. Technology has the potential to be really democratic and at the moment it is perhaps not democratic because it is only being exploited and capitalised on by a few. We need to change that and we can change that through education at every single level.

Coming back to one point about things that need to change, perhaps it is starting with young people already but that idea that the learning never stops. You do not stop learning, whether it is to GCSE, A-level, whatever level of apprenticeship. The learning has to go on otherwise your learning will become out of date or obsolete. That needs to be built into employers’ thinking as well as with their own workforce so that they put things in place. I wonder whether there is not something—almost like an annual service—that everyone buys into and you check where your digital skills are. All of us could do with improving our digital skills. These things change weekly.

Rachel Neaman: I think that is an extremely important point. The lifetime between new technological developments is getting so much shorter that the idea of setting a curriculum that is going to last five to 10 years in the digital space is clearly no longer feasible.

Q118 Earl of Courtown: It is a great start. You have been talking about training and so on. Having had experience outside this House and managing SMEs employing 20 people, it is really difficult to do it because of the cost and the lost opportunity and lost profit of having somebody away on a course for a couple of days. That could be a loss of £3,000, for example. I am just making that statement. I do not know how this can be improved. Do you have any suggestions for the smaller SMEs who have this great difficulty of training on all aspects but in particular digital skills?

Karen Price: I recognise entirely what you are saying. Even if you go down to Tech City and talk to the small companies there, their instinct is always to hire experienced people. “I need somebody who can do this job on Monday. I will go to eastern Europe to get it because the idea of hiring in somebody and having to train them is something that I do not have the time to do”. Also the training and education system, the ecosystem does not work. Of course, many of the large tech corporates use online blended learning and we certainly need to move into taking much more advantage of that. People talk a lot about MOOCs. I am not proposing that they are any sort of panacea for anything, but we have to somehow incentivise training companies and our FE colleges to offer blended learning solutions that work for the time-poor, cash-poor small company.
Go ON UK, Tech Partnership and UK Digital Skills Taskforce and TeenTech CIC – Oral evidence (QQ 113-128)

The Chairman: We also have to show them the economic benefit of doing it, which I think we are very good at measuring and proving to people.

Q119 Lord Macdonald of Tradeston: The further education sector always seems neglected in comparison with universities or schools. How would you solve that problem? Is it the fact that it is underfunded or that it lacks relevance? Is there a strong vested interest that is resisting change? How do we transform further education?

Karen Price: My colleagues will have views but I have quite strong views in this area. I do not think that FE colleges are at all resistant to stepping into this space and working there. I think the funding system currently works against it. We have a funding system—I know my colleagues feel strongly on this—and we have an enormous adult skills budget here. A lot of it is spent on IT but I am afraid it is the wrong sort of IT. It is qualifications that are 10 years old, very out of date. Of course the offer of colleges is driven by where they can access the funding. The courses and qualifications need repurposing—it is not going to cost us any more money—and then the amount of the adult skills budget that is being spent on it currently can be spent on relevant material that the community and the market need. At the moment they cannot give it away.

Rachel Neaman: I totally agree with that. At the moment the adult skills budget is just over £2 billion and yet some of the qualifications are 10 years old. In terms of the relevance to today’s digital world, those are not going to help us become a digital nation with digital businesses and digital people. We have to face the fact that digital literacy has become really the fourth pillar of literacy. You have reading, writing, arithmetic and digital skills. We need to ensure that from preschool right the way through to adult learning, seniors, over-75s and so on, that that continues to be the way we look at this. It is a basic pillar of education.

Maggie Philbin: For far too long FE has been the Cinderella of education and that needs to change. The colleges sit in the community and are ideally placed to understand the real needs of that community. One of the things that digital also offers is the ability for a business to be positioned anywhere, not necessarily in London or Manchester or Bristol but anywhere. We are only going to do this if we get the skills in those areas. The point was made very clearly and passionately in Plymouth that down there was a real potential to rebirth the career prospects of that part of the UK. So you need to develop the skills base at every level and to some extent keep it local. Also with digital skills, it is important that they are accessible. It feels to me that we have a rather rigid system of education but we need to be able to access training at any age, no matter what your background, gender or whatever, at any time. FE is ideally placed to do that.

The Chairman: Or it is potentially ideal. I want to bring in Lord Aberdare because in a sense we have strayed rather into your question. I do not know whether you want to pick up on some of this but I think what would be useful is to get some granularity about how it should be redesigned. I think you are describing how it should be but it would be very good for us to be very clear what it is that we could recommend about a redesign of FE.

Q120 Lord Aberdare: Thank you. Yes, the question does very much follow on from what we have been talking about. The question is: what does effective digital skills delivery look like? One of the things we have heard—including from you—is that the skills needed are much more generic than specific. They are to do with flexibility and learning to learn and things like that. Another of the things you mentioned is the use of new technologies in passing
those skills, including MOOCs and tablets and what have you. We have heard about an enormous number of very good initiatives that are tackling part of this issue. I suppose the question there is: how do we identify which ones are worth scaling up and how do we scale them up?

**The Chairman:** How do you change the incentives within the FE structure so that it starts to deliver what you are talking about?

**Lord Aberdare:** To pick up some of those techniques.

**Rachel Neaman:** Looking at the skills sector in general, so slightly broader than simply looking at the FE area, as we have already said, there needs to be a much more strategic approach that focuses much less on individual activities and inputs but actually measures the impact of that. At the moment that is something that we are not always as good at as we should be. It is getting some common metrics and common understanding of what good looks like and what success measures we need, then identifying what interventions work, because there are a plethora of interventions out there from face to face, using basic digital as well, digital champions, resources tools—the lot. A lot of money is spent on this but we do not know what exactly works.

**Maggie Philbin:** That is critical. I think many people would welcome having some sort of common set of measurements that people fed honestly into, just to help shape what good ought to look like, because it is very difficult at the moment. Obviously some people do measure but they are not always consistent and they are not always done in the same way.

**The Chairman:** Who could do that? Where would the measurement come from?

**Rachel Neaman:** It is something that we at Go ON UK are looking to do, working with government and partners right across the sectors to try to find what is the right measurement. Some of that is based on work that we have done before to define what basic online skills are. We want to move on a little bit from that now to look at digital potential because simply focusing on basic skills is not going to solve the problem. What we need to do is ensure that everybody has the skills relevant to what they need to do in their society or in their workplace, and some of that will be very high end and some will be quite basic.

**Karen Price:** I want to ensure that we do not lose the focus on the urgent need for developing deeply technical skills as well, if I may. Economic growth is going to flourish if the UK has the talent to be a global leader in data analytics, mobile, e-commerce, cloud, cyber, the opportunities are enormous, and getting ahead of the game—I would include the internet on that as well—in defining what that capability is and building it into courses. I would like to make an enormous plea to try to strengthen the role of apprenticeships in developing that capability.

A revolution has taken place across the tech sector, which has finally decided that apprenticeships are not just for bricklayers. They are finding that they are able to access, train and develop the talent they want much more quickly. Many of the companies are switching their recruitment profile from the traditional graduate entry into taking on apprentices. That is working very well for the big companies. It is working much less well for the small companies because there is not the local affordable provision of training that they need. If you want just one apprenticeship, no trade body is—

**The Chairman:** So it works where you have a big HR department who can organise it all?
Karen Price: If you are taking on 40 or 50. If you want one or two, nobody wants to work with you.

The Chairman: So it is back to Lord Courtown’s point actually.

Karen Price: Yes.

Maggie Philbin: Building a community of SMEs that could work together would certainly be one way forward. I absolutely endorse the strengthening of the apprenticeship programme, because I think there has been an overfocus on a university degree being a passport to the future for everybody. It does not always work like that. Also, an apprenticeship does not necessarily preclude taking a university degree. But for those who are already in the university system, I think it is important that universities should be very much encouraged to have a computing for non-specialists module as part of any degree, no matter what it is, whether you are doing a degree in physics or in geography. It is just so important. It would get so many students off to a head start and make them more employable.

The Chairman: Yes. That is very helpful.

Q121 Baroness Garden of Frognal: My question is very much about what you have been discussing already: how can education in skills delivery be effectively partnered with industry? You have touched on a lot of that. In previous incarnations I have been a teacher and I have worked for an awarding body. I recognise that there are both assessment skills and teaching and learning skills that could be very useful to employers if they are delivered appropriately. I wonder how you see working with teaching, and I very much welcome what Karen has been saying about FE colleges. I think they are an under-utilised resource in many cases. They are often very willing to adapt to local issues. But how do you see those partnerships working with employers to try to raise the profile of digital skills?

Maggie Philbin: There are a number of opportunities. If we look at schools at the moment and look at the access to experiences that broaden the experiences of particular students, I think it is very much weighted in favour of the parents who are able to fix up fantastic work experiences for their own students. It would be very sensible to measure schools on taking a rather more intelligent approach to work experience, whereby they actually looked at students and it was done in a slightly more scientific fashion. For instance, we know that a much lower number of girls will take a work experience opportunity in a STEM company. That is something that you could measure within schools and encourage them to improve the balance.

One of our recommendations was to have a website. It constantly came up at all of the regional meetings we set up for a kind of dating agency, whereby it was much easier for schools and companies to make connections of all kinds, both for work experience and for people coming into the schools. At the moment what happens is that some schools are amazing at getting all sorts of support from companies—they have a raft of companies up on their walls—and others have nothing. This simply is not fair. There are those moments where a student has direct interaction with a company and the company can often be the one who goes, “Actually, do you know what, you would be amazing as a project manager” and no one has ever told the student that. Those kinds of people are very much needed within the whole technology and digital space. It is not just about technical knowledge, and those people within industry are best placed to help students understand their own potential.
Rachel Neaman: There is also something about companies and organisations taking more responsibility in their local communities, to enable schools to produce people with the right skills or to put forward more apprentices and apprenticeships. Role modelling is very important in getting people into schools to demonstrate, “This is what it really means and this is what it means in practice”, again not always focusing down on, “This is a highly technical, specialised thing”. That is critically important but it is not the only thing. So I think role models, working in local communities and companies getting out there and spreading the message is important.

Lord Lucas: I will pick up a point from the last question. Do we need to extend apprenticeships to older people so that we can make it easier? If that is working for the tech sector, would it work for older people who already have established positions in the community and perhaps children to look after and other things that make them a less flexible employee at that sort of level? Secondly, if we need to have much more input from industry on keeping qualifications up to date and making that flexible, how is that best organised? Is that the Tech Partnership and, if so, how does it get funded to do it?

Karen Price: I think apprenticeships for returners in this sector—returners to work or people wanting to enter the workforce—would be an excellent idea. I will not comment on the terminology and whether somebody in mid-life would suddenly want to become an apprentice, although I do think it is starting tonight on the television. The tech sector would welcome and benefit from people who bring business experience and then get trained in technology, because technology is about solving business problems.

The Chairman: Do they know that they would benefit from that?

Karen Price: Yes, they do. In retail quite often they will take somebody from the supermarket floor and train them in technology because they need that knowledge to solve the problem using technology.

To answer your second question, I am a great believer—and I think there is a lot of evidence behind a sectoral approach—that employers will tend to cluster around sectors. That is not saying that it cannot be sectoral and local. I do not think there is this dynamic that if we have that it is either/or; I think it is both. But employers need to come together collectively and take responsibility for supporting and partnering, to ensure that there is an ecosystem of training and education that meets the needs of not only their own employees but everybody else’s employees as well. This needs to be done for the nation and it is an economic imperative. The cost of supporting that needs to be funded centrally from government, but it is miniscule compared to the savings that would be made from what is currently wasted on the wrong sort of training for the wrong sort of skills.

Baroness O’Cathain: I want to go back to something more basic than anything else we have discussed, and that is the kids themselves, the children—well, the teenagers and young adults who are still at school. You ask them, “Are you computer literate?” Of course they say they are and they have iPads and they have tablets. But an analysis that I read about said that young people use tablets and digital skills 65% for networking, 25% for games and the rest is whatever. They think digital skills means social networking and games. So what are you going to do? How can you convince them that their future is actually to get much wider than this?
Maggie Philbin: I think it might be worth saying that by using those social networks, and it being so embedded in them, they are developing certain digital skills. The problem is that often that is not acknowledged and they do not even realise that they have a skill that is valuable to a company that they could take to it. So I think that is worth saying.

We had a lovely day at Buckingham Palace yesterday with the winners of the TeenTech awards. Among them were the winners of the program category. These boys had written 35,000 lines of code for a game, which was very impressive. However, they had been told off by a teacher at their school for mucking about on a computer. So there was that lack of understanding about what they were actually doing and the skills that they were building up. Students do need to be encouraged to see where they can go and also, because of the way that digital skills and the tech industry is positioned sometimes, they do not necessarily see themselves as being part of it. Helping them see that they belong is really important.

Obviously there is a real issue with girls in the tech sector but I am willing to bet that if you did a bit of a survey on the social background of people currently working in, say, Tech City, that might be quite revealing as well, and we need to change that.

Q123 Lord Aberdare: One of the things that comes across to me is the apparently dire state of careers advice and guidance. Do you have any thoughts about what is the right approach? Who should get stuck into this and what is the way to improve it from what appears to be such a low base? You would have thought it should be quite straightforward.

Karen Price: I agree. I think it is absolutely shocking, and traditional careers advice is not working for any sector or for any company at the moment, particularly this one, because it is very difficult for those giving the advice to have any experience of it. I think we should turn this on its head. At times experience of the world of work needs to be the basis of the careers of the future. We absolutely need to revolutionise what experience of the world of work is from a full week in work, a work-shadowing opportunity. I think we could even do an awful lot digitally. We can start sharing it and we should do something transformational there to help young people.

If I may just come back to this digital capability of young people, I think there is enormous raw capability in young people that, unless it is trained up and polished, could cause a business a lot of damage. However, I believe that every business that wants an online presence would benefit from that capability if we could polish it up. If we could introduce that into our school system, where everybody came out being able to explicitly say, “I am coming to work in your restaurant or I am coming to work in your company, but I can also put content on your website and I can help with your social media profile”, that would transform productivity of businesses.

The Chairman: That is very helpful.

Maggie Philbin: It is critical that we help teachers and parents in this space because it is shown that they are massively influential. They are the ones who the teenagers will turn to, so all the inspiration in the world goes to one side if a parent goes, “No, you ought to be a lawyer”. We have to do something to reach the parents and the teachers. In that you get what you measure. I think it does come back to putting something in place to measure the way careers advice is being delivered, the access that students have. It does not matter who is doing the delivery, whether it is teachers or it is coming from companies, but those students do need to have access to it.
At the moment teachers seem to be so focused on getting that number of A to C grades. I am not blaming the teachers. If that was the thing I was measured by, that would be what I was doing, not taking that deeper breath and thinking, “Well, where does this lead?” We had a teacher who came to an event where we had someone talking about 7,000 jobs that were going to be created on the Here East site, talking about the kinds of skills that were going to be needed, the opportunities for start-ups and also people to work or lead these companies. A design and technology teacher came up to me afterwards and said, “I could not see the point of that. Why is that relevant to me?” It was not relevant to her because that is not what she is being measured on, but it should be relevant.

Rachel Neaman: I think there is a lot in how we reframe the debate around all of this because, again going back to the example of kids networking and playing games, that is demonstrating creativity and problem solving and those are the things that are needed in the workplace. There is something about how we change the language around this so that we actually start from the end point: what is it that we want people to achieve? Then having digital skills and using technology is a way to achieve that. It is as valuable to know how to network online as it is to know how to code because you will need that in whatever role you take on.

Q124 Lord Haskel: You emphasise how important it is to form a partnership with industry. How do you get to industry? Do you do it through chambers of commerce, trade organisations, employer organisations, LEPs? What is your experience of trying to get to employers?

The Chairman: That is a very worthwhile question because that is one where we have had a lot of not great evidence in some ways.

Maggie Philbin: Of course I have a marvellous organisation called TeenTech—which I will shamelessly mention at the moment—that forges those connections. But you do raise a very interesting point because there is a level of frustration. I think there is a great willingness on behalf of employers who want to engage with schools. They do not always quite know the best way of doing it. They sometimes have the opposite effect and go in and turn a whole load of young students off because they do not understand how to do it well. There are schools who are dying to engage with local employers and perhaps, because they only reach out to a few who always get asked, do not get them to come. So I think you are absolutely right: it has to be on a very local level that there is an ability to connect so that those connections can be made, and those keen people who want to participate, who want to help shape and enthuse and also, quite frankly, to spot potential talent are able to do so because it does need to be nurtured quite early.

The Chairman: We are going to have to move on because otherwise we will not get through our questions, but anything further that you could contribute afterwards on that particular question would be very helpful to us because it is something that has come up repeatedly.

Q125 Lord Janvrin: I want to take you to a slightly different area, the contribution of the third sector in all of this and whether this is crucial in addressing some of the issues about the excluded 9.5 million, but also—I think, Maggie, this came out in your report—as a way of experimenting with some of the things that we have been talking about. If there is time, could each of you say something about the role of the third sector in addressing some of these issues that we have been discussing?
**Rachel Neaman:** I think that the third sector is unique in being close to the end users. A lot of the interventions that we see from third sector organisations are at local, hyper-local or community level, which is important because without knowing and understanding the specifics of the local community, trying to deliver a “one size fits all” solution is not going to work. So I think that is the unique strength of a lot of these third sector networks.

Going back to the point we made earlier that there does need to be greater investment in a joined-up strategy that enables those organisations to deliver on the ground, based on common metrics, common purpose, common outcomes and a shared understanding of the problems, we do not have a clear enough evidence base yet. We do not have enough stats on exactly who is online and offline, who has basic skills, who does not have basic skills, what the cost to the economy is and so on. We really need to have that.

**The Chairman:** Perhaps I can push you a tiny bit. When you talk about a strategic approach, which you all have, are you talking about that being national or are you saying that we need local digital strategies joining everybody up—or both?

**Rachel Neaman:** I think it has to work at both levels. There absolutely needs to be a national strategy for how to deliver on this agenda and then I think the local organisations need to identify what works for them in their local community, based on the framework that is put in place nationally.

**Maggie Philbin:** What the third sector can do is always be slightly ahead of the curve because it is more agile and it has that ability to start understanding what is coming up on the horizon and then developing programmes that engage young people, so it can help in that way. I absolutely agree that there is a need to have some common form of measurement so that we can understand what is going on. I also think that we need to have a way of understanding who is doing what, and where, because I suspect that there are certain areas of the UK that get a lot of interventions from organisations and others who do not benefit. Understanding that would be very helpful also.

**Karen Price:** There are third sector organisations that are doing absolutely fabulous jobs, and I am sure you have come across many as part of your work with this Committee. We lack a conductor, a co-ordinator. There is confusion in the marketplace; every school is bewildered, employers are bewildered, and we could get so much better value if it could sit within a national framework.

**The Chairman:** That is very clear. Thank you. That is really helpful.

**Maggie Philbin:** One point—and this is just before I forget it—is that time and time again students, schools and employers have said how much they value project-based learning, that helps to deepen digital skills because you are applying your knowledge rather than just being taught the theory or principals. It also develops the other skills that we have mentioned: the leadership qualities, the ability to collaborate, work in a team. We need to make space within the curriculum for this because at the moment teachers are finding time and money and resourcing those projects themselves, and we need to be a little bit cleverer.

Q126 **Lord Haskel:** Perhaps we can move on to the impact on society. We have heard a lot recently about inequality and what that is doing to society. This is due in no small way to the awareness of the benefits of digital skills. What can the Government do to make growth more inclusive by using digital skills?
The Chairman: Clearly, as well as the social impact, we are very aware of the economic impact of the exclusion.

Rachel Neaman: Some of this goes back to what I said earlier about identifying what the barriers are to taking up additional services online. It is about the Government becoming more joined-up in dealing with those barriers. As we said, the infrastructure and the access point are very critical. Skills are absolutely essential: motivation and awareness. The question, “What is in it for me? Why should I do this?” is really important. That goes back to a lot of what we have discussed about how we change how we talk about this so that it becomes a more attractive and much more compelling narrative. Finally, it is the issues around security and safety that put a lot of people off. So I think we need a much more co-ordinated digital strategy looking at all of those bits rather than looking at them individually.

Alongside that, the third sector and private sector can also do an awful lot to support all of those areas. We work with a lot of partners in all sectors to deliver those sorts of interventions in regional areas. It is not just for government or the third sector or the private sector to do it; we need that joint investment. We need everyone to understand what their role is in it and to work together collectively and in a co-ordinated fashion.

Q127 Lord Kirkwood of Kirkhope: Perhaps I can follow up on that. Your evidence is very welcome and very compelling about all the potential, but we are hearing evidence that there are some real risks about your one-in-five disconnected individuals, and it is getting worse because they are more deeply left behind and there are more of them because they do not have internet access. It is a foreseeable risk and it is a worrying risk. If you think about the next five years from a political point of view, austerity is everywhere and it is going to be very hard to fight to win funds to do any of this stuff. If I gave you £100 of public money to spend on the digital agenda, what percentage of that £100 would you spend on dealing with disadvantage?

Rachel Neaman: That is an interesting point. I firmly believe that digital is an equaliser and not a divider and that it should be a democratising agent for all sorts of reasons, but at the moment it simply is not. We need to invest in that baseline to reduce the number of 9.5 million adults who lack basic online skills so that we can start to invest in a lot of the higher-end activities that we have talked about, but until we really crack those people who are excluded and are left out—

Lord Kirkwood of Kirkhope: I will ask the question another way. What is your manifesto bullet point for the political parties in the May election next year to deal with digital exclusion?

The Chairman: You are asking Lord Macdonald’s question, but that is fine.

Lord Kirkwood of Kirkhope: Am I? He has a more strategic general question. This is about exclusion.

The Chairman: That is fine. Actually, why do you not come in on it now and then you can answer it all together?

Q128 Lord Macdonald of Tradeston: I think a hard-nosed Government would say that improving competitiveness is the first-order issue; whether it is dealt with equally in the fallout from that is a second-order issue. So if you had to say to the Government, “Here is what you do to improve your competitiveness through improvement of digital skills”, what
Go ON UK, Tech Partnership and UK Digital Skills Taskforce and TeenTech CIC – Oral evidence (QQ 113-128)

would that single suggestion be? And perhaps, Lord Kirkwood, you could persuade them to put it in the manifesto.

**The Chairman:** Or if you want, since we have asked you two questions, you can give us one and a half answers each. Who wants to kick off?

**Karen Price:** I will kick off. I do not have a lot of expertise in digital inclusion but I have been to visit transformational projects locally on the ground that have made such a difference, and I think we ought to find the best of those and try to scale it. It is not as expensive as you think. If you go to India they just put the kit in the hands of the people and it is transforming lives without teaching and skills and what have you.

On the manifesto point, I realise I have sat here for a whole hour and I have not droned on about the gender divide. I have not had that opportunity but, believe me, it is very important: 16% of the tech workforce is female. That is a national tragedy. But my election point is—

**The Chairman:** Do not worry; we are on that gender point.

**Karen Price:** I will write in.

**The Chairman:** That is fine. We have had lots of evidence and we are having another session on that, but do not worry, we will not forget that. So you have a chance for your other point.

**Karen Price:** My suggestion is that we commission an employer-led review of public spending on education and training in the IT space or the digital space, at school, college and university and across the publicly funded private training providers. The objective would be to improve the relevance of what is on offer. Are the courses and qualifications relevant and do they remove the duplication and enormous waste that is going on? People are being trained in the wrong things or the same things twice. We should try to reduce the fragmentation and get some sort of national framework in place. Then I would come up with a series of certificates that individuals can gain, at school, college, university and in the workplace, so that employers know exactly what they are getting when they hire somebody from school, college or university. They know what they can do in this online world and where they can make best use of that talent. They also know where to train the people who are already on their payroll. If they, as a company, want to go digital or if an individual says, “I see a further career opportunity for me by acquiring digital skills”, they know where to go.

**The Chairman:** Yes, very helpful. Thank you very much indeed.

**Rachel Neaman:** I completely endorse everything that Karen has said and I think she has put it extremely accurately and clearly. I am not sure that the rest of us can add to that, but I still want to say that I think a key role for government is to facilitate this joined-up strategy and to focus on that. If they are promoting the digital-by-default way of working and way of living, they should ensure that inclusion is included within that properly.

**The Chairman:** Thank you very much indeed.

**Maggie Philbin:** There are some very compelling figures that show why it is worthwhile investing in this and why it is so important, leaving aside the massive social value that it would ensure. Perhaps making that very clear in the press so that people understand why an investment is being made would be very important. There are some fairly simple things that can be done. I still do not quite understand why we do not share our wi-fi more so that
people do not have to pay huge amounts. Why can we not do that and just make it easier? Things do not necessarily have to be expensive, but I think it does have to be addressed.

The Chairman: Thank you very much indeed. That has been an incredibly useful session this morning. Thank you very much.
Q210  The Chairman: Thank you so much for agreeing to come and share your thoughts with us this morning. We were particularly keen, as you could see, to have an evidence session with a focus on how on earth we raise the involvement of women in the sector from the age dot through to pension age. We are also acutely aware that, as well as being very eminent women, you are both very eminent across the piece, so we will not stick exclusively to the issue of gender, but we are very concerned. We have lots of evidence about the difficulties of women’s involvement in the sector, from girls at school onwards. One of the things we are anxious to do is quantify what the change in the economy would be if we could shift the dial on that and, secondly, some practical ideas for how things could be changed. That is just by way of context about this morning’s session. Thank you very much indeed.
Just a bit of housekeeping first. You have a list of interests that have been declared by the Committee. They were declared orally at the early sessions in July. This is a formal evidence-taking session of the Committee and a full note will be taken. It will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you will be able to revise any minor errors. This session is on the record, it is being webcast live and will be subsequently accessible via the parliamentary website. You are very welcome to submit supplementary evidence after the session. Indeed, we may specifically ask you to do so on some issues. I am asked to remind you to speak up, and indeed all of us to speak up, although the acoustics are not bad in here actually.

I will start by asking you to introduce yourselves, and if you wish to make any opening remarks please do so but do not feel you have to. On some of the questions, clearly one of you may want to talk more than the other. That is completely fine. It is not a competition. If you want to chip in with each other, that is fine by us. We just want to get the information that we want to get this morning. Professor Hall, shall we start with you?

**Professor Dame Wendy Hall:** I am a professor of computer science at the University of Southampton, and for the last 15 years I have been working on the area of Web Science, studying the web. I knew Tim Berners-Lee before the web—we were working on hypermedia systems—and I have been involved with multimedia and hypermedia systems since the 1980s.

I will just say one thing. I have not prepared an opening statement—I think we are better having a discussion—but I wrote my first paper on the lack of women in computer science in 1987. That is a long time ago. I was a young junior lecturer and I realised that I was going into the October registration period and we had three years of computer science students and no women at all to teach, and really it has not got any better. At Southampton we are one of the top computer science departments in the country, and if we have 10% women on our courses that is good, and a lot of those will be from overseas. In some ways it has got worse rather than better in the area of tech, from my long perspective on this. I have worked tirelessly to try to change it, but if I knew any wonderful answers I would tell you.

**The Chairman:** Well, that is a cheering start.

**Baroness Shields:** Thank you, Lord Chairman. Like Dame Wendy Hall, I started my career 30 years ago in technology. In fact my first job, believe it or not, was as a product manager, designing chips that made analogue machines digital, so it has been a long road for me as well. My career has been primarily in product development and technology, but then eventually in executive positions with the companies that you all recognise, the Googles and Facebooks of the world. I have seen the transition of our world, our culture, our economy, who we are, how we live our lives and interact with each other, from the very early days all the way until now. Hopefully that perspective from the consumer side and from a society and culture perspective has fed into the work that I have been doing as the adviser to the Prime Minister on the digital economy.

Like Wendy, I remember there were three girls out of 500 in my computer science class in 1980 and it was daunting. I do feel that those figures have not improved anywhere near to the level that we expected. I expected pluralism to happen and that we would all be sharing it. The one thing I will say is that in developing products, the teams that I have been on that were gender-balanced were the most successful teams of all. It is absolutely essential, all the way through the product development cycle to society as a whole, that we somehow break
down these barriers. I am sure Wendy feels the same. There are optimistic signs, and I believe there are ways in which we can do this. I thank you for inviting us here and look forward to answering your questions.

Q211 The Chairman: Thank you very much indeed. If I can start with a pretty broad-brush question: can you help define for us the importance of the digital sector in the wider sense to UK competitiveness? To what extent can we define what the economic impact would be on the UK if more women entered the IT sector in the broader sense and were equally skilled as men? How would this shift UK GDP and global competitiveness?

Baroness Shields: Thank you, Lord Chairman. As we have come out of this difficult double-dip recession, if you cut the data in a way that no one is really talking about, you look at them in the sense not of how many jobs have been created but of where those jobs have been created. Government has primarily contracted, and big business, if you look at the FTSE 250 or the Fortune 100 in the US, has also contracted. The real catalyst to growth has been the entrepreneur-led businesses. In fact, those scale-up businesses have been the biggest contributors to the economy during this period and have pulled us out into growth. Many of those businesses are tech and digital businesses, so it is absolutely essential that we nurture and create the environment for those companies to flourish. If you just look at London, 27% of all job growth during the three-year period from 2010 to December 2013 has come from tech and digital businesses. If you took that out of the equation, we would not have recovered, so it is that essential to what is going on.

I see the green shoots everywhere. Two weeks ago I went up to Sheffield with the Deputy Prime Minister and we launched something called TechNorth. One of the most important things that we have to do is look at these green shoots of growth all across the country, and we in government have identified 13 clusters. There are many, many more. A Government cannot create a technology cluster, but what we can do is recognise the unique strengths of each of these cities, their great universities and how industry, universities and the cities all come together and how we can help them flourish. What are the conditions we can create? Everything from the R&D tax credit to the Patent Box, which is an absolutely brilliant concept, are things that allow more money to come in and give people the comfort that they should take the conviction of their ideas all the way forward and invest their time and energy in building businesses from the ground up.

Q212 The Chairman: It is really interesting that you raise that, because we had evidence from one of your colleagues about it. One of the things that we were trying to probe was what the constructive role is for government. Last week we were talking about the example of logistics in Sheffield. Here is a great opportunity to have a modern version of what they have done before and look at the logistics space: how can that be digitalised? What do you think the role of government is in making that happen? Rather than just saying, “Here you are. This is great. This is an opportunity for you”, how does government then make the partners come together properly and make sure the right research funding goes in and all the rest of it?

Baroness Shields: I think the most important thing is to listen to the people on the ground. If I look at the defining factor of success in the last four years that I have been involved with Tech City, I would say it is listening to the people and asking them what they need specifically and then prioritising those. Oftentimes we react to anecdotal evidence. Wendy is...
a scientist. You absolutely have to have an evidence base, but informing that evidence base and validating the assumptions through direct contact with people in these clusters has really made the difference.

We host these things called Tech City breakfasts. We bring people in from all over the country and we hear about the primary thing that is holding them back. Is it finding talent or access to talent? Is it, “My people, my team, cannot get here fast enough in the morning because there is too much construction on the M1.”? I do not know what it is, but it is identifying those things and then prioritising them that is the responsibility of government.

In many respects it has been more ad hoc than it should be, and part of the digital advisory committee that I am working on right now is taking all those initiatives and putting an evidence base behind them and then trying to prioritise and make the correct decisions, based on what is needed right now, and then a long-term vision in what we can do in the future.

The Chairman: That is really helpful, thank you. Professor Hall.

Professor Dame Wendy Hall: To add to that, I would like to make a point about the skills gap that we see. Our students are snapped up before they have finished their degrees. Many of our students start their own businesses, and that does not get reported properly in the statistics.

The Chairman: Is that why we are told there is quite high unemployment? We were puzzled by that.

Professor Dame Wendy Hall: I was going to come to that. Our evidence is that our students are absolutely snapped up and the companies come back to us for more. They particularly say, “We are looking for women”, and we do not have any. We have a handful of them. Last year in the statistics that were released by HESA, computer sciences comes bottom of the employability list, and that is really negative press. When you dig under, you find that a lot of different types of courses are classed under computer science. You have to dig to see which are the ones like those in the top CS departments; some of the new universities teach wonderful computer science. I still call them “new”, the non-Russell Group. You will get IT lumped in with all sorts of different things under computer science, and they are not necessarily the ones that we need. We need to make people employable, and that is bad press.

I was going to make the point that I travel a lot and go into universities and lecture to computer science students all around the world. When I go to the Far East, Singapore, Malaysia or India, the classrooms are more than half full of women. When I talk to the students, the CS classes are bursting, because in their culture they see this as a career that will earn them a lot of money and get them a job. I walked into a classroom of computer science at the University of Qatar that was 90% women. Then I realised that that was largely because the men were being educated overseas and the women could not go overseas, so you have to dig beneath the statistics. When I talk to the girls in India, some of them say, “My parents want me to do computer science because I will meet the right husband”. There are all these sorts of things underneath it, but it is still wonderful to go into a culture where they see these types of skills as absolutely top. They are probably more popular than law or medicine. That is our problem. We have this big culture thing that this is a geeky thing to do and, “It is not going to get me a job”. We have to shift that culture.
The Chairman: You think that with the concern about employment, they do not understand that it—

Professor Dame Wendy Hall: It is just making our issue worse. It is making it harder for us to recruit good students on to computer science courses.

Q213 Baroness Garden of Frognal: I think you have partly answered the question I was going to ask, which was: where should the Government focus efforts in order to grow the UK’s economy and support the digital sector? You have already suggested the tech cities and the hubs and entrepreneurs and so on. Are there other ways or places where you feel the Government should concentrate efforts and perhaps also comment on the Government’s role in improving female contribution in this area, because we have identified the lack? I realise, Professor Hall, that you have suggested that any bright ideas you would have had would have come out already, but I am just asking.

Professor Dame Wendy Hall: I have some. If I had a really amazing answer I would give it to you, but I do not. I do have some positive things I want to say, but do you want to take that question first Baroness Shields?

Baroness Shields: Yes, sure. There are many areas of technology that we, the UK, can lead the world in. We have a strong concentration in big data. In fact, Wendy is leaving this Committee hearing and heading over to the Open Data Institute for a speech there. We are leading the world to open data sets and what that will enable for the economy: artificial intelligence, machine learning. There are a lot of areas in other things, such as FinTech. Our financial technology sector is bigger than New York at this point. More investment is going in than is going in in New York, and we lead the rest of Europe by a long shot. There are more data scientists in the UK than there are in France and Germany combined. That is pretty exciting. We have so many strengths.

The question is how you pull those strengths out and nurture them somehow. You find that these clusters naturally gravitate towards their skillsets. The University of Southampton has incredible skills, and people come out of there and start businesses that relate to what they have studied and then a cluster forms around that. You know that you have access to talent in that university, and that happens organically without the overseeing of any institution or organisation.

Professor Dame Wendy Hall: The most important thing for me is that the Government should be consistent in their approach. We have both been at this game for a long time and in the UK I have seen campaigns come and go—mostly go—and they leave no legacy. There is no memory of what has happened. There are new things happening now: there is your Committee on Digital Skills, the DCMS Taskforce on Digital Skills, a new BIS initiative—what is it called, My Life?

Baroness Shields: Your Life. Yes.

Professor Dame Wendy Hall: Your Life. There is a huge issue. I was just reading in the Times at the airport this morning about the new virtual identity that is coming in. We, sitting in this room, might understand it. We probably understand it—I do not know how many of you understand what having a virtual identity means—but most people out there are not going to understand it. They need to have the skills, and it is more about digital literacy than digital skills. We need a mix. We do need people like extreme programmers. If you watch “The IT Crowd”, we teach a lot of guys like that. Computer science attracts guys who cannot talk to
people but they can talk to machines. There are girls who work in that world and do extreme programming, and we need more of them.

**The Chairman:** Extreme programming; we have not heard that. It is great. Sorry, go on.

**Professor Dame Wendy Hall:** Stanford, for example, say that is what they teach in computer science at Stanford, and they feed Google. That is what they want, extreme programmers, and we need those skills as well.

Everybody in the country needs some level of digital literacy, and I totally applaud what is happening at the moment with the changing of the curriculum. We are talking about reintroducing programming back into primary school and teaching those skills through. In the long run, that will hugely help. Not everybody needs to be a programmer but everybody needs to have digital literacy skills, and I think the Government have to be consistent in putting it in place. It is about teacher training, educating the parents as well, educating employers, but it has to be consistent instead of this start-stop mechanism that we have at the moment of fund something, fund a campaign for three to four years, then the money goes away and everybody has to start again. I was talking to the people at BIS starting Your Life. Is that the right name?

**Baroness Shields:** Yes. That is what it is.

**Professor Dame Wendy Hall:** I cannot get that name in my head. There are very hungry young researchers who are looking into what to do. They have no memory at all of what has happened in the past, what has worked, what has not worked.

**Baroness Shields:** They almost reinvent the same programmes.

**Professor Dame Wendy Hall:** They reinvent. They call me up and say, “Why are there no women in science and technology?” Oh dear, I want to say. Do some research. Look at all the things that have gone in the past and look at what has worked and what has not. But we do not leave any footprints in the sand, and I think the most important message for government is consistency and legacy to make sure these things build on what has gone before.

**Baroness Shields:** I would add that the road is paved with good intentions in this area. Again, people are almost reinventing the same programmes. What is interesting right now is that the conversation is happening all over the world.

A book came out recently by Peter Thiel, one of the most prolific investors in Silicon Valley, called *Zero to One*. Inside his book he talks about how everybody is creative when they are young. All kids are innovative; they are all special in their own way. Over time the institutions of school beat it out of them and they become less and less innovative. In fact, he said it is no coincidence that the most successful people in Silicon Valley are on the Asperger’s spectrum, because they were the people who did not care what people thought about their ideas so they pursued them anyway. It is a really fascinating view into what is happening, because if you ask seven or eight year-olds, “How many of you are artists?”, they will all raise their hands. I forget who said this; I did not say this. Someone said this, and I thought it was a fascinating comment. If you asked 13 year-olds, “How many of you are artists?”, they all go, “Not me”. By then they have lost their will to try because they are so worried about taking exams and delivering that A result.

I have a 15 year-old son. We went away on a break and he said something profound to me, and I think it is important to everybody here. He said, “When I was young, all I ever talked
about was time travel. I wanted to come back to this point in time”. He was fascinated with Einstein and he had all these ideas. He said, “Now, Mum, I am just trying to get from one day to the next”. I think that is so profound. That is the strongest thing. As a mother, your heart hurts.

To be in this area, in this field, and to feel that, we have to do something. We have to flip this around. We have to make it about ideas, creativity and innovation and less about the structure. The reason Google do so well is because one day of the week, or a certain part, 20% of your time, of your day, is spent thinking. If we just gave our kids 20% of time to be creative, what would happen? You cannot even imagine what we would create.

**The Chairman:** I would love to have you two here when we have the government Ministers, actually.

**Professor Dame Wendy Hall:** Can I riff off of that, please?

**The Chairman:** Yes. I have two members of the Committee wanting to come in as well, but carry on.

**Professor Dame Wendy Hall:** My passion at the moment is what we call web science, which is about studying the way the web has evolved. We founded this new science with Sir Tim Berners-Lee and Sir Nigel Shadbolt.

Web Science is built on the idea that the web is a technology, but it grows because we put content on it. We, the people, everybody, and women probably more than men but certainly as much as men, use the internet. We are great communicators and we love the social networks, and we are great users in a way that we did not used to be. In the 1980s, when the first personal computers came out they were sold as toys for the boys because there was very little to do on them except assembly language programming and playing war games, and that is when it all started to go wrong.

Women love this technology, they love using it, but they are not involved in developing it. In the web science area, we study it from a sociotechnical point of view, so it is not just about technology. We look at it from the social science, psychology and economic perspectives, so at least 50% of our class on that are women because they enjoy that aspect of it. It is not about extreme programming. It is possible to do that and get real interest.

The other thing I will say is that all the research shows that in primary school the girls will work with the boys on technology until adolescence. It all goes wrong around about 12 to 13 in mixed education, where they suddenly do not want to be seen to be doing things that are not feminine.

**Q214 Lord Lucas:** One great resource of women who might get involved in technology are those who are returning after looking after children. What can be done to encourage them to look at something that they never learnt when they were in school and to get to the point where they know that this is something they might be good at?

**Baroness Shields:** You are absolutely right. Sometimes they stay out of the workforce for three to five years. Three to five years is a lifetime in this world. If you have a gap that large, you will come back without the skills that you need, and that is a very big issue. Then it is discouraging, so it is a self-fulfilling prophecy. You pull back; you do not put yourself forward any more. You feel like you cannot contribute or be on that path.
I think what is missing is thinking about this as you are going to have to in the future: dip into learning all along your life. There are going to be times when we all need to retrain on something, so we need to create a facility for people to dip in and out of learning.

One of the things that we are doing right now at Tech City is creating a digital business academy, and this is perfect for women returning to the workforce. If you know you are going back in six months, you can work on this MOOC and you can start learning the things that you will need and the skills that you will need to go back in. We are working with the Judge Business School at Cambridge and UCL to pull this coursework together and make it open to any university, Codeacademy and other coding organisations.

It teaches you a couple of things. First, it is not focused on coding, because there are a lot of really good MOOCs on coding. It is focused on digital skills, how to operate in this world, and business skills. The other thing is that we always compare ourselves to the US, but in many ways we do not need to look over our shoulder to the US for inspiration because we have all that inspiration here and all the great ideas here. What the US does differently is that it has four years of university and in that fourth year you become a well-rounded person. You take business courses. Even if you are a computer science graduate, you learn other things, and you learn additional skills that augment and make you that much more prepared for the workforce. That is one of the things that is missing at the outset, but later on it is about flipping people’s mentality around and saying that everyone needs to retrain—retraining is something that we are all going to have to do—and about opening up those possibilities. The digital business academy is just one way of doing that.

Lord Janvrin: I hope this question is not at a tangent, but it picks up on what you were saying earlier about creativity. It comes back to a question we had in an earlier session about whether you can teach creativity and innovation. How do we do that? How do you stimulate people to get excited by that into their teens and throughout life?

Professor Dame Wendy Hall: It is hard to teach innovation. I think you have to be almost immersed in it, I would say. I love the idea of the academy. I think incubators are good. We are exploring this at Southampton, and other universities are as well. Our students do a lot of project work and we encourage them to think about how they would start a business and teach them those skills. We get people in from industry, and the people who have done the start-ups come and talk to them. In an incubator they can work in groups and think about starting businesses with help from people, just to learn the language. Many computer science degree courses will do some sort of project work that involves developing something that could be a product and thinking about how you would take that to market. I am talking university level here, but I think you have to do it. It is very hard to stand up and teach innovation.

Lord Janvrin: What is it?

Professor Dame Wendy Hall: Exactly. I was going to say something, if I may, following on from the question about woman returners. Sue Black, who is a force of nature—I do not know if she has given evidence—has started something called Techmums. Research shows that girls are influenced mostly by their parents and if their mothers are frightened of the technology and do not use it very much, that will put the girls off trying to follow a career in it. The idea is that we help the mums to get back. That does not mean they are going to have a career in this area but just to get them into the digital literacy-type programmes.
**The Chairman:** It is like English as a second language, in a way, is it not? It is focusing on the mum.

**Professor Dame Wendy Hall:** Absolutely. The whole point is that at the end of it they might well, of course, be able to go into the workforce in this sort of area if, as Joanna said, they have the confidence. It is a lifetime to be out for the time that you have your family and then try to come back. The technology has moved on so much.

**Q215 Lord Giddens:** Good morning. You might be able to answer this question. I am a social scientist and economist and this seems to me to be the biggest period of technological change ever, partly because it is global. It involves the creation of new skills, certainly, but also the constant destruction of old ones, and this can happen almost overnight, even in very skilled trades. It has happened many times already. My question is: how do we prepare ourselves? How do we future-proof the economy in order to ride this wave of change? It is likely to get greater rather than less, as far as I can see.

A supplementary question, in case you do not want to answer that. You mentioned that we should not look over our shoulders at America, but to me it is always important to look for best practice elsewhere. Is there another country like Norway, somewhere that has done so much for women, where women do better in relation to the digital economy? Where should we look for best practice? I do not think we should be too isolationist about it.

**The Chairman:** You have asked two questions, but that is fine.

**Lord Giddens:** The second was in case you did not want to answer the first.

**Professor Dame Wendy Hall:** I am going to go for the second question because I half-answered it before. I look to south-east Asia, not America. Of course you have Silicon Valley, but there are quite a lot of problems in Silicon Valley to do with gender.

**Baroness Shields:** Definitely.

**Professor Dame Wendy Hall:** There are a lot of problems with woman developers going to conferences and not having very happy experiences, and a lot of potential bullying and intimidation of women, in Silicon Valley. I might be wrong, but a lot of the entrepreneurs are geeky-type men, as you said earlier. There is a problem in that little bubble. Silicon Valley is a bubble, by the way, and most of my colleagues in America report the same. I was president of an American-based computer society and we had exactly the same issues with the lack of women in computing. I am looking for my research, and I look to the experience of the culture of south-east Asia for encouraging women into this area.

**Baroness Shields:** I will take on the future-proofing. I love the idea that we can future-proof the economy, but the minute you future-proof it in your mind, everything changes again. As you said about the changes happening at scale, this is exponential. It is really hard even to get your head around what is happening, and sometimes it is too late. I grew up in an area of the US where Kodak was the primary employer, and then I was at Facebook three years ago when we bought Instagram and Kodak declared bankruptcy the same month. Kodak was the major employer where I grew up, and you knew that if you worked hard you could get a job there and work there the rest of your life. I think this is happening across every industry that we know. In fact, we are talking about education. Education is being disrupted as much as other industries, and it is hard to stay ahead of that.
Lord Giddens: MOOCs are an example of that, possibly for the future. They could undermine campus-based universities. No one really knows at the moment.

Professor Dame Wendy Hall: I think that will be a real issue for universities. You are a social scientist. Sorry, Baroness Shields, do you mind me picking this up?

Baroness Shields: Not at all.

Professor Dame Wendy Hall: There is the whole issue of whether students need to be on a campus. For 18 year-olds coming out of school and going into university, the socialising at university is very much part of their growing up, but a lot of people are studying at a distance and using the technology that MOOCs are built on. Of course, MOOCs are free, so they do not give you a qualification. They are a means to an end, not an end in themselves. What comes beyond MOOCs, when we start charging for online courses that look really sexy and we can basically sell them to anybody in the world, will change the nature of universities, I think. All our universities will have to become global as a result. That is possibly another issue.

Baroness Shields: I think you will see the merging of the entertainment industry with education, because the production values have to be as interesting as when you sit down and watch a film or a documentary.

Professor Dame Wendy Hall: Absolutely, yes.

Baroness Shields: I think we are going to see a lot of change.

Professor Dame Wendy Hall: We will all have to sing.

Baroness Shields: Oh god, we are in trouble then, Wendy. Maybe you are good at singing; I am definitely not.

The only thing I would say is that ideas flourish when people have human contact, which is why I love the idea of the clusters and people coming together. The best way to make a MOOC successful is to keep people excited about it, because a lot of people drop off. The last I heard, only 8% of people finish it.

Professor Dame Wendy Hall: That is okay.

Baroness Shields: No, that is okay too. Yes, you are right. At the same time, it would be good if you could add a little human contact, as if we were all going through these courses together. Stanford University has something called a startup school right now, and if you have not seen it, have a look at it. Every week they release a course with an expert in the field who teaches that course: everything from how to raise financing to how to market your products on the web—all the various things that you can learn. The great thing about it is that the community that is talking about it. You have to encourage that idea-sharing otherwise the learning experience is not as strong.

Professor Dame Wendy Hall: I have a great story about that. Southampton is part of FutureLearn, the UK MOOC platform. Our first one was about web science, so it starred Nigel Shadbolt and me. Nigel and I started the week and ended the week, and then we had breakfast with Susan Halford and Les Carr every day, so it was a bit like entertainment. Thirteen thousand people registered and 2,000 finished it. They were from all over the world.

Baroness Shields: That is a lot.
**Professor Dame Wendy Hall:** That is a lot of people. Suddenly they know what we are doing. They know about Southampton, they know what we are teaching and they know something about web science. Then I was in India and I gave a talk about web science, and this chap came up to me and said, “My wife did your MOOC”. This is in Bangalore in India. I said, “That is amazing”, and he said, “Yes, and she used the social networks. She got involved with people, chatting”. You use the social networks to do the tutoring on the MOOCs, and they self-tutor. PhD students also do the tutoring. He said that she met people on the social networks and they started meeting in McDonald’s in Bangalore to talk about the MOOC. It is a whole different world.

**The Chairman:** I am going to move us back specifically to girls’ education at this point, because we do want to get underneath this a bit.

**Q216 Lord Holmes of Richmond:** Good morning. Just slightly continuing your idea of education and entertainment, when I was at Cambridge, having been lucky enough to be lectured by Lord Giddens, I can say that his performance was equal to any Hollywood blockbuster.

Currently around 4,000 students do A-level computer science. Only 100 of those are girls. How do we get more girls doing STEM in primary and secondary education, particularly in your area of higher and further education?

**Professor Dame Wendy Hall:** I will pick up that one first, because I saw that statistic in the questions. There are several factors to this. One is that many universities do not require a computer science A-level to study computer science. That is partly because we have not had the teaching in the schools, and that will change now that the curriculum is changing. Also because the curriculum is changing, more people will be interested in studying it. It will become a better A-level because they will have learnt a lot of the basic skills earlier and they will be less intimidated, maybe, by doing a whole A-level. Largely, A-level computer science attracts the guys who do this for a hobby anyway at the moment. That is basically who it attracts.

The other thing is what I said before: that we need the Government’s help to unpick the statistics that say computer science is the least employable degree to do, because that just sends such a wrong message. Why would I want to do a computer science degree if it is the least employable in that long table of employability?

**The Chairman:** Perhaps the Government could be showing the enormous gaps, the number of vacancies, that there are.

**Professor Dame Wendy Hall:** The gaps, yes, and highlight the types of courses where employability is way into the 90 per cents.

**Baroness Shields:** As Wendy said, though, you have to look beyond those statistics. It is slightly irresponsible for the media to perpetuate these myths. It is a myth, really. If you look beyond it and you understand, this is super frustrating because we are a myopic society led by media and we react to media. I say this all the time. We have to get out there and be more proactive about the facts and myth-busting, because it is damaging our potential and affecting competitiveness.

The other thing I wanted to say is that last summer I felt that I did not know enough about the world of computing, so I took a bunch of courses. I decided that I was going to learn to
code again. It was the greatest thing I have done, and I have not really touched it much since then; you get a little bit busy. What I understood that is different today than when I studied computer science is that the premium, the thing that matters most, is your creativity and your ideas, because a lot of the code is off the shelf. There are modules that do this, that and the other thing, and you can bring them out, mix them all up and put them all together, and the secret sauce is your idea.

If we can get that concept out to women, I think you would see a lot more women go, “Okay, I get that, because I have the ideas and I am really good at thinking these things through”. People still think you are going to sit in a dark room and write lines of code that have a small impact on a much bigger thing, but you can create a product on a Saturday, in code, yourself, and I think that that mental flip will change everything.

**Professor Dame Wendy Hall:** The work with Raspberry Pi so far, although the evidence is not clear, is attracting girls as well as boys to play with them.

**Baroness Shields:** And showing them how to build stuff. Once you see that, you get kind of excited—“I can build a product from start to finish”—and that is really encouraging.

**Lord Holmes of Richmond:** What about the importance of role models as well, to ensure that successful women in this space are out there and people can say, “I could do that. There are role models.”? The importance of role models in anything cannot be overstated.

**Professor Dame Wendy Hall:** That is a hard one. Because there are so few of us, we get asked to do everything.

**Lord Holmes of Richmond:** You are sleeping too much.

**Baroness Shields:** I think people might get tired of us.

**Professor Dame Wendy Hall:** I just got off a plane from New York. I have come here, I am going to the Royal Society after this to chair a diversity event with Julia Higgins, then I am going to the ODI, and I will get home about midnight tonight. I am constantly asked to go out into schools, but I can only do so much, and the trouble is it really does not scale.

**The Chairman:** It is a media issue that you are describing: that somehow we have to find a way of explaining this world in a different way.

**Professor Dame Wendy Hall:** Yes, we are role models, but your average 16 year-old is not going to want to look at someone like me and say, “I am going to be like her”. I am far too old for a 16 year-old to think, “I want to be like her”. When we do our careers fairs, we get the employers to come and they always bring back the girls who have just gone out into the workforce, because they are the best.

**Baroness Shields:** I am older than the mums of most people I employ now, which is really strange. Oh well. We are still going at it.

**The Chairman:** Yes, you had better keep going.

**Lord Macdonald of Tradeston:** I do not want to argue that going to university should just be about improving your employability, but when you talk about a lot of these courses being lumped into a statistic that shows that they come at the bottom of the league table, does that not imply that academia is encouraging a lot of courses that are not providing value for money and that it is about time you were a bit more radical in the universities about clearing out the old stuff to make way for the new?
Professor Dame Wendy Hall and Baroness Shields – Oral evidence (QQ 210-220)

Professor Dame Wendy Hall: Yes. I do not want to point to any particular university; it is up to them to sort it out. I do think that we have to unpick these statistics, because if our students are 90-something per cent employable, there are some universities doing courses where the students are only 20% employable if the average is low. You may say that; I could not possibly comment.

The Chairman: This question about the funding of such courses is for us to bank for when we have Ministers as witnesses as well.

Professor Dame Wendy Hall: Of course, nowadays the students fund it themselves. They pay to go on it but they do not end up getting a job. We require maths. We like physics but we require a good maths A-level.

The Chairman: And not all do.

Professor Dame Wendy Hall: We teach computer science as an engineering subject. We definitely like maths and we like physics as well, if they have it, but we do not make that compulsory for computer science. It is for electronics.

Q217 Lord Aberdare: This very much picks up on what we have already been talking about, so I will try to give it a slightly different dimension. We have heard that some of the major problems include lack of awareness of the opportunities in this sector and what is described here as “patchy” careers guidance. I think that is extremely overpolite. Professor Hall, you said that in south-east Asia a lot of the girls see computer science as a career that can earn them money and get a job. Why cannot we develop that perception here? I was very struck when we went to the Hartree Centre recently. I had been slightly put off by the description of “big data”, but I suddenly discovered that they are actually answers for everything. If you could see this in terms of something that we can use to tackle the things we are interested in, maybe that would make a difference.

I suppose a specific dimension is: what is the role of parents? What is the role of teachers? We have talked a little about the role of media, but how can they be helped to contribute to this?

Baroness Shields: Also, what is the role of the student? We live in a world where you have to own your own destiny. Things are changing so rapidly that the careers advice cannot keep up, to be fair. It is about the hunger for learning and knowledge and encouraging that, because you have to learn those skills early on. I remember a statistic that I read, and I will get back to the Committee on it. It was a US Department of Labor statistic that said that the 18 year-old of last year would have 11 jobs by the time they were 37. If you have 11 jobs by the time you are 37, you have to own your own career path. The days are gone when you relied on a career counsellor, like you did in the early days, who said, “You might be this”, and then you became that for the rest of your life.

Professor Dame Wendy Hall: We have done research on what attracts women to computer science courses, and looked at the same cohort and why they were not interested in computer science, and it is so much about what the parents think. It really is, as well as peer pressure. It is the teachers, of course, but it is so much about what the parents think.

The Chairman: How do we break down the feeling that it is for a geeky minority? Exactly as Lord Aberdare said, we have received evidence here about big data. None of us are particular experts. When we saw it in practice—it was mapping health problems and all the
rest of it—it became completely real to us, but that was because we saw it. How do we get that out to a much wider group of people so that they think, “That sounds really interesting. That is worth pursuing.”?

**Professor Dame Wendy Hall:** It is all about the curriculum. There is no quick fix, because it is a culture change. The culture changed dramatically—I can show you the graphs—in the 1980s. Women were about 30% of the computer science graduates in those days, before the personal computer. When the personal computer came along, suddenly it was toys for the boys. It dropped off dramatically, and we have never got over that. It is not a quick fix, because it is a culture change, but we need to make absolutely sure that the curriculum is right all the way through as we introduce the new curriculum, that it is really female-friendly, that it is something that is taught not just from a technical point of view but from a social point of view. It is about ethics and what it means to be a digital citizen. By the time today’s five year-olds grow up and start going out in the workforce, the world will have changed again. We could have chips in our brains or something. It will not be like it is today. It will be much more immersive, whatever it is.

**Lord Aberdare:** I want to follow up on the careers service bit, because the careers service as it is today cannot keep up. Is it possible to define a model, therefore, of what a careers service of the future might look like? What is the useful advice and support that young people could be given?

**Professor Dame Wendy Hall:** I would absolutely go the social network route. There is a company in Portsmouth that does this—I forget the name—helping students to decide which university to go to and which course to study, and it is all on social networks. Universities put information up about their courses, but it is all the chit-chat on the social networks. Students who are studying at Southampton will say, “I like this course”, or, “This was not what I expected”, and that builds up on the network. I would go that route.

**Q218 Lord Lucas:** What scope is there for getting universities to play a greater role in schools in this area? There is a great lack of knowledge in schools as to what careers can be, but by and large people at universities have a better feeling of that.

**Professor Dame Wendy Hall:** We get into trouble if we start trying to tell teachers what to do, and we should not, but I think the way to make it scale is to look at teacher training. That is where you make the difference, I think: looking at the curriculum in the teacher training courses, which are often in universities themselves.

**Baroness Shields:** Just to add to what Wendy said, social networks allow you to scale the advice and allow people, either as themselves or anonymously, to interact and have conversations about their future potential.

Something else that is really important is that when we were growing up we did this Myers-Briggs test—remember—which pushed you in one direction or the other and helped you understand the way you think, the way you react and various other things. Neuroscience and cause and effect in that area has changed a lot. I discovered a platform. There was a young self-taught neuroscientist in Vancouver who created a platform called Sokanu. It is a personal discovery experience online that is completely unique to you and it is all questions-based. It gets smarter as time goes on and suggests ideas for careers for you. It is absolutely brilliant. Again, it is about scaling that. The more people who get on that, the more the system learns, and that learning system helps to give better advice. These things get smarter.
and smarter over time, and it is absolutely brilliant. It is S-O-K-A-N-U. He was one of those kids who was not doing well in school, as I understand, and his mum bought him a book on neuroscience. He was 14. Now he is literally being consulted by the best neuroscientists in the world. It is fascinating.

**Lord Janvin:** Just taking this one step further into what can industry do to effect culture change: are we missing a trick there? Are they just not interested in engaging in trying to change perceptions? Is there anything that they can be incentivised to do? Where does industry fit into all this?

**Baroness Shields:** I think every company is digital and has a responsibility in this area.

**Lord Janvin:** Yes, absolutely.

**Baroness Shields:** I think one of the key roles in an organisation today is a chief community officer. Sometimes the community is a virtual community; sometimes it is a local area. That person and the team of people there have to be thinking about skills and thinking about how you cultivate the right skills, and that partnership between industry and schools is absolutely vital. You cannot complain that you do not have the right skills if you are not extending your hand to the schools in your area. I think this is grassroots. It is local, and it is absolutely vital. Every company should have a chief community officer and a team under them.

**The Chairman:** Most do not.

**Q219 Lord Kirkwood of Kirkhope:** Could we change the focus of the gender question, which you have been addressing in a very interesting and informative way? I have the same concern about low-income households, so it is more a question of whether inequality is inevitable unless we can connect some of these low-income households to the internet and what the consequences are in the long term for increased inequality if we do not solve that problem. Do you have any advice to the Committee about this? First, it is the same kind of problem as gender, but is it a problem. How should we be starting to address it right now?

**Baroness Shields:** What attracted me to the internet is the idea of social mobility and the fact that it would level the playing field and give everyone access to the same information, and in many ways it has. I grew up in a working class environment and I went to a state school, not one of the top schools, and you find your way. What I was so excited about is that with all this information accessible to people, everyone has the same level of opportunity, but it is still about helping them use that information and finding their way. In a low-income household, the parents do not necessarily have the skills or the knowledge of how to make the most of that. The walls have come down, the doors are open, the kingdom is available, but how do you get there and how do you make the most of what you discover there? We have not solved that problem yet, and I do not have the research for you, but this is a big issue. Low-income young people are not performing as well because they do not have the—I do not know whether it is role models or what it is, but it is a big issue and it is a concern.

**Lord Kirkwood of Kirkhope:** I do not want to put words into your mouth, but all your excitement and your progress seems to be working around Government rather than through Government. Tell me if I am wrong, but Joanna made the important point that you are now sitting on a digital advisory committee. Would it be better if there was a digital cabinet committee?
Baroness Shields: I think we can achieve the same thing. Putting it in a Cabinet role gives it a certain level of gravitas and importance, so maybe that is important, but I think we are working towards that anyway. There is recognition that we need a digital committee and that we need to focus on this, but again the road is paved with good intentions. Everyone is trying to solve these problems, but there has to be some kind of cohesive strategy wrapped around it. Everyone is doing great things but in a very small, micro way, and we have to think about how we identify and scale these best practices. I think that is what a Cabinet level or a Committee like this could do.

Lord Kirkwood of Kirkhope: You are too soft.

Baroness Shields: No one has ever said that to me, but I will take that on board.

Lord Kirkwood of Kirkhope: I say it with the best of intentions. Listening to what you say, it is such a powerful case it seems to me that if you really put your mind to it you could get Government to respond. A lot of work has been done, partially because of your efforts. This is not trying to attack people, because everybody is busy, particularly you, but should we not be giving Government a harder time?

Professor Dame Wendy Hall: My problem is that there are too many things going on. We have Joanna’s efforts, we have Martha Lane Fox’s efforts, we have the new Digital Skills Taskforce that is run out of DCMS.

Baroness Shields: That is the same one. There is only one.

Lord Kirkwood of Kirkhope: I think you are making my point, slightly.

Professor Dame Wendy Hall: Yes, and then there is Your Life and so on. I find it hard to understand what is going on. You may be closer to it than I am, but if somebody rings me up and says, “I have been tasked to do this”, it comes out of the blue at me and it is another thing that is starting. We need more joined-up thinking, for sure, but that is so easy to say, is it not? It is so easy to say.

Baroness Shields: Yes. That is why this committee came about, and a committee to answer that is kind of an oxymoron. We do have to put it on a level of strategic importance, and a Cabinet-level position would give it that. This is what I have lived and breathed the last two and a half years. This is my passion. I think it goes back to the question about social mobility. My feeling is that the internet has the potential to empower so many people, and that is where Government has a responsibility to help.

In terms of business, it is about setting the conditions and then getting out of the way so that businesses can thrive. We do not have a Google or a Facebook. We do not have a big-scale internet platform that was built in the UK, and everybody thinks there is something systemically wrong here. The only thing that went wrong was that during the dotcom crash we retreated and said, “That is not a career to go into”, and the US dusted themselves off and started going again. We lost six, seven, eight years, and we are behind right now because we lost those years. It is not because we do not have the skills, there is something wrong with our universities, we are not creative or we are not the ground-breakers that we of course are. It is just a mentality. When things went wrong, everybody retreated here and then they said, “Do not go into that. That dotcom crash was a disaster”, and people really retrenched. The US said, “Fine, well, let us try something else”. That is the difference in mentality.
Professor Dame Wendy Hall: The venture capitalists stopped investing in these types of companies. Yes. I suffered from that.

Baroness Shields: We are seven or eight years behind, but I predict that we will have great platforms. The only problem with platforms is that you get a first mover advantage and it is hard to unseat the first mover.

Lord Giddens: If I may just say so, looking at these things, one of the things that happened in the US was the transfer of digital technology to other industries, which we did not, and that has transformed the industrial base of the US. One of the things this Committee has to try to say is that there is no such thing as a digital economy because all aspects of the economy are digital.

Baroness Shields: Precisely.

Lord Giddens: You cannot start a small business or do anything, like be a personal trainer, without having a website or whatever. It is the whole economy we are talking of here, I think.

Baroness Shields: I completely agree.

The Chairman: Which brings us to our last question.

Q220  Lord Macdonald of Tradeston: I wanted to tighten the focus on what we have just been discussing and ask whether there is one key suggestion that you think that this Committee could be recommending to the Government that would improve the UK competitiveness, especially in the area of digital skills. How would you make it happen and how much would it cost?


The Chairman: We have asked this of everybody, because we want people to focus very clearly on the fact that there is loads and loads, but what is the most important thing?

Professor Dame Wendy Hall: I am going to turn the question around slightly. When I was on the Prime Minister’s Council for Science and Technology, we were playing with these ideas and somebody said to me, “How much would it cost?” If the Government gave me an infinite amount of money, you would not actually be able to change it overnight. I suppose you could bribe people, but I do not think that would work. I have always wanted to try to give more scholarships to girls to study computer science, but we cannot because of the equality laws, which is fair enough. Some countries do that—I think Canada and possibly Ireland. It is Ireland. It is a country that has had a lot of success in giving scholarships to women to study computer science.

Lord Macdonald of Tradeston: Governments can change the law.

Baroness Shields: This would not cost a lot of money, but I have watched east London transform around a number of incubators, accelerators and Google Campus. Google Campus is run by Google and funded by Google, but it is not a Google P&L; it is separate. The last I heard, 22,000 businesses started from Google Campus. It is a hive. It is the most positive place in London.

The Chairman: We have visited. We have had a Committee visit there.

Baroness Shields: Exactly. It is buzzing with people.
The Chairman: The lights went out, unfortunately.

Baroness Shields: Really? Oh, no. Oh, dear. There is excitement. We used it earlier this year for the Flood Hack. We brought together 200 engineers to have a hackathon on the floods that were plaguing the country, and there are things that come out of people coming together in those environments. This has been said before too—there are no good ideas any more; they are just recycled—but it is about using old buildings and putting a Google Campus-type place in these buildings. All across the country there are unused assets. I just feel that you need a movement. The movement cannot say, “Here it is”. There have to be people who want to do it, are passionate about it and pitch for it. Then we will take it forward. You cannot say, “We are going to create these centres”, because that does not work. You need the grassroots organisation of a local authority or a local community to say, “We are going to create an ideas factory right here”.

The Chairman: What was the gender balance like on the hackathon?

Baroness Shields: It was pretty bad. There were very few women there, unfortunately, but we put out a call to arms. We did it on Friday night and by Sunday morning we had 220 engineers. You remember? It was incredible. It was a time of crisis, and what I love about that is that people come together in a community around a crisis.

The Chairman: It involves solving something. It is interesting. It is not abstract.

Baroness Shields: Exactly. We just have to own these problems on a local level and come together to solve them.

The Chairman: We will have to leave it there. We could have gone on for ages, but thank you very much indeed for coming this morning. It was really helpful. Thank you.
Tony Harper – Written evidence (DSC0075)

**Background**

I am a former Chief Technology Officer (CTO) for one of the UK’s largest systems integrators, I have been working in the IT industry for 20 years but started writing code from the age of 8. I have been responsible for recruiting and building teams of developers and consultants in my last 2 roles and have experience of developing Graduate, Higher-apprentice and overseas talent pools. My current role is as a co-founder of a niche training provider (Digital Native UK) established to address the current gap in the IT skills market. The views below are my own based on the above experience.

**The changing technological landscape**

1. **What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years?**

The pace of change will continue to vary depending on which area of the Digital Technology Landscape you are considering. The temptation is to focus on the fast changing while ignoring the essential technologies that run our country and major companies. It is in the essential technologies where we have a burning platform.

The aging technology workforce (typically now in their 40’s), years of organisations treating IT as a cost to be driven down have led to under investment in succession planning. This has left many companies unable to run their IT effectively in the UK. I have recently spoken to one company where they are currently trying to fill 30% of the roles in their IT department. Many experienced IT professionals are leaving the oppressive corporate IT environment to effectively semi-retire and start their own companies. They are disillusioned and fed up of being viewed as a cost, where quality of delivery counts for nothing and constantly under threat of seeing their jobs move to India or moved over to another company.

This change in the IT Landscape while not technical means that doing the basics in many organisations is constrained by resources. The current focus on developing Digital Skills needs to encompass a landscape that is changing at different rates, by focusing on one area over another we risk being able to create web sites and digital content, but this will mean nothing if the FTSE 100 cannot base their IT functions in the UK.

2. **What are the leading innovations?**

Individual Innovations don’t matter it is key themes that count. The key themes I’m seeing in the US market which leads the UK are:

**Consumerisation**, technology is getting easier to use leading to more people using it. However, there is a difference between being a consumer and a creator. Many of the ‘Creative Digital’ roles I see are little more than consuming a tool or capability delivered by somebody else. I.e. creating digital web content using commercially available software is effectively word processing from the 80’s you wouldn’t expect to be highly paid for being able to use a word processor today, so don’t expect to be highly paid to create digital
content tomorrow....... We should be focusing on developing people who can create the platforms for tomorrow’s consumers to use.

**Globalisation**, the removal of national boundaries and perspectives, i.e. it doesn’t matter where you are, you are competing with the whole world for work.

**Consolidation**, technology infrastructure capacity is moving from individual organisations to major providers (Cloud). The growth of Amazon like services means that there will be less need for a broad base of technology infrastructure skills. Companies like Amazon, BT etc. will employ a greater % of the workforce with these skills. As they will gain competitive advantage through their methods an approaches they will want to control the training of these skills.

**Increasing complexity**, of delivering technology, creating an easy to use platform for users that seamlessly hides the joining together of a number of remote hosted platforms will require greater skills and more flexibility.

3. **What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?**

4. **What is the employment impact on the UK’s labour market?**

5. **What are the regional differences?**

My experience shows me that London is growing fast, Manchester growing fast, but the Midlands has a long way to go to enable this change.

**Future workforce**

6. **What skills do future workers need in order for the UK to be globally competitive?**

A recent report O2 report identified that there is a functional hierarchy of these digital skills, as follows:

**Advanced digital skills**: with the main emphasis being on the creation and/or strategic exploitation of new digital applications, including more advanced programming and coding involved in the creation of new software, etc., but they also cover the strategic business skills needed to convert ideas into successful commercial projects and ventures.

**Intermediate-level digital skills**: involving the skills needed to implement and manage on a day-to-day basis the applications developed by those with advanced skills, but they may also provide contributions to the development of digital content, provision of system support and maintenance, etc.

**Entry-level digital skills**: where the emphasis is on the use of digital applications designed, developed and promoted by others: involving for example searches for and/or the capturing and recording of digital data across a wide variety of business and public services, the administration of databases, the monitoring of data, contributing to the management of digital content, etc.
From a Knowledge Economy perspective entry level skills will enable us to be digital taxi drivers while advanced skills will enable us to design the next generation of cars. I don’t want to be in a country of Digital Taxi drivers...

My perception is that we are currently investing too heavily in Entry-Level skills rather than enabling a smaller number of people to achieve advanced skills. For all of the above a mix of skills are required:

Analytically, Interpersonal, Communication, Business and Technology.

A flexible approach to the working day and international mobility i.e. not having to wait 4 weeks to get a visa to work in the far east.

**7. How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment?**

No other industry changes like technology changes, occupations come and go in a matter of years. This is has resulted in an employment market place for IT skills that is much more commodity based than many markets, job descriptions are very tightly defined. I.e. a company will ask for an Oracle 10g SQL developer, rather than a Developer. In medical terms this is like asking for a doctor who can prescribe a single drug. The developer has the skills to develop solutions across many platforms but the requirement is for that platform.

There is a typical path that most technology occupations follow which sees them devalue over time. i.e. while a skill is rare it is highly paid, as more people acquire the skill market forces cause it to devalue. Finally as the technology it was based on is superseded by the next technology the skill becomes redundant.

This is largely possible because unlike other professions Accountancy, Law, Teaching and Medicine there are very few barriers to entry to this market place i.e. there are very few legally mandated professional qualifications, the technology is often accessible globally enabling a global market to apply to complete any work.

It looks to me that we are too focused on the training for a technology job or occupation rather than educating a set of broader skills. This is very evident in our current Apprenticeship schemes where the frameworks target developing an individual for a role, this is not hairdressing. This approach historically is one of the causes of underemployment in the existing workforce. People are trained and valued for their skills in a given technology then as the technology changes unless they are able to jump onto the following wave quickly they struggle to make the transition.

To address this we need to move to a system much closer to the German model where training and education is encouraged throughout life. A person is able to update their skills and experience outside of the workplace to enable them to maintain their marketable value. The value this brings to wider society as well as the individual needs to be recognised through funding options. Technology is one area where we do need to move truly to a lifelong learning model.
In summary anyone entering technology related career needs to be educated in methods and approaches to address an unknown challenge in the future i.e. Analytically, Problem solving, Interpersonal, Communication, Business skills rather than training to execute an occupation or role today. This needs to be balanced with method of rapidly acquiring the skills that the market is demanding. The current frameworks of Apprenticeships and Degrees are too monolithic to deliver this.

8. Can the current supply chain deliver this?

No, there are too few technologists early on is the system to inspire the next generation into technology careers,

The Further and Higher education institutions are structured such that they have large fixed costs and funded where low quality volume provision is the only model that can cover the fixed cost base. They are not geared up to do a wide range of small short courses to a small class size. The commercial organisations are but accessing government funding to deploy this to those that cannot afford commercial prices is confusing and uneconomic for them.

9. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one?

Fundamental issues, the damage done by ICT and relatively low salaries over the past 10 years means that historically there are very few technology literate staff in the education system. It’s just not a destination for enough technology geeks. Without this passion for technology uncovering the great resources that exist globally i.e. Stanford, MIT, Caltech etc. are producing some great Massive Online Open Courses (MOOC) but I am yet to see these make it into mainstream provision.

10. How can this be improved?

The work that http://www.computingatschool.org.uk/ is doing is very encouraging, the limited engagement they are getting with schools is a reflection of the number of technology literate / passionate teachers there are. I spoke to my local schools head of IT recently, he was just not engaged with the broader technology scene. But as a trained PE teacher why would he?

11. How are schools preparing to deliver the new computing curriculum in an innovative way?

We are speaking to schools about outsourcing the provision of the Computing Curriculum. This appears to be a popular approach!

12. How can the education system develop creativity and social skills more effectively?

It is clear that there is confusion about what the term Digital Skills mean Creativity and Social Skills imply you are looking to address the creating pictures and fluff element of the digital skills market rather than the more complex analytical, problem solving, coding and business understanding. I have no interest in helping people create pictures. It is people who can create technology we need. Leave the pictures to artists.
13. **How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist?**

It doesn’t. This question highlights how far government thinking is from understanding the technology employment market place.

We should stop trying to focus on preparing people for occupations. We need to educate and empower young people with a set of skills to address an unknown future, these should focus on analytical thinking, problem solving, listening, understanding business, communicating and learning. We then need to ensure that anyone entering a technology career has an understanding of the context that the technology will be used in. We need to find a balance between marketable skills that are required to find work on leaving education and educating a person in the general transferable concepts, procedures and approaches that will enable them to transfer their skills between technologies as required for a long term career. This balance has to include more emphasis on the context that technology is used in. We don’t teach enough of our technology students about the environment that the technology will be used in. i.e. Business, banking, research.

14. **How can this be improved?**

**Short- and medium-term support to the digital sector**

15. How can the digital sector be supported in the short- and medium-term?

16. What is the role for higher and vocational education, national colleges, industry, and industrial policy?

17. **Is there a need for increased high skills immigration in the short-term?**

NO. This will only enable industry to continue to hide its head in the sand and not face up to the problem and invest in growing talent.

18. What are the implications of this?

19. Is there an inclusion agenda in relation to digital skills in the workplace?

20. How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged?

21. How can this be improved?

22. What do the best local skills delivery models look like?

23. What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

**Industry**

24. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy?
25. How are these best overcome?

26. How can businesses help equip the workforce with new skills in a rapidly changing environment?

**Infrastructure**

27. Does the UK have a competitive infrastructure to support a knowledge-driven economy?

28. How does the UK compare to other countries?

*5 September 2014*
The Hartree Centre, Professor Nick Bostrom and Innovate UK (formerly known as the Technology Strategy Board) – Oral evidence (QQ 26-39)

Transcript to be found under Professor Nick Bostrom
1. This evidence has been compiled from a wider 6-month long research project which will be submitted to The Education and Training Foundation. The evidence is based upon a needs analysis undertaken with 575 trainee practitioners and 200 learning technology managers currently employed in the Learning and Skills Sector in FE and Sixth Form Colleges, universities, County Councils, private training providers and in industry. They were asked what changes they would like see in the Initial Teacher Education curriculum and ongoing CPD to help build the skills required in the sector to realise the 50% online delivery for funded FE provision proposed by last year’s FELTAG report commissioned by the then Minister for Business and Skills, Matthew Hancock.

2. This evidence adds to a body of evidence that highlights that a strategic change is required in the Learning and Skills sector in the use of learning technologies if the FELTAG recommendations are to be realised. It focuses the spotlight on Initial Teacher Education (ITE) and details the step change required in terms of diagnostic assessment, curriculum content, teacher education staff capability and the need to adopt a strategic approach to the use of capability across institutions to realise better digital literacy for ITE trainees. It points to the need to develop a technology module for use by trainees and experienced practitioners alike.

3. The research project conducted a needs analysis with respect to the future ITE curriculum and ongoing CPD support for practitioners’ learning technology development. The findings from the research are being actively used to inform the future ITE curriculum, having so far been disseminated to Centres for Excellence in Teacher Training (CETTs), JISC and The Association of Learning Technologists as well as to sector press and to individual ITE practitioners via social media. It is hoped that this research can be used to inform curriculum design, learning provision and trainee practitioner support within ITE.

4. There are many encouraging signs that new practitioners in the sector were ‘tech-curious’ and already used technology for many purposes, including learning; that said, there are significant challenges to the realisation of FELTAG’s learning technology ambitions. These are summarised in the remainder of this evidence submission.

5. Initial Teacher Education faces real technology skills development challenges given the diversity of digital literacy of its students on entry. This is compounded by varying and equally diverse levels of risk aversion, self-confidence, subject-specialist knowledge and conventional ‘classroom’ teaching experience. Assumptions are made that new entrants into the sector from industry will have higher levels of digital literacy than many of them actually possess and these must be corrected.

6. The absence of a robust system to diagnose digital literacy and learning technology skills levels on entry to ITE hampers course teams’ abilities to provide differentiated support and this needs to be addressed immediately. All ITE students undertake initial diagnostic assessments to establish their entry numeracy and literacy skills – ironically many of these tests use IT. There is no similar set of tests to establish levels of digital literacy or experience in learning technology use or pedagogy; only 11% of our respondents had these skills
assessed. Such skills diagnostics need to form a core part of every ITE induction; a differentiated action plan can then be created and monitored for all students.

7. The current ITE curriculum is no longer fit for purpose with respect to learning technology skills development. Immediate and significant changes are needed to the available curriculum to allow effective initial assessment of trainees’ entry skills and then provide planned, differentiated development of digital literacy and pedagogy. It will be important to shift the focus from discrete technology tools viewed in isolation to a far more holistic approach prizing pedagogy development and examples of contextualised implementation.

8. ITE students tell us that they wish to experience blended learning and technology use from a learner’s’ perspective and that a knowledge of the underpinning pedagogy and contextualised examples are what they need and not a ‘tools-focused’ approach. If a new, compulsory technology module was developed and delivered using a blended approach it would give a valuable opportunity for ITE teams to model tools and strategies while delivering underpinning knowledge of pedagogy. This needs buy-in from HEIs and Awarding Bodies to prevent inconsistencies in depth of coverage.

9. The Learning and Skills sector must ensure that both ITE students and established practitioners have digitally literate role models and see technology use as an embedded, everyday part of their practice. Senior leaders are also important role models and need to advocate and model fluent technology use. At present, fluent learning technology use at governor, principal and senior leadership level can be the exception rather than the rule in some organisations. Senior managers need to be informed users of learning technology so they will be aware of the challenges facing practitioners in the sector. They should model and advocate technology use; some managers will need further development to enable this.

10. The sector must also create a climate where both trainee and established practitioners are given every encouragement to experiment with learning technology, to take risks and ‘play’ in order to develop skills and confidence in its use. Many of our subjects commented that the climate in the sector was not conducive to their experimentation with unfamiliar technology or new delivery strategies using it. The fact that many viewed themselves as technology novices in comparison to some of their learners also made some more risk averse and unwilling to develop their practice. We must ensure that access to technology is made available and security and use restrictions do not prevent practitioners from trying out new technologies and strategies.

11. Organisations in the sector must encourage more planned and extensive collaboration between learning technology support staff and senior management, practitioners and teacher educators. The significant experience in ILT teams is not currently put to best use. There should be more coherent collaboration between ILT teams, senior managers and faculty in planned programmes to develop skills at all levels of an organisation. This should be embedded and include ITE and ongoing practitioner CPD but also encompass governor and senior management training; an ‘ILT governor’ presence in each organisation may facilitate this.

12. The sector should also look to develop the knowledge and skills of HM inspectors and Quality Improvement observers of learning and inform them of its diverse use more
thoroughly so that they are able to make informed judgements and give relevant and challenging developmental suggestions. If robust judgements are to happen, they too need to be digitally literate and experienced users of learning technology. In order to provide challenging development pointers to practitioners, some inspectors and observers will need technology skills development and improved knowledge of related, underpinning pedagogy.

13. Teacher Training delivery teams will also need skills development in many organisations. The level of challenge and support presented to ITE students can vary significantly depending on the digital literacy and learning technology experience of their teachers and mentors. We need to ensure that all ITE students receive a similar, high quality experience; some teams and individuals may need further skills development in order to make this possible and delivery of the new proposed curriculum effective.

14. All teacher training courses should provide learning technology mentors; these are needed to develop skills and model contextualised use. Trainee practitioners are calling for subject-specific support in embedding learning technology into their existing pedagogical frameworks. Many have commented that their resistance to its use is due to unanswered questions and worries they have about learner management, motivation and inclusion and how its use affects their professional role and identity. These types of concerns were far more prevalent than those about the technology ‘tools’ and their operation.

15. Trainees are also calling for technology and pedagogy to be developed together, not in isolation, and want to see this modelled and contextualised to their subject areas by fellow practitioners. In addition, trainees comment that while they are still finding their way with face-to-face delivery of their specialism, developing their own pedagogy and classroom management and style, they feel that calling upon students to lead a segment of a class as ‘experts’ will diminish their authority with their learners.

16. This research project has produced a comprehensive and detailed research report using the opinions of hundreds of trainee practitioners and learning technology experts. We recommend that any interested parties who may be engaged in planning future teacher training curriculum or resourcing future ITE provision take time to read the full work and its recommendations. There is a project wiki available at etfresearch.pbworks.com which can be consulted to view the full report, read more about the methodology used in the research and comment upon it.

28 August 2014
**Here East – Written evidence (DSC0048)**

**Introduction: About Here East**

Here East is the unique cluster on the Queen Elizabeth Olympic Park, occupying the former International Press and Broadcast Centres. It is being developed by iCITY, the company selected by the London Legacy Development Corporation in 2012 to deliver a legacy from the former Press and Broadcast Centres. iCITY is a joint venture between Delancey, a specialist real estate investment and advisory company, and Infinity SDC, the UK’s leading data centre operator.

Here East has a number of features that make it a unique location.

- It is London’s home for making, a dedicated campus where creative businesses growing in scale join businesses of scale growing in creativity. It is designed as a place for startup, entrepreneurial businesses to co-exist and collaborate with global, established businesses and support genuine product innovation.
- It provides over one million square feet of dedicated and versatile spaces for creative and digital companies.
- It is situated in one of the most deprived boroughs in the country, with high levels of youth unemployment and people living on low-income salaries.

The development will create one of the most exciting business campuses in the UK, creating over 7,500 jobs directly on-site and in the local communities, supporting the expansion of the creative and digital communities, and providing pathways for talent for local people from apprenticeships, colleges, higher education through to employment opportunities with global companies and innovative start-ups.

1. What is the pace and change of the future digital technology landscape over the next 5, 10 and 15 years? What are the leading innovations?

The UK is already a global leader in the creative and digital industries, and has continued to capitalise on the opportunities presented by hosting and delivering London 2012. We have a proud tradition of innovation and discovery, and the internet economy is already responsible for more than eight per cent of UK GDP, which is a greater share than in any other G20 country.262 The internet-related market in the UK is now estimated to be worth £82 billion a year while British businesses earn £1 in every £5 from the internet.263

However, the last twenty years have repeatedly shown the incredible speed with which the digital technology landscape develops and shifts, and this is likely to continue apace over the next twenty years and beyond. The London 2012 Olympics were awash with thousands of spectators capturing moment on their iPads, whereas four years earlier in Beijing there were...

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Here East – Written evidence (DSC0048)

none: the iPad hadn’t yet been released to the mass market, marking the breakthrough moment and catalyst for the entire smart-pad revolution.

Here East’s ambition is to provide further support and capacity to strengthen the UK’s position as a global leader in these industries. One particularly important and fast-growing area where we are already seeing a significant impact on business practices is the exponential growth and spread of the making movement.

The making movement has largely been led by developments in the US, where Maker Faire regularly attracts hundreds of thousands of visitors. Indeed, the White House itself recently hosted Maker Faire, showcasing a vast range of projects, inventions and products created by people from across the US.

This movement is being driven by the preponderance of new digital tools and technologies that are now readily available and are disrupting and challenging established models and practices, and creating entirely new ways of doing business. These tools and technologies have reduced the barriers to ideas becoming physical products, and made it easier than ever for a single individual or small business to create and distribute unique items.

As a result, small, innovative companies and individuals are making a future of intelligent things that use technology and data to learn how to be more efficient and smarter. Notable examples include 3-D printing, robotics and the increasingly diverse and new applications of computer numerical control (CNC) machine tools that were previously the domain only of large corporates.

All of this has been made possible by the rapid developments in digital technology combined with the UK’s leading position in the creative and digital industries. Over a relatively small number of years, we have seen that the inherent creativity and resourcefulness of makers is becoming ever more attractive to established businesses, who are critically reviewing and developing their own innovation, R&D programmes, and processes for recruitment, talent identification, development and retention.

This movement is one of the fundamental inspirations for Here East’s vision. We want to create a unique place for the most innovative companies and individuals to create and shape the future digital technology landscape. The leading innovations are emerging, changing and developing at a rapid pace, but innovation must be structured and designed so that it creates opportunity, and is not purely focused on efficiency improvements. Such creative innovation, in which the US is significantly further ahead than the UK, is key to supporting British companies to develop, mature and for the UK to remain at the forefront of these developments.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

The threats to the UK from emerging economies such as China and India is well-documented. However, these threats are compounded by the need to rebalance the UK economy following the financial woes of recent years, and gradually transition away from our current over-reliance on financial services.
For the UK to successfully undergo this transition, there is a clear need to tackle the stubbornly high levels of youth unemployment and number of NEETs through upskilling not only our young people, but those that have been out of work for long periods yet are capable to enter or re-enter the job market.

As the economy enters a growth era, there are signs that businesses are beginning to recruit and expand the workforce once again, but there remains a significant mismatch between the numbers of young people unemployed and the high numbers of skilled job vacancies that continue to exist. Businesses in diverse sectors continue to emphasise the difficulties they face in identifying and recruiting the right talent.

It is equally important to focus on uplifting the skills of those in work, and particularly the low-paid who have seen wages stagnate or even shrink over the last seven years, alongside the increasing army of under-employed and the now substantial part-time workforce.

There are also significant physical infrastructure challenges that, if left unchecked, could harm the UK’s ability to grow. The recently high profile lack of access to high-speed broadband and connectivity problems, particularly in East London and Old Street, is a particularly pertinent threat to the UK’s ability to further grow the creative and digital industries, and examples abound of businesses locating to new premises yet still struggling to secure access to appropriate broadband.

It is important to note that the UK has an impressive track record and capacity to tackle such problems and complete a successful shift to a more balanced and productive economy. The London 2012 Olympics were in themselves an example of our ability to strategically plan, create and deliver on a vast scale. We need to do the same in regards to the challenges we now face in securing sustainable economic growth, and we need to build on the infrastructure we already have in place to enable a thriving, knowledge-driven economy.

We believe that Here East has a critical role to play here as it consists of a unique physical infrastructure, including access to unrivalled power and, crucially, flexible office spaces that allow companies to scale up as necessary. The vast majority of new jobs are being created by companies less than five years old, whereas the traditional corporates are shrinking. The ability for such companies to scale up as they enter periods of rapid growth, without having to relocate or seek new infrastructure support, is critical for the UK to remain at the forefront of innovation.

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

The digital and creative industries are the fastest growing sectors of the UK economy, and they are becoming ever more strategically important in terms of future growth and rebalancing the UK’s economy.

At the same time, the global economy continues to develop and diversify at a phenomenal pace. This has profound implications for the skills that today’s young people need to develop
to secure future employment, and to ensure that the UK remains at the forefront of these developments and a global leader in the creative and digital industries.

UK manufacturing is currently undergoing a renaissance, but the forces driving this are significantly different to those in the past. Failure on behalf of policymakers and the wider business community to understand these forces will mean that the UK is unable to capitalise on the opportunities presented by this resurgence.

The barriers that traditionally prevented ideas from entering production and becoming prototypes and rapidly breaking down, and these innovations mean that the face of business is transforming. The consequence of this is that the skills needed to develop and take products to market are changing and evolving, which has implications for a national curriculum which therefore needs to change and continuously evolve to keep up with these developments.

The tech-driven economy, and the jobs of the future, require a very different skillset. There remain widespread shortages for key skills such as coders and developers, and there are gaps in the supply chain that prevent this situation from improving. The lack of appropriate skills is consistently one of the key challenges we hear from our tenants and prospective tenants, and this situation is replicated across the country in key creative and digital industries. The introduction of mandatory coding lessons for children as young as five years old from this September is a welcome first step, but the physical and human infrastructure surrounding this urgently needs to be developed. A recent survey suggested as many as 73% of teachers do not feel adequately prepared to teach coding.

There are templates that exist and schemes that have been shown to work and open up alternative career opportunities for young people, and we are beginning to see the emergence of a generation of young people who are increasingly equipped, and from a particularly young age, with the skills and knowledge to secure the jobs that a knowledge-driven, digital economy offers. There undoubtedly remains a need for further expansion of apprenticeship schemes, and to tackle their perception as something solely suitable for those who are unable to go on to university.

One significant threat is the inability of the UK’s training and education system to keep pace with the constantly evolving skillset required by the most innovative companies. As job creation is increasingly led by startups and young businesses, as opposed to large, established corporates, our education system and training institutions need to develop and innovate at a similar pace to provide young people with the appropriate skills to take advantage of these employment opportunities. Without recognition of the need for training and skills development to more closely match the paths of innovation dictated by small, disruptive companies, there is a very real danger that the skills gaps in our economy worsen, and that we need to act in other ways – such as increasing immigration – to cover these shortages.

Education, training and skills development are at the core of Here East’s offer, with talent pathways through from the UK’s first digital apprenticeship developed and delivered by

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Here East – Written evidence (DSC0048)

Hackney Community College, to Loughborough University’s first London campus focused on research and innovation, and on to employment opportunities with both established global companies and innovative start-ups. We hope that this deliberate design, blending and co-location of education and business, is replicated and can act as a model for business campuses up and down the UK in years to come.

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

The fundamental challenges facing and impeding the digital sector are lack of access to the most advanced physical infrastructure, and the shortage in supply of appropriate skills and talent.

Here East hopes to contribute to tackling this by utilising the unparalleled infrastructure that is the legacy of London 2012 on Queen Elizabeth Olympic Park, and by creating the aforementioned campus mentality. The digital sector thrives on co-location and collaboration, which is where the design of such a campus is incredibly important. An open environment that brings together small, creative businesses growing in scale alongside large businesses looking to becoming more creative, facilitating the exchange of ideas and capitalising on the incredible energy and creativity of those operating in, and redefining, the creative and digital industries.

The key challenge is to provide an environment that fosters and promotes innovation. Businesses operating from the US really understand the campus mentality and how it contributes to such innovation. Alongside the physical location and surrounding environment, it remains equally important to continue to promote greater business and higher education collaboration. This will occur as a result of businesses and education facilities working side by side, but it is also paramount to secure greater business involvement in the design of curriculums and the skills our future workforce are taught.

There is also a valuable role for broader mentoring schemes involving business leaders, and business involvement in education should not be confined solely to higher education. Businesses should collaborate and engage in the education system at younger years, both to demonstrate the range of future job opportunities available to young people, and ultimately increase the available talent pool for the digital sector.

There are again lots of good examples that can act as templates for such involvement. Initiatives such as the CBI’s suggested network of back-to-work coordinators to fill the gap left by reduced or ineffective careers services, and the 5% club, where leading businesses commit to 5% of their workforce consisting of apprentices and graduates by the end of a 5 year period, are welcome. But clearly not enough progress has been made in attracting greater numbers of girls to study stem subjects, either at school or in higher education, and there is a need for greater resources to scale up existing programmes.

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

Business has a vital role to play both through directly equipping its workforce – prospective and those already in employment – and through greater input and collaboration into
designing the curriculum for young people so that they are equipped with the appropriate skills to secure employment in the digital economy.

The key area for greater business involvement is engaging with young people significantly earlier in their education. There is an opportunity to broaden schemes to target youngsters at primary school age, and develop partnerships with primary schools to introduce youngsters to the business world. Businesses should actively seek to host days and activities for young people that begin to build their understanding of the world of work, and better prepare them to enter that world and make informed choices about their education.

4 September 2014
Summary:
This document contains the written evidence of HM Government. An organogram of government activity is attached at annex 3. All questions have been answered, with questions 9 and 14 being answered together, reflecting that the same evidence was relevant for both questions. The additional question the Committee raised on the impact of technological changes on wages and the welfare system is answered under the related question 3.

The Devolved Administrations are understood to be submitting their own written evidence.

The Government believes that the correct approach to ensure the UK has the digital skills it needs now and in the future, is for Government, industry and academia to work in partnership to ensure that a strong talent pipeline is built, which recognises the opportunities and possibilities that digital skills provide. The Government aim is to ensure that all individuals reap the social and economic benefits that changes in technology and the move towards a more digital economy will provide. In addition the Government is taking action to reform those elements of the IP system to bring it up to date with the digital age.

QUESTION 1: WHAT IS THE PACE AND CHANGE OF THE FUTURE DIGITAL TECHNOLOGY LANDSCAPE OVER THE NEXT 5, 10, 15 YEARS? WHAT ARE THE LEADING INNOVATIONS?

Lead Department: BIS

1. Technological progress continues to be rapid in telecommunications and broadcasting. These advances are enabling existing technologies to deliver more services more effectively (for instance increasing the amounts of data that can be delivered through existing infrastructure), or make it cost effective to deliver enhanced services to meet demand. Services that once were only available at a few fixed points are increasingly available on the move for a fraction of the former cost.

2. The expectation is that these technological developments will continue to progress at a rapid pace. There is no shortage of potential technological developments, especially in the wireless space, that might emerge to meet future demand.

3. Further advances in artificial intelligence, machine learning and natural language processing may automate processes and services. The digitalisation of production processes means that autonomous production systems and factories increasingly will be possible. This could lead to innovations in the broader production environment. New industries, jobs and business models will be created but some areas may see a decline. Businesses that recognise changes early can adapt and will be well positioned to take advantage of the potential opportunities that emerge from technological innovation.

4. Owing to the advances in computing, there is a continuing move for aspects that have hitherto been provided as fixed infrastructure to be provided by general purpose computers. This on-going virtualisation of the infrastructure means that skills are required in terms of
understanding the complete network chain and how each aspect relates to the other (question 15 provides more information on infrastructure).

**Leading innovations:**

5. A key future innovation is the promise of 5G, the next phase of mobile telecommunications technology. 1G saw national only analogue phones, this was followed in the 1990s by digital 2G phones that could be used internationally. The new century brought 3G and wideband data was introduced. The current decade has brought 4G and better data access. 5G looks to connectivity that can do all you need, when you need it. It will provide a radio and wired link that underpins all communications needs. This will require network developments and changes, coupled with new business models. The performance of existing technologies will continue to be enhanced, with the prospect of delivery of 1Gbps over hybrid fibre/copper networks, and further enhancements in the provision of broadband via satellite can be expected.

6. Better use of the radio spectrum will also enable the emergence of new services, improve existing services and support further innovation. The Government published its UK Spectrum Strategy in March 2014, aiming to double the annual contribution of spectrum to the economy by 2025. The Strategy sets out a series of actions that will enable change of spectrum use over time to the benefit of the UK including greater sharing of frequencies and dynamic spectrum access. These are likely to lead to further convergence in fixed-mobile or broadcast-mobile technology. The extent of this is unclear and in part will probably be driven by commercial needs to reduce costs and deliver enhanced services.

7. The pace of change for Future Cities, the Internet of Things and Cloud Computing is also rapid and could potentially impact on nearly every aspect of our lives from transport to energy to health and social care over the next 5-10 years. The UK workforce will need to adapt and increase their digital skills to keep up with the pace of change to enable the UK to be best placed to compete in a global market. Throughout the world, the rate at which data is being produced is growing phenomenally. There will a particular skills need in future for analysts who can collate and interpret data, and use this information to generate new insights and value. In 2013, IBM estimated that 90% of the world’s data was created in the last two years, and EMC Corporation forecasts the digital universe to grow 10-fold from 4.4 gigabytes to 44 trillion gigabytes between 2013 and 2020.

8. Big Data is described by Gartner as “high volume, velocity and variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight & decision making.” Leading innovations over recent years in big data include the development of high-performance computers and new software tools such as Hadoop and NoSQL which enable quicker and more complex calculations and data analysis to be undertaken. The development of cloud services and increased data storage facilities also enable greater volumes of data to be collected, stored and analysed.

9. The cyber security market will continue to evolve in key areas such as behavioural analytics, identity management, mobile security and critical infrastructure protection. It will be shaped by more holistic approaches to security such as security-by-design and increasingly necessary delivery models for coping with the increasing complexity of security of environments and responses (such as third party or managed security services). There is a
common appetite for trusted services and products. There are a range of concepts and design regimes that can underpin this, but only a few that are generally used and accepted. Cyber security needs to be better embedded in services in ways that link harmoniously with related services in order to create a commonly understood and employed trusted environment. Developers need to be aware of what is needed and how it can be implemented in their products and how this fits in with other related products.

QUESTION 2: WHAT ARE THE MAIN CHALLENGES FOR ECONOMIC GROWTH AS THE UK TRANSITIONS TO A KNOWLEDGE-DRIVEN ECONOMY?

Lead Department: BIS

10. According to sector data, knowledge intensive services already account for 35% of UK GVA and much of “other services” such as health, transport and retail have knowledge intensive aspects.

11. The UK is, therefore, in many ways already a knowledge-intensive economy so the transition is already underway and there are potential challenges such as competition issues relating to search engines and retail platforms, intellectual property rights ownership and shortages of key skills in the sector and other related knowledge intensive sectors.

12. The move towards more knowledge based industries is transforming what makes firms competitive. For example, in the automotive sector, software is an increasingly prominent factor in the cost of developing new vehicles, with high-end vehicles relying on millions of lines of computer code. Old ideas about what drives manufacturing competitiveness are becoming increasingly less relevant. As devices and production processes become more complicated more expertise in multiple disciplines are required to succeed, not only traditional science but also data science, computing and logistics.

13. Traditional methods and processes will have to adapt to the growth of knowledge intensive companies. There will have to be a shift from purely based on physical assets to a knowledge based asset. Multi-national companies tend to have more sophisticated accountancy approaches and are able to maximise their returns by re-listing their business or moving their intellectual property to countries with more favourable tax regimes compared with smaller companies.

14. Knowledge-intensive sectors also pose challenges for competition policy where the sector is evolving fast. There is also the potential for strong network effects with a “winner takes all” landscape.

15. Intellectual Property regimes have not always kept pace with the evolution of knowledge intensive sectors. However the UK is among world leaders in adapting its copyright system to allow researchers, business and consumers to take advantage of digital technology, without undermining the creative incentives that IP provides. The recommendations in the report ‘Digital Opportunity’, which was commissioned by the Prime Minister in 2010 and led by Professor Ian Hargreaves, have either been implemented or are under way. Government is also working with industry and IP professionals to promote effective market solutions to the use of digital content, for example through the industry-led Copyright Hub.
16. As knowledge capital becomes more important, the valuation of assets becomes important particularly when reporting on financial or corporate issues. Companies should be able to borrow against their “knowledge” as collateral. Government is working with industry and financial institutions to help create the conditions for more IP enabled investment through its work on ‘Banking on IP’. These initiatives should enable successful UK digital start-ups to scale up and become internationally competitive, rather than having to sell to existing large international players as they do today.

17. Policies that relate to human capital become increasingly important with a move to knowledge intensive sectors. This is not just about skills but about how to ensure investments in knowledge and know-how are accessible to firms and that all of the investment in people and R&D is not simply appropriated by an overseas firm and moved out of the country.

18. Countries like the UK will face increasing competition from China, India and elsewhere as they move up the value chain. The move to a high skilled knowledge economy is dependent on the availability of the appropriate skills. In the case of China and India’s population with low level skills, even at current rates of graduate education it will take decades to change the countries’ overall skill composition. They could however, potentially focus their resources in a smaller number of areas where they want to compete more intensively.

19. The infrastructure required for a successful digital economy requires a combination of both “hard” infrastructure like roads, rail, internet connectivity, and soft infrastructure like legal systems, property rights, and respect for the rule of law. Advanced economies like the UK will need to continue to adapt and evolve institutions which are already in place but the UK does however have “social capital” such as the attitudes towards intellectual property which also assist on their ability to be a knowledge intensive economy.

**QUESTION 3: WHAT IS THE EMPLOYMENT IMPACT ON THE UK’S LABOUR MARKET? WHAT ARE THE REGIONAL DIFFERENCES?**

**WAGES HAVE BEEN REPORTEDLY GOING DOWN. ARE CHANGES IN TECHNOLOGY PUTTING MORE STRAIN ON THE WELFARE SYSTEM?**

**Lead Department: BIS**

**Impact on the Labour Market**

20. The changing technological landscape is not expected to have a negative net impact on employment growth in the digital sectors or the wider economy. As technology improved between 1997 and 2011, the number of jobs in the digital, creative and information services sector increased by around 0.8%\(^\text{265}\). The Warwick University Working Futures report predicts positive employment growth, greater than 20% in Information Technology sectors between 2012 and 2022\(^\text{266}\). However, any projections of the future have a large degree of uncertainty around them.


21. An estimated 2 million jobs are attributable to business and commercial activity delivered through digital technology and digital activity. It already contributes over 10% (and growing) to the national economy.

22. The UK’s total employment levels are nearly the highest on record. In the last year up to June 2014, employment rose 820,000 to 30.6 million people in work. In 2011 BIS estimated using ONS data that the digital, creative and information services sector accounted for 3.7% of total employment. More broadly the knowledge services sectors were around a quarter of total employment.

23. People enter and exit the labour market meaning that new job opportunities are always being created. There are around 6 million job changes each year – around 1 in 5 of total employment - even in years where overall employment is falling. Consequently, in the future the net change in employment is expected to remain substantially less than what the Working Futures report calls Replacement Demand (replacement demand is defined as job openings created by those who leave the labour market). For example, in the latest Working Futures publication looking at the period 2012-22 they conclude that the net employment growth over the decade will be around 5.8% but this is dwarfed by the 39.2% replacement demand. This means that because of this need for replacement demand there will always be opportunities for people at all occupation levels.

24. The demand for digital skills in jobs is likely to increase in the future. The precise nature of the demand will be uncertain. Consequently, the challenge is not really what specific digital skills future workers need, but rather what basic skills are required by everyone and how adaptable the educational, training and labour market systems are in responding to the needs and demands of the future before and as they arise.

25. In order to take advantage of the educational advantages associated with demand in some area, individuals need to be in a position to ‘learn how to learn’. There is a universal need for all people to have a basic level of learning that allows them (a) to be able to compete at the lowest level in the labour market and (b) that they are in a position to move on to higher levels of skill acquisition. Amongst the areas where there is a general acceptance of the basic requirements are Maths and English. In addition, in an increasingly service based economy, interpersonal skills are also at a premium.

26. The Government believes that the sooner that these universal basic levels of education can be acquired the better. Acquiring basic skills, including digital skills at school - before the minimum school leaving age - is optimal because it gives the individuals the longest period to take advantage of this investment. Also, acquiring them at school means that there is no opportunity cost of acquiring them later, as whilst they are learning they are (generally) not earning.

Regional differences:
27. The geographical distribution of employment in different sectors can vary considerably, although, there is a spread of jobs that contain digital elements across the country.

28. In terms of Warwick University projections of employment, between 2012 and 2022 the projection suggest that the southern part of England will continue to grow more rapidly than other parts of the country. Almost half of the growth in jobs in higher level occupations is expected to occur in London, South East England and the East of England. The remainder of England and the other nations of the UK are also expected to see a recovery in employment levels.

29. As a general proposition, the areas which tend to have the greatest density of jobs also tend to have the greatest number of workless people. Generally employment rates are high across the country by international standards – the vast majority of local authority areas have employment rates above the EU average for example. However, there are a few local authority areas where the employment rates are lower. These tend to be in the larger cities such as London, Glasgow and Birmingham, some seaside and coastal towns and some (but not all) ex-industrial areas. In the biggest problem areas (large cities such as London), there are plenty of jobs but many are taken by commuters. This would suggest that problems are on the supply/institutional side and therefore improvements here will enable a fairer distribution of employment opportunities.

Wage changes

30. Weekly Pay excluding bonuses for employees in Great Britain was 0.6% higher than a year earlier. Pay including bonuses for employees in Great Britain was 0.2% lower than a year earlier. This was mainly due to an unusually high growth rate for April 2013 as some employers who usually paid bonuses in March paid them in April last year. There is some evidence that the composition of employment growth may be contributing to this lower earnings growth. Wage growth over the last year has been less than the growth in consumer prices which has been 1.6% resulting in average weekly pay falls in real terms.

31. The Average Weekly Earnings is only one source of data on wages: latest business data shows that for people in work, firms are typically making above inflation pay offers (median of 2.5%), while the ONS Annual Survey of Hours and Earnings showed Median earnings grew 2.6% between April 2012 and April 2013. The Office Budget Responsibility expects wages to rise by 2.5% in 2014 and 3.2% in 2015 above consumer prices (but not retail prices).

Strain on the Welfare System

32. Although, any projections of the future will have a large degree of uncertainty around them the changing technological landscape is not expected to have a negative net impact on employment growth in the wider economy over the next 5-8 years. Based on this view and the information on pay growth it is not anticipated that there will be a significant extra strain on the welfare system due to technological changes over the next 5-8 years.

QUESTION 4: What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply deliver this?

Lead Department: BIS and DfE

33. The UK’s skills requirements especially digital skills, evolves rapidly and in response to the changes in technology (as set out in question 1). The Government is mindful of the
broad range of skills that are required in the Tech Sector, with businesses highlighting the importance of social skills in their workforce, alongside more specialist digital skills. In response to this, the Government’s approach has been to ensure that individuals have a broad range of skills, which can then be applied as technology changes.

34. In a growing digital economy, all members of the workforce require or benefit from some level of digital skills. These can be broadly divided into three categories:

- **Basic ICT users**: those whose main career is not in the tech sector, but use IT in their working and personal life, for instance browsing the internet, sending emails or accessing data.
- **Advanced ICT users**: those who are competent users of advanced software tools, often applying ICT within their roles, but with ICT not being the main focus of their job.
- **ICT specialists**: those who have the ability to develop, operate and maintain ICT systems. The use of technology often constitutes the main part of their job and these occupations tend to be graduate dominated.

35. In terms of anticipating future skills, data from e-skills UK highlights IT managers; IT project managers; IT business analysts, architects and systems designers; software developers; and web specialists as the occupations with greatest growth. There is particular demand growing for skills in areas such as data analytics, cyber security, mobile, e-commerce and cloud computing, reflecting the speed of technological change.

36. On the supply side, Government recognises that there have been challenges in ensuring a strong pipeline of individuals with the right set of digital skills, including specific skills such as cyber security. For example at school level, take up of ICT and Computer Science has dropped off significantly between 2003 and 2013 owing in part to the old ICT curriculum, which was seen by pupils, employers and universities as insufficiently challenging, exciting and inspiring. The Government has and continues to take action to address this issue and to ensure the supply of digital skills into the workforce.

**School curriculum:**

37. In England, the new computing curriculum (launched September 2014) and reformed GCSEs and A levels will equip pupils with transferable problem solving and computational thinking skills that will be valuable in a wide range of careers. Studying computing from Key Stage 1 (age 5) to Key Stage 4 (age 16) will increase pupils’ exposure to the subject and is likely to drive take up of qualifications at GCSE, A Level and beyond. To further enhance the status of computing, computer science GCSEs have been included in the EBacc from this year.

38. Digital skills are just one part of the broader set of interconnected STEM skills needed for the UK to be globally competitive. The Government is making improvements to post 16 mathematics education by introducing new ‘Core Maths’ qualifications from 2015, which build on GCSE study and will be valued by employers and universities. These will build young

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268 Tech Insights 2012, e-skills UK and Core Data Set August 2014, e-skills UK.
269 The National Cyber Security Programme supports a raft of specific measures to build cyber security skills.
people’s confidence and competence in more advanced mathematical thinking and problem solving. The launch of the ‘Your Life’ campaign (see question 5), aims to help significantly increase the numbers of students, particularly girls, taking A-level physics and/or maths within three years. This will ensure that thousands more students are able to take degrees in engineering, physics and maths and move on to employment in these fields.

**Vocational education:**

39. In vocational education, competing on the global stage requires Government and business to work together to create a skilled and motivated workforce. The 14-19 curriculum is being reformed so that 16-19 study programmes include the right mix of work-related learning and academic or vocational qualifications, to ensure individuals are work ready.

40. The Government’s reform of the Apprenticeship system is putting purchasing power for training in the hands of business. Through Trailblazers, businesses are able to develop Apprenticeship standards that reflect the skills they need for specific occupations. Standards for two IT occupations (Software Developers and Network Engineers) and one cyber security occupation (Cyber Intrusion Analyst) have already been created and a further three standards were announced in August 2014. The Government has also committed £40m to support an additional 20,000 Higher Apprenticeships to provide a work-based progression pathway into higher education and professional careers. Through this, learners receive practical experience, whilst employers gain employees who are work ready, with the necessary skills for their roles.

41. The Government is looking to create National Colleges for occupations where there is likely to be a rising demand for higher vocational technical skills. A call for employer engagement was launched in June 2014 and it is expected that a proposal for a college focused on digital skills will be forthcoming.

42. Good teaching is key to ensuring that the right skills are being developed. Key priorities of the Education and Training Foundation (the sector owned body responsible for raising professionalism in the FE sector) is to increase capacity and capability of leaders and teachers of vocational education. The Foundation is leading on implementing the recommendations from the Commission on Adult Vocational Teaching and Learning (published March 2013). A key priority is developing models of employer/provider partnership, building on the concept of the ‘two-way street’ to increase employer engagement with education and training providers. This will ensure that vocational education is both delivered by teachers and trainers who combine occupational and pedagogical expertise and has access to industry-standard facilities and resources; reflecting how technology is transforming work.

**Higher Education:**

43. The Government recognises that an issue remains in ensuring that there is a strong supply of employable Computer Science graduates, which meet the needs of employers. It is worth noting that whilst the Government does not control the higher education curriculum (UK Higher Education has complete academic freedom and autonomy), it is working to better understand why Computer Science graduates have higher rates of unemployment that any other subject.
44. In Higher Education universities aim is to develop graduates equipped with the skills that allow them to learn and respond to changing environments and problems. Courses that embed core digital skills as well as subject specific use of technology are enabling students to gain the skills and confidence they need to use digital technology, not only to support their own learning but also in the workplace. Universities recognise that improving digital literacy is an essential component of developing well rounded and employable graduates and employment outcomes are now one of the key comparators for students selecting an HE institution. So, whilst there will be students developing skills specifically for work in the digital economy, all graduates joining the labour market are expected to have well-developed digital skills.

45. BIS has undertaken research on Computer Science students. They are more likely to come from disadvantaged backgrounds and more likely to have lower previous attainment. However, analysis of the available destinations data provides some examples of universities where graduates have low unemployment rates, despite their lower levels of prior attainment. There is evidence that sandwich placements and time spent with businesses has an impact on increasing employability. Roundtables between the Government, universities and employers have been convened to discuss these issues, with the most recent meeting take place on 29 August 2014.

46. More widely, 90% of new jobs are expected to require digital skills, therefore it is expected that all graduates, not just those wishing to enter digital occupations, should leave university with well-rounded skills. JISC (formally known as the Joint Information Systems Committee) has funded a £1.5million programme focused on promoting the development of institutional strategies and organisational approaches for developing digital literacies for all staff and students in UK further and higher education.

http://www.jisc.ac.uk/whatwedo/programmes/elearning/developingdigitalliteracies/developingdigitalliteraciesprog.aspx

Public sector:

47. The Government itself must also ensure it has the right skills to operate effectively in the information era. The Civil Service includes a number of specialist professions including scientists, statisticians and operational researchers. Work is already in train to equip these professions with the right technology and skills to exploit new technologies and practices such as data science, for instance BIS recently arranged for a group of analysts to have an introduction to data science at Open Data Institute.

48. Across the wider Civil Service, CS Learning and the Government Digital Service provide a number of learning products to increase digital awareness and the skills to manage the digital transformation of services. These include e-learning, on-line guides, master-classes and an induction and development programme for Digital Service Managers.
QUESTION 5: HOW ARE WE TEACHING STUDENTS IN A WAY THAT INSPIRES AND PREPARES THEM FOR CAREERS IN THE FUTURE WORKFORCE IN OCCUPATIONS THAT MAY NOT YET EXIST RATHER THAN THE CURRENT ONES? HOW CAN THIS BE IMPROVED?

Lead Departments: DfE and BIS

49. The increased pace of technological developments provides a challenge for the education system to reflect the immediate needs of the job market. The key is to equip students with core skills such as rational analysis and problem solving that are useful in a wide range of occupations so they can adapt to changes in the job market. The Government is working to make the education system more closely linked to the world of work, giving employers a greater role in inspiring and motivating young people about the range of jobs available.

School curriculum:

50. In England, from September 2014 the Government has replaced the previous and much criticised ICT curriculum. The new computing curriculum sets expectations that match those in the highest-performing education systems in the world and challenges pupils to realise their potential in an increasingly competitive global market.

51. In developing the new curriculum, the Government has consulted experts working in cutting edge areas to ensure the Programmes of Study reflect recent and emerging developments. The drafting was led by experts who understand the current and future job markets (including the British Computer Society and the Royal Academy of Engineering). A wide variety of organisations also had input including employer representatives such as e-skills-UK, companies such as Google, academics and campaign groups such as Next Gen Skills.

52. The Government funds the STEM Ambassador Network of over 28,000 volunteers from STEM companies or academia who work with schools across the UK to raise awareness about STEM subjects and careers. Government funding is also provided to STEMNET to support the STEM Club Network to increase the number of clubs to 80% of state funded schools. These clubs provide STEM related activities aimed at inspire secondary school pupils about STEM subjects.

53. Innovative private and third sector companies are also playing a significant role in inspiring students. One example is Code Club, a nationwide network of free volunteer-led after-school coding clubs for children aged 9-11. [www.codeclub.org.uk](http://www.codeclub.org.uk)

Careers guidance:

54. DfE has published new statutory guidance for schools, effective from September 2014 and will shortly publish equivalent guidance for colleges. The statutory guidance emphasises the importance of exposing pupils to a range of professionals from occupations (which require STEM subjects). It also highlights the role that employers can play in giving pupils a better understanding of the current labour market and how opportunities may change in the future. Ofsted is giving careers guidance a greater priority in school inspections. Key stage 4 and key stage 5 destination measures, published by DfE, show the percentage of students continuing their education or training (including through an apprenticeship), going into employment, and those who were not in education, employment or training. They should
expose any schools that are encouraging pupils into post-16 options for which they are not suited and which they therefore drop out from.

**Vocational education:**

55. The Independent Commission on Adult Vocational Teaching and Learning (CAVTL) was established in 2012 to help identify the issues and challenges faced with creating excellence in teaching and learning. CAVTL recommended the adoption of the “two way street” (see question 4 para 39) between providers and employers. The Education and Training Foundation is leading the implementation of the CAVTL recommendations and has established 3 expert panels that will influence the delivery of vocational education and ensure employers are fully engaged in the design, development and delivery of the curriculum. Through its ‘Teach Too’ programme, more people from business will become directly involved in the delivery of vocational education, which will directly influence learners. The Foundation recently published new standards for teachers that embrace the importance of supporting and inspiring learners ready for work.

56. The Further Education Learning Technology Action Group (FELTAG), and the subsequent measures announced in the Ministerial Response to FELTAG (issued in June 2014), aim to ensure that the FE workforce and FE delivery mechanisms become much more digitally agile, not only to enhance learner outcomes but also learner employability.

**Higher education:**

57. University research is often at the cutting edge in developing the technological advances which drive the creation of new industries and new types of jobs. This puts universities in a unique position to inspire students by reflecting the latest research in their teaching. This ensures that courses prepare students for the future workforce. Higher education also develops a student’s critical thinking skills and ‘soft’ skills, which are valued by all employers.

58. The Higher Education Academy has a ‘Digital literacies in the disciplines (DLD)’ project which promotes online learning by funding the development of online interactive resources. The project funds student partnerships in various disciplines such as modern languages; the arts; health and life sciences to develop online learning resources using specialist software. This complements the JISC Developing digital literacies project (see para 61).

59. To ensure that courses remain relevant in the face of technological change it is vital that Universities and industry work together. In his 2012 report to the Government, Sir Tim Wilson’s review of university-business collaboration highlighted the importance of placement activity in providing the opportunities for students to develop their skills and gain valuable work experience. While such engagement is the responsibility of universities, the Government, with partners, provided funding to set-up the National Centre for Universities and Business, to bring together university and business leaders and share best practice. This covers all aspects of HE-business working, skills needs, work experience and graduate recruitment. NCUB noted the poor employment rates of computing graduates, despite an industry skills shortage, and have been researching the benefits of placements in aiding the smoother transfer into the IT labour market. NCUB’s report, “Undergraduate Placements in Computer Science: uncovering the offer and learning best practice” will be published (estimate October 2014) and will provide new evidence on the provision, take-up and quality of placements (including good practice examples).
60. The Government is also supporting excellence in higher education teaching, for example through the National Teaching Fellowship Scheme. JISC is also examining how the student experience is changing and examined students’ incoming expectations and how well their Higher Education experience was preparing them for success in the world beyond.

**Your Life**

61. In May, the Chancellor launched the Your Life campaign, which is supported by more than 180 organisations, bringing together business, educators, civil society and government to help guide pupils towards the right choices and better prepare them for the future workplace. It aims to make the most of all our talents and to grow the number of women in society, technology and engineering. [www.yourlife.org.uk](http://www.yourlife.org.uk)

**QUESTION 6: HOW ARE SCHOOLS PREPARING TO DELIVER THE NEW COMPUTING CURRICULUM IN AN INNOVATIVE WAY?**

**Lead Department: DfE**

62. The new computing curriculum has been designed to allow for innovative teaching. It is considerably shorter than the old ICT curriculum and does not specify how teachers should teach, for example it does not stipulate which programming languages should be used. This means teachers have more freedom to innovate and keep up with emerging technological trends.

63. Although the three broad areas covered by the new computing curriculum (computer science, digital literacy, and IT) were all present to varying degrees in the old ICT curriculum, the new curriculum places a much greater emphasis on computer science and introduces completely new content in the Programmes of Study (including e-safety content for Key Stages one and two). This creates both opportunities and challenges for schools. While many teachers will need to improve their knowledge and skills to gain confidence in teaching computing, doing so should be a spur for the development of innovative new lessons.

64. Grassroots computing teacher associations such as Computing At School (CAS) and NAACE are contributing significantly to teachers’ efforts to prepare themselves and have created a wealth of innovative resources. CAS has around 2,000 computing resources on its online forum, the majority of which have been created and posted by teachers. Members use an online forum and local CAS hub meetings to swap lesson ideas, highlight and evaluate resources, share and gain expertise, and connect with other teachers in their area.

65. Schools are also supporting the delivery of the new curriculum in interesting ways. For example, Our Lady’s Catholic High School in Preston has been supporting teachers nationwide since 2011 to introduce and develop outstanding computing in their schools.

66. The Government has also committed over £3.5m to support schools in their efforts, including the national Network of Teaching Excellence in Computer Science. Since it was established by the British Computer Society (BCS) and CAS in 2012, the Network has forged links between schools, universities and employers. In April 2013 a further £2m was allocated to CAS and BCS to expand the Network to provide more comprehensive coverage nationally and build a network of 400 ‘Master Teachers’ by March 2015. To date over 260 Master Teachers have been recruited and around 7,000 teachers have received training via the Network. Master Teachers have also made contributions outside of the Network. For
example, a Master Teacher helped create the University of East Anglia’s Teach Computing MOOC (Massive Open Online Course), part one of which over 4,000 teachers participated in. Before the course, 41% reported they felt confident or very confident in teaching the new curriculum. After the course, 72% reported feeling confident or very confident.

67. A further £1.1 million has been given to BCS to develop the Barefoot Computing programme which will create resources to help primary school teachers with little or no experience in teaching computing. To support these resources they will deliver 800 in-school workshops.

68. In February, the Government launched a £500,000 computing matched fund to encourage innovative proposals from sector organisations that would have a positive impact on the quality of teaching of computing in schools, drawing in industry engagement in the form of matched-funding. After the first round of bidding, £338,000 was allocated to seven projects, matched by over £426,000 from the bidders’ partners such as Microsoft, Google and IBM. One project, being led by the Faculty of Philosophy at the University of Oxford, is delivering teacher training that help bridge the gap between block-based languages such as Scratch and text-based languages such as Python and help Key Stage 3 pupils learn text based programming.

QUESTION 7: HOW CAN THE EDUCATION SYSTEM DEVELOP CREATIVITY AND SOCIAL SKILLS MORE EFFECTIVELY?

Lead Departments: DfE and BIS

School curriculum:

69. A key principle of the new national curriculum is to give schools the freedom to design a wider school curriculum that best meets the needs of their pupils and to decide how to teach this most effectively. The teaching of computing is a good example of how many schools can move beyond the specified national curriculum by integrating the learning of knowledge with creativity and social skills. A major impetus to redevelop the old ICT curriculum came from the creative industries — the NextGen\(^\text{270}\) report made a compelling case for a new curriculum that would give young people the skills to be come makers rather than consumers, opening up careers in video games or other digital arts.

70. Though the new computing curriculum came into effect in September, many schools, including maintained schools and academies, are already demonstrating this integration. At primary level students might design an animation in ‘Scratch’, the block based programming language, before learning the computational thinking concepts that lie behind making it. The popular software ‘Kodu’ is based around learners creating games which can then be played outside of the classroom on a PC or games console.

71. Far from being solitary activities, development of social skills are an important by-product of effective learning in computing. Pupils using the products described above, are encouraged to share their products with their peers and place them online where peers can comment on them or rework them, collaborating to change or improve them. These benefits are replicated at secondary level where pupils might work on apps that can be tested on and

\(^{270}\) http://www.nesta.org.uk/sites/default/files/next_gen.pdf
used by their peers, for example an interactive mapping tool to help their junior peers find their way around the school.

72. The development of these skills does not stop at the school gate and students are also benefitting from the work of innovative third sector organisations such as Young Rewired State who bring young people together to work on real world problems by using open data to build websites, apps and algorithms. Government also funds STEMNET (see question 5) to increase the interest of STEM subjects in a creative way.

**Vocational education:**

73. The Education and Training Foundation’s key objective is to improve the quality and capability of leaders and teachers of vocational education. In publishing revised standards for teachers, the Foundation is supporting the sector to ensure that teachers ‘develop expertise and skills to ensure the best outcomes for learners’ and as leaders of learning, that they ‘inspire and motivate learners through their enthusiasm and knowledge’, including by being exemplars of creativity.

74. Within the FE sector the Gazelle Group of further education colleges, are changing the way in which students are taught. Gazelle colleges are collaborating in learning networks to identify innovative and successful curriculum models from across further and higher education. They are also promoting a culture of social enterprise in their colleges, acknowledging the changing values of young people by introducing them to social entrepreneurs. Gazelle College students have access to a full range of national learning events, competitions and conferences designed to encourage students’ creative, business and leadership skills. They have engaged with and been inspired by social innovators, business leaders and entrepreneurs, enabling them to share their knowledge and mentor through peer-to-peer relationships.

**Higher Education:**

75. As autonomous institutions, universities are able to provide a wide variety of differing opportunities for students to develop their skills. Each university has its own individual offer on creativity and social skills. In a competitive market, universities adapt to student-led demand and course choice will be a factor in determining the skills that universities can offer their students.

76. Many universities offer subsidised extra-curricular activities which can help promote both creative and social skills and a number use the Higher Education Achievement Report - a concise, electronic document, following a standard template, the ‘HEAR’ includes not only a detailed account of students’ academic achievements throughout their course, but also a record of any additional awards or recognised activities and roles of responsibility. This encourages students to develop a wide range of skills which employers’ value.

77. Students are encouraged to be active learners in a joint endeavour with their institution and the Government. HEFCE (Higher Education Funding Council For England) is funding the Student Engagement Partnership, which helps students and their representative bodies become active partners in the development of their own learning experience.
78. The Arts and Humanities Research Council has committed £16m to support four Knowledge Exchange Hubs, bringing together university research with creative and cultural organisation to generate new and exciting knowledge exchange opportunities and foster entrepreneurial talent for those involved.

**QUESTION 8: HOW DOES THE CURRENT POST-16 SYSTEM INSPIRE AND EQUIP STUDENTS TO PURSUE CAREERS IN THE FUTURE WORKFORCE IN OCCUPATIONS THAT MAY NOT YET EXIST? HOW CAN THIS BE IMPROVED?**

**Lead Departments: DfE and BIS**

79. The situation whereby education seeks to equip students for jobs that currently do not exist is not new. Industry and jobs are in a continual state of change and education is in part always trying to catch up. Education seeks to equip students with the tools to ensure that they are able to up-skill or develop new skills in the future. Hitherto at its most basic this has been via numeracy, literacy and the ability to study. Now there is an increasing focus on STEM, enterprise skills and on the provision of digital skills which are now as important skills for employment.

**School curriculum:**

80. Recent changes to the system mean that by 2015, the participation age for education will have been raised to 18. The best preparation is for pupils to study a broad and balanced curriculum until 16 which provides essential knowledge, understanding and skills for a wide range of opportunities post-16. This is why English, mathematics, the sciences (including computer science) and languages are included in the English Baccalaureate school performance measure and why mathematics and English each count twice in the new Progress 8 school performance measure by which schools will be held to account from 2016. This is consistent with recent developments and current practice among European and other OECD partner nations.

81. Post-16, it is crucial to build on the foundations laid by the curriculum and continue to emphasise the importance of STEM subjects, which will help equip students for the demands of future occupations. The Government is therefore making significant changes to post-16 mathematics, with the ambition that the majority of students should continue to study it until 18. From August 2014 students who have not achieved a good pass in English and/or mathematics GCSE by age 16 must continue to work towards achieving these qualifications or an approved interim qualification as a ‘stepping stone’ towards GCSE as a condition of student places being funded.

82. Complementing this, post 16 mathematics education is being improved by introducing new ‘Core Maths’ qualifications from 2015, which build on GCSE study and will be valued by employers and universities. These will build young people’s confidence and competence in more advanced mathematical thinking and problem solving. Mathematics and further mathematics A levels are being reformed to make them more rigorous. Government is funding Cambridge University £2.8m to March 2015 to develop an advanced mathematics curriculum and teaching materials for A level.

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83. The Government is supporting increased take up of A level mathematics and further mathematics via the Further Mathematics Support Programme, which provides support to educational institutions who want to offer A level Further Mathematics. The ‘Your Life’ campaign (see question 5) will also seek to target pupils aged 14-16, as age 16 is a key point when many pupils stop studying maths or physics. This will support more young people going forward to take STEM degrees. In terms of careers advice, as set out in question 5, the statutory guidance emphasises the important role that employers can play in giving pupils a better understanding of the current labour market and how opportunities may change in the future.

**Vocational Education:**

84. In response to the Wolf Review, major reforms have been made to vocational education for 14-19 year olds, to ensure that students can choose to study for high quality qualifications that are valued by employers and universities and will give them the skills they need to succeed in the future in fields constantly evolving to make best use of new technology.

85. For 16-19 year olds, new “Tech Levels” provide an excellent pathway to Apprenticeships and Technical Degrees. They are backed by industry and equip students with the specialist knowledge they need for a specific recognised occupation, such as engineering or computing. These new qualifications will be taught from September 2014. A qualification will only be approved as a Tech Level if it is recognised by a relevant trade or professional body or at least five employers representative of the industry sector to which the qualification relates. There are 5 Tech Levels in IT and ICT, recognised by bodies such as the British Computer Society.

86. The Government published its vocational qualification reform plan “Getting the job done” in March 2014. This set out the measures being taken to improve vocational qualifications to make sure they are valued by employers and encourage and support innovation and new technology.

**Higher Education:**

87. The Government’s reforms have brought future employability into sharper focus for institutions and the Key Information Set enables course comparison and captures employment data from former students to inform future students’ choices. (See question 9/14 for more information on the data available).

88. Universities are seeking to support development of graduates as well-rounded individuals equipping them with a set of attributes that they can draw on throughout their lives and careers. As part of this, universities are linking with employers and local/national stakeholders to inform the development of their courses.
9. How can the digital sector be supported in the short and medium term? What is the role for higher and vocational education, national colleges, industry and industrial POLICY?

14. HOW CAN BUSINESSES HELP EQUIP THE WORKFORCE WITH NEW SKILLS IN A RAPIDLY CHANGING ENVIRONMENT?

89. In the short and medium term, the digital sector can best be supported by the Government working together with business and academia to better identify future skills needs and putting in place actions to ensure the right skills are being developed. There is a need for employers to be clear about the skills that they want, which enables them to be an intelligent customer of the education system.

90. Through its Industrial Strategy approach, the Government is working in partnership with industry to set the long term direction needed to give business the confidence to invest - creating more opportunities, skilled jobs and making the UK more competitive so that British businesses can thrive and compete with rising economies. Skills is a key cross-cutting themes for all sectors.

91. The Information Economy Strategy published in June 2013 summarised a number of actions to be taken by business, Government, academia and others to ensure a strong flow of future talent, a skilled workforce and a digitally literate population to reap the economic and social benefits of the digital economy the UK. The Information Economy Council (the Sector Council) is overseeing the implementation of these actions and has also set-up a working group on skills, which brings together expertise from the tech sector to look at these issues.

92. As set out in question 6, industry has been involved in the development of the computer curriculum in England. This will also help to develop people who can use devices and apply technology as well as people who can invent and develop the devices and technology of the future.

Vocational education:

93. Business, academia, local bodies and skills organisations must work in partnership to develop a high level digital skills strategy. In July 2014 the Government announced £18.4m of co-funding for a new employer led industrial partnership, the ‘Tech Partnership’ through the Employer Ownership Programme. The Tech Partnership is a growing, inclusive network of employers with an ambition to develop relationships with businesses of all sizes. Key deliverables of the Tech Partnership are:

- An employer established brand called Tech Industry Gold to design, deliver, quality assure and certificate new, sector-valued development programmes, of which 2750 young people will undertake industry accredited Apprenticeships
- 5000 Continuing Professional Development interventions, supported by a strategic skills fund
- Three Tech Skills Hubs, focusing on cyber security and Big Data, and supporting partnerships
- Employer developed Industry Gold degrees, conversion courses and graduate training programmes, delivered by universities
• An industry-backed Massive Open Online Course (MOOC), which leads to direct interaction with employers for interview practice and the development of employability skills
• A Continuing Professional Development programme for teachers and a new curriculum, to improve their subject knowledge and teaching, to support students who wish to study the subject further and enter into the sector
• Employer led support to careers education, information, advice and guidance for young people with the aim of encouraging at least 14,000 female new entrants to the sector

94. The Government is also looking to create National Colleges in occupations where there is a likely to be particular demand for high level vocational skills. A call for engagement was launched in June and it is expected that the Sector will come forward with a proposal for a Coding College.

95. The Apprenticeship Trailblazers Programme gives employers the opportunity to lead the development of new Apprenticeship standards and the high level assessment. A consortium of employers developed standards for two ICT occupations (Software Developer and Network Engineer) which were published in March 2014. Standards for three further ICT occupations were announced in August 2014 (Software Tester, Digital Marketer and Digital Media Technology Practitioner).

Higher Education:

96. The Government's view is that the best way to produce more employable graduates, with the particular ‘skill-sets’ required for the workplace, is for employers, either individually or jointly, to work directly with universities and colleges. The CBI Skills Survey (July 2014) found that two thirds (70%) of businesses have developed links of some type with universities and nearly half 48% are looking to grow their ties with universities.

97. The Government continues to promote and encourage the creation of placement and internship opportunities, but responsibility rests with businesses and universities, to work together to help students acquire the skills and knowledge that employers need.

98. The Government also provided development funding for a National Centre for Universities and Business to bring together university and business leaders and shares best practice. It covers all aspects of HE-business working, including skill needs, work experience and graduate recruitment.

99. The Government also continues to support graduate internships - through the Graduate Talent Pool (GTP) website www.direct.gov.uk/graduatetalentpool. GTP has proved a useful way of encouraging employers, especially small enterprises, to offer graduate internships, and of ensuring that those internship vacancies are available to the widest possible audience of new graduates. GTP is free to employers and to graduates, provides information and advice on all aspects of internships, and includes a quality assurance process for vacancies. Around 98% of vacancies are for paid internships. The service has carried 60,000 vacancies since 2009, and has registered over 9,000 employers and 103,000 graduates.

100. The Government has also increased the information available to prospective students. All universities now provide a Key Information Set which enables applicants to compare key
information on a course by course basis. This includes employment rates for recent graduates, so applicants can make a judgement about their employment prospects before choosing a course. [http://unistats.direct.gov.uk/](http://unistats.direct.gov.uk/)

**QUESTION 10: IS THERE A NEED FOR INCREASED HIGH SKILLS IMMIGRATION IN THE SHORT-TERM? WHAT ARE THE IMPLICATIONS FOR THIS?**

**Lead Departments: BIS and Home Office**

101. Digital technology companies across the UK are engines for growth, creating jobs and attracting investment and the London Tech sector is set to expand and grow dramatically over the next ten years. The signs are also positive for many of the UK’s emerging regional tech clusters, such as Manchester and Sheffield. However much of this predicted growth will rely on the sector having access to personnel who have the right skills and experience to take it forward.

102. The UK currently faces a skills gap in this particular sector which if not addressed will negatively impact the growth of the sector. Whilst the utmost is being done to ensure these roles are filled by home grown talent in the future, it is impossible to estimate how quickly the gap could be closed by home grown talent alone. British Tech companies will therefore need access to the global skills market to obtain the talent required to grow in the short-term.

103. This has been recognised by the Government and it has recently made changes to the immigration rules to ensure the UK attracts the brightest and best minds in digital technology industry to these shores. From April this year, the Tier 1 (Exceptional Talent) visa route has been opened up to applications from the digital technology sector which will give world-leading experts in the field easier access to the UK and the freedom to take the sector forward. (See annex 1 for more information on tiers.)

104. For those migrants who may not be classed as world leaders but nonetheless have skills which would benefit the sector and the UK, the Tier 2 route continues to be a viable option from which UK digital tech companies can recruit skilled workers to fill vacancies which cannot be filled from the resident workforce. The Tier 1 (Graduate Entrepreneur) route offers a further option for talented graduates with strong business ideas who wish to establish or join a technology start-up company.

105. The Government message is a welcoming one that encourages the brightest and most talented individuals in the digital tech community to come and work in the UK however this needs to be balanced with the need to operate a robust immigration system which is fair to all. Where Government and the sector work together to attract the right talent to the UK digital tech sector, there is nothing to stop it expanding as predicted.
QUESTION 11: IS THERE AN INCLUSION AGENDA IN RELATION TO DIGITAL SKILLS IN THE WORKPLACE? HOW ARE GROUPS WITH PROTECTED CHARACTERISTICS SUCH AS OLDER PEOPLE, THOSE WITH DISABILITIES AND WOMEN BEING ENGAGED? HOW CAN THIS BE IMPROVED?

Lead Department: GDS

106. Reducing digital exclusion is about making sure that people have the capability to use the internet to do things that benefit them as needed.

107. The Government’s Digital Inclusion Strategy, published in April 2014, focuses specifically on the needs of individuals, SMEs and VCSEs (Voluntary, Community, and Social Enterprises) and organisations and seeks to reduce the level of digital exclusion amongst UK adults by 25% by 2016. Government has set up a dedicated team in GDS to drive the strategy’s recommendations forward, funded by a range of departments (see annex 2 for examples of government activity). Progress to date includes:

- Over 50 organisations from the public, private and voluntary sectors have signed the Digital Inclusion Charter launched alongside the Strategy. It commits signatories to identifying and scaling up successful digital inclusion initiatives, as well as developing new and innovative solutions to tackle digital exclusion within and outside the workplace. Signatories meet as a forum to share good practice, offer expertise, advice or resources and help to shape the policy agenda.
- A Digital Inclusion Delivery Board has been established to oversee the delivery of the Digital Inclusion Charter commitments. A sub-group of the Board specifically focuses on upskilling SMEs and VCSEs.
- As a large employer, it is important that the Civil Service also acts as an exemplar organisation where the digital skill of its workforce is concerned. The Digital Inclusion Strategy commits all government departments to ensuring that employees have the skills they need to do their jobs effectively. An annual skills review (launched on 4 August) will identify gaps in skills of civil servants and a self-assessment tool (launched on 1 September) will point employees to appropriate learning and development tools for those who need to improve.

108. In relation to groups with protected characteristics:

- Digital exclusion is greater in the more disadvantaged groups in society - social housing tenants are disproportionately affected (37% lack basic digital skills), whilst 33% of people with registered disabilities have never used the internet. As many as 69% of over-55s lack basic digital skills. Improving people’s digital literacy skills is key to improving the lives of these groups.
- GDS is working with departments to ensure that building people’s digital capability is considered in relation to any policy area where it can make a positive impact. An example is the DCMS £1m Women and Broadband Challenge Fund. The Fund will boost the capacity of broadband projects to develop activity that encourages women-led businesses or potential female entrepreneurs to take advantage of superfast broadband to expand or set-up new businesses, including home-based businesses.
- Many of the Digital Inclusion Charter signatories also have a particular interest in helping vulnerable and disadvantaged groups. Examples of their work include:
Age UK: One-to-one technology taster sessions, short courses, laptop loans, help with setting up computers, Skype and WiFi at home, help with using digital cameras, phones and iPads. These activities are mostly run by volunteers, as peer to peer learning is particularly effective.

Digital Unite: train and support digital champions embedded in social housing communities across the country, to help people get and stay online. Network currently has 18 member organisations, including a national partner in Wales, together representing 2.1 million residents.

Abilitynet: Co-developed a profiling tool ‘Clear Talents’ to help individuals get into work regardless of disability, race, religion, age, gender or any other requirement covered by the Equality Act’s ‘protected characteristics’.

Tinder Foundation: manage a network of over 5,000 UK Online Centres with the aim of widening digital inclusion amongst the most excluded groups in the country. Tinder is also working in partnership with the NHS on the Widening Digital Participation programme, aiming to reduce health inequalities among older people, disabled people and those on low incomes. 97% of centres that receive funding from Tinder Foundation are located in the top 10% of deprived wards in the UK and, in the last financial year, 85% of learners in the UK online centres network were socially excluded, facing a complex combination of barriers to health, wealth and wellbeing.

How it can be improved

109. A number of government departments are jointly funding a piece of quantitative research to get a clearer picture of ‘what works’ in tackling digital exclusion and to help identify the support needs of the currently offline users of government services. Results are expected in the autumn. It is important that the design of future inclusion activity is informed by the results of this research rather than assuming ‘traditional approaches’ will achieve the long-term change required.

110. Digital exclusion must be tackled through a partnership approach rather than organisations competing against each other, eg for funding for training activities. The Charter marks a step change in organisations committing to work together, building on the work of Go ON UK, Baroness Lane-Fox’s digital skills charity. The Government’s digital inclusion activity and that of Charter signatories is being aligned with Go ON UK’s partnership programme which, through its regional rollout, aims to reach the whole of the UK in 2 years, bringing together expertise and efforts from across sectors to work on local problems, boosting local digital skills and capabilities and reducing digital exclusion by 25% in each area.

QUESTION 12: WHAT DO THE BEST LOCAL SKILLS DELIVERY MODELS LOOK LIKE? WHAT IS THE ROLE FOR LOCAL GOVERNMENT, LOCAL ENTERPRISE PARTNERSHIPS AND THE THIRD SECTOR

Lead Departments: Cabinet Office and BIS

111. The Government has implemented significant reform to the Further Education (FE) system. The system is no longer driven by central targets and central commissioning has been removed so that Further Education providers are free to respond to local skills needs.
112. The Government is putting power into the hands of learners and employers through the introduction of loans for those aged 24+, and reforms to apprenticeship funding – building the future skills system around what businesses need.

113. Local Enterprise Partnerships (LEPs) have been given a clear remit to articulate their skills priorities to support local economic growth. The Government is actively encouraging them to work with the FE sector to influence local provision to respond to local economic needs.

114. Evidence from existing SME digital skills programmes delivered by LEPs and their partners shows that a portfolio of activity, including face to face advice; seminars; group workshops; exhibition events; portals; case studies; and action planning events; is effective in engaging SMEs and improving their digital skills. For example, Manchester Growth Hub estimates that by June 2015 the total number of companies engaged through their Digital Growth Service will be 395 and the increased expected GVA will be £8,559,300.

115. LEPs have a key strategic role in delivery of the majority of the EU Structural & Investment Funds (ESIF) 2014-2020. Each LEP has submitted its strategy for the investment of its notional allocation of ESI Funds (which includes European Social Fund and European Regional Development Fund). Most LEPs have decided to opt into the Skills Funding Agency’s ESIF process in order to access £170 million of match funding for ESIF; by doing so, LEPs will ensure they have stronger influence over the use of the mainstream Adult Skills Budget.

116. In addition, Government is going further to meet local skills priorities through local skills pilots to test how LEPs can increase their influence over skills delivery through approaches being developed in three LEP areas: North East, West of England and Stoke and Staffordshire. LEPs are developing details of the pilots, which will be live in the academic year 2014/15.

117. Local areas have been given the opportunity to negotiate new powers and greater influence over the skills system through Wave 1 (2012) and Wave 2 City Deals (2013/2014) such as the Sheffield City Region skills model launched in March 2013 which aims to create 4,000 new apprentices and up skill 2,000 adults over a three year period.

118. Furthermore, all 39 LEPs submitted Strategic Economic Plans in early 2014, which formed the basis of the Growth Deal with Government (all 39 Growth Deals were announced in July 2014). The Government has made £330m of skills capital funding available to LEPs as part of the Local Growth Fund, providing local areas with a powerful lever for increased influence over the FE and skills sector.

119. The London Growth Deal for example includes plans for a pilot for a digital skills programme. Funding is offered from the Local Growth Fund to support the proposed programme. This will complement funding being sourced by the Greater London Authority from the private sector and from other local partners in order to develop a coherent package of support which will ensure a systemic approach to raising digital skills.
120. Alongside Local Growth Fund allocations, LEPs were invited to submit policy proposals for further freedoms and flexibilities focused on driving local economic growth. Skills policy related proposals included:

- LEPs asking for increased influence (in some cases devolution) over Adult Skills Budget to align to local priorities
- Employer engagement and brokerage activities, and/or greater local influence of the apprenticeships agenda
- Payments by Results and outcomes
- Greater influence over National Careers Service provision and a more strategic approach to Information, Advice and Guidance, including a more focused and coordinated approach to linking local employers with schools

121. More generally, Government has agreed to support Growth Deal programmes in Sheffield City Region, Greater Manchester and Liverpool City Region which give direct influence over a proportion of local skills investment. Government agrees to invest £21.7m over 6 years in the Sheffield City Region Skills Bank, which will provide local businesses with more of the skills they need. In addition, the Government has agreed to commit £12m of adult skills funding to Greater Manchester over the next two years (2015/2016 and 2016/2017) so that local residents can access the courses they need to secure good jobs, and £4.6m to Liverpool City Region over 3 years (2015/2016 – 2017/2018).

**QUESTION 13: What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?**

**Lead Department: BIS**

122. Knowledge is now recognised as the driver of productivity and economic growth, leading to a new focus on the role of information, technology and learning in economic performance.

123. While there are a number of barriers for businesses operating in a knowledge based economy the ability to adopt technology and acquire the skills to fully utilise technology are key factors in determining a company’s success. Having the right level skills and digital skills in a knowledge driven economy, in particular, are crucial drivers on labour productivity and innovation activity. However, 28% per cent of SME employers reported that a general shortage of skills was an obstacle to their business success. Market failures suggest the level of investment by employers and employees may be sub-optimal.

124. Central to the efficient exploitation of knowledge and the use of technology in a knowledge driven economy is effective use of the internet. SMEs who make full use of the internet, and associated activities such as e-commerce enjoy particular benefits. According to McKinsey research, they grow faster, export more, and create more jobs\(^2\). Services such as cloud computing allow companies to operate in a cost effective and flexible way, through mobile access to computing and data, the ability to quickly scale their computing capabilities as business needs change, and digitising back office operations to reduce start up and

operating costs. However, many SMEs are not currently making the most of these opportunities, with recent studies showing that fewer than a third of UK SMEs transact online.

125. Research by Lloyds Bank\textsuperscript{273} has identified that the most common barriers preventing small firms from adopting new technologies and taking steps to move on-line are attitudinal. This will often stem from a lack of information about full range of possible ways that they could expand their use of digital technologies and the extent to which greater adoption would benefit their business. Many are also held back by a lack of skills including lack of specialist knowledge or capability. There are also concerns about security. Accessing external advice could help firms overcome these barriers. However, wider research has identified a range of market failures that prevent firms from making optimal use of external advice – with possibly as many as 1 in 3 SME employers having latent demand for advice. Key drivers of these market failures is a difficulty identifying the nature of advice they require; information to quantify the potential benefits and having trust in the quality and intention of providers.

126. In order to overcome attitudinal issues it will be important to articulate the benefits of being digital and fully exploiting the internet more clearly. Given the market failure outlined above, helping equip SMEs with the tools and skills they need to effectively use the internet effectively and trade online (in both domestic and international markets) and to grow their business will also be important.

127. Through the SME Digital Capability Programme, Government has committed to help more businesses get and transact online through online support, mentoring and digital advisors. After an initial pilot in the North East of England BIS is working with Go On (a charity, led by Baroness Lane-Fox, responsible for helping people and businesses get online) to develop a programme to help SMEs acquire the digital skills to use the internet more effectively and transact online successfully. It is also important to ensure SMEs trust and have confidence in the internet. The Government is seeking to educate businesses and other users on cyber security through guidance for small businesses and the Get Safe Online campaign.

128. It is also essential to ensure that the infrastructure is in place to enable businesses to operate in a knowledge-driven economy. Fast and reliable broadband is important as it stimulates innovation in business models and drives business efficiencies. It also supports new business creation by helping start-ups reach new customers quickly. The Government recognises the importance of this essential infrastructure and is transforming broadband provision across the UK. Government has invested over £1bn to ensure that 95% of the UK has access to superfast broadband by 2017 and to improve mobile infrastructure in areas currently without coverage. The Government is also looking ahead to what digital communications infrastructure businesses will need over the next 10 to 15 years. The Government published a consultation on 6 August 2014 to gather evidence to inform the new Digital Communications Infrastructure Strategy, which will consider how this demand should be met.

\textsuperscript{273}The Lloyds UK Business Digital Index 2013
QUESTION 15: DOES THE UK HAVE A COMPETITIVE INFRASTRUCTURE TO SUPPORT A KNOWLEDGE-DRIVEN ECONOMY? HOW DOES THE UK COMPARE TO OTHER COUNTRIES?

Lead Department: DCMS

129. The Government’s ambition is for the UK to become one of the fastest and best connected nations, with a leading digital economy. The UK’s existing infrastructure compares favourably with many of its competitors but the Government recognises that more needs to be done. This is reflected in the vision of the Information Economy Strategy, published in June 2013, for a thriving information economy that enhances national competitiveness and is underpinned by infrastructure. The Government has also put in place successful infrastructure roll out programmes. It has published a spectrum strategy – the availability of spectrum will be an essential component of any future communications infrastructure – and is developing a Digital Communications Infrastructure Strategy to build on the UK’s strong digital foundations in the near term and over the next 10 to 15 years. The Government has recently established a Digital Taskforce, chaired by the Minister for the Cabinet Office. The Prime Minister has asked the Taskforce to build on the UK’s current position in advancing the digital economy, including ensuring our infrastructure is world leading.

130. The Government is currently investing over £1bn in broadband and mobile infrastructure to keep the UK internationally competitive and to support a knowledge driven economy. This is contributing to long term economic growth with a projected GVA uplift that rises to £6.3bn per annum by 2024 and by creating a net increase of 20,000 jobs also by 2024. DCMS has committed £780m to BDUK’s Superfast Broadband Roll-Out Programme to provide over 5 million homes and businesses across the UK with superfast (>24Mbps) broadband, bringing coverage up to 95% by 2017, and to provide virtually all homes with standard broadband speeds of at least 2Mbps. The Government is committed to improving infrastructure across the entire population. In June 2014 DCMS announced the 8 successful bids for its £10m innovation fund to explore ways to take superfast broadband to the most remote and hardest to reach places in the UK. The Government expects these projects to report their initial findings by September 2014. Our £150m Urban Broadband Fund is supporting 22 Super Connected Cities to develop the digital infrastructure they need to remain international competitive places to invest, visit and do business. The fund is already supporting wireless projects in 10 cities and has issued over 1500 broadband connection vouchers to SMEs.

131. Mobile connectivity is increasingly important to business and consumers. The Government has invested £11.6m in a world leading 5G Innovation Centre at the University of Surrey. It is also investing £150m in the Mobile Infrastructure Project (MIP), which is building infrastructure to provide mobile coverage to the remaining 0.3%-0.4% of the population who have no coverage at all. Although the project aims to remove gaps in voice coverage, all new sites will also be capable of providing 4G services.

132. The Government is also taking action to break down barriers and facilitate the provision of infrastructure by industry. Changes to the planning system in 2013 have made it easier to deploy infrastructure. The Government is working with infrastructure providers and developers to ensure all new buildings are equipped with the infrastructure for fixed high speed broadband access.
133. As a result of billions of pounds of investment by industry supported by targeted Government investment and policy developments, the UK performs comparatively well at an international level across an external range of indicators. The broadly based Network Readiness Index produced by the World Economic Forum ranked the UK 9th in the world. The UK leads other major European countries (Germany, France, Italy and Spain – the EU5 including the UK) in availability of services (including superfast broadband), take-up of devices and prices\(^\text{274}\). The UK is rated as the leading e-commerce economy in Europe.\(^\text{275}\) Our current superfast broadband coverage of 73% of UK premises ranks us highest amongst the EU5\(^\text{276}\). The UK is also top of the EU5 for take-up of superfast broadband, with 9 connections per 100 people\(^\text{277}\), and use amongst those connected is more than twice that in other major EU countries.\(^\text{278}\) The UK has the lowest priced broadband amongst EU5 countries and the USA.\(^\text{279}\) Purely in terms of availability and take up of superfast networks and higher end devices Japan and Korea in the Far East tend to score higher than the UK and the rest of EU5.

134. Mobile coverage in the UK is the best in Europe. The Government expects 4G roll out to be the fastest and most complete in Europe. This will be driven by competition; O2 are committed through a condition on their 4G licence to provide 98% indoor 4G coverage by 2017 and all the other main network operators have publicly stated their intention to match this level of coverage by the end of 2015. EE recently announced they are on track to have 6m customers by the end of the year using their 4G network and the other networks are also experiencing strong take-up of 4G.

135. The Government wants to ensure the UK remains a world leading digital economy, competitive to international investors. In common with many of our global competitors, the UK has developed a strategic and policy response to enabling the provision of broadband (the UN Broadband Commission has estimated around 119 countries have a broadband plan). Other countries are now putting in place new plans to further improve infrastructure and the UK needs to ensure it continues to take advantage of the productivity benefits that improved infrastructure will provide.\(^\text{280}\) The Connectivity, Content and Consumers report, published in July 2013, specifically identified a need to develop a longer term digital communications infrastructure strategy. This strategy is being developed now with a consultation document published on 6 August 2014. The strategy will look at how the UK might realise the benefits of having world class infrastructure in terms of innovation, creativity and growth; facilitation of private sector investment; and the role of Government. A further key consideration will be which countries the UK should benchmark itself against to ensure the UK puts the infrastructure in place to remain a competitive world leading digital economy over the next 10-15 years.

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\(^{274}\) The European Broadband Scorecard 2014  
\(^{276}\) Ofcom European Broadband Scorecard – March 2014  
\(^{277}\) Ibid.  
\(^{278}\) Ofcom Communications Infrastructure Report – October 2013, 1.46  
\(^{279}\) Ofcom International Communications Market Report – December 2013, p101  
ANNEX 1 – Immigration Tiers (relating to question 10):

Digital Technology Sector

The London Tech sector is expected to expand rapidly until 2024 and this was supported by a recent report by Oxford Economics predicts that digital technology in London will generate upwards of £12 billion in the next 10 years and create some 46,000 new jobs. The Government is committed to enabling the best international talent to access the UK labour market and the UK employs an immigration system which is aimed at doing just that. There are various routes by which talented and highly skilled migrants can enter the UK.

Tier 1 (Exceptional Talent) Visa

The exceptional talent visa allows internationally recognised leaders, or those showing potential to become future world leaders, in the fields of science, humanities, engineering, medicine, digital technology or the arts to come to the UK and work without the need for a sponsoring employer.

After the recent changes, out of the 1000 visa quota for this category per year, 200 places have now been specifically allocated for applicants from the digital technology sector to enable them to set up business or work in the UK. Tech City UK was awarded Designated Competent Body status for the digital technology sector and as such have the responsibility of advising the Home Office on whether an applicant is an exceptional talent or not.

Tier 1 (Graduate Entrepreneur) visa

The graduate entrepreneur route is for talented graduates who have been identified as having developed genuine and credible business ideas and entrepreneurial skills to establish one or more businesses in the UK. There are 2,000 places available per year. Graduates entrepreneurs who successfully start businesses can switch into the Tier 1 (Entrepreneur) route while those who find jobs working for start-ups can switch into Tier 2.

The route covers graduates of UK universities who are endorsed by a Higher Education Institution, as well as talented global graduate entrepreneurs identified through UK Trade & Investment’s Sirius Programme.

Highly-Skilled Migration

For a migrant to enter the UK using the Tier 2 visa route for skilled workers they must personally meet the criteria for such a visa and rely on a company holding a Tier 2 sponsor licence to sponsor them. Over 28,000 UK employers are licensed sponsors.

There are two routes into the UK for skilled workers. Tier 2 General is for skilled workers with a job offer, for a position skilled to Bachelor’s Degree level. Migrants must be paid a minimum of £20,500 or the appropriate UK rate for the job they will be doing. Companies must comply with certain reporting duties and show that a ‘resident labour market test’, showing that no UK individual was available who could undertake the job, has been met*.

Tier 2 Intra-Company Transfers (ICT) are used by multinational employers wishing to transfer established employees to a skilled position in the UK branch of their organisation. ICTs remain outside the Tier 2 General limit and are not subject to the Resident Labour Market Test (RLMT).
Tier 2 entry visas issued for main applicants increased by 18 per cent to 47,000 in the twelve months to March 2014. Intra-Company Transfers account for around 73 per cent of Tier 2 visas.

*The UK employs a shortage occupation list (SOL) which is part of the Tier 2 immigration route

If the job is on the shortage occupation list then the sponsoring employer does not need to carry out a resident labour market test (although the Sponsor will still need to be 'trusted' and all other visa processes will have to be gone through). Changes to the shortage occupation list are recommended by the expert Migration Advisory Committee (MAC). To be added to the list, a job must be skilled and there must be a shortage which can sensibly be filled through immigration. Some technology jobs (in the visual effects sector) are currently on the list. The Government intends to commission the MAC to review the list again in the next few months and will ask it to consider shortages in the tech sector in particular.

ANNEX 2– Examples of Digital Inclusion activities across the Government (relating to question 11):

**NHS**
The NHS is embracing digital technology; patients will be able to order repeat prescriptions online, book appointments online, and have online access to GP records in 95% of GP practices by March 2015. Those who are most likely to be digitally excluded are also those who are most likely to use the NHS: older people & people with long term conditions and disabilities. Providing digital skills training will ensure that they are not left behind in having convenient access to NHS services.

**Department of Health (DH)**
The Department of Health will increase digital capability amongst all DH staff to the digital inclusion scale Level 7 by the end of 2015. This will be achieved in a variety of ways:

- **The Digital Champions programme**, which aims to develop digital confidence in all staff by providing local expertise and support to a community of up to 200 ‘champions’ (one per branch throughout DH), whose role is to inspire and encourage a digital-first mindset within their teams, and identify opportunities for agile, open, user-oriented or merely more efficient digital transformation
- **Digital coaching for the leadership team** (Permanent Secretary and Directors General), providing 1-on-1 bespoke coaching on trends and innovations in the digital arena which could be harnessed to systemically improve DH’s approach to commissioning, service delivery and communications, delivered via 6 half-hour sessions over a 6 month period
- **Digital Passport** – to be presented by their Digital Champion to all team members reaching Level 7 after a short skills course
- **Digital Communicators’ Curriculum** – a bespoke programme of training for professional communicators, on stakeholder mapping, engagement, monitoring, analysis and insight generation by and through digital comms channels – backed up by ensuring all communications professionals have a digital performance objective
Providing a new DH intranet – a modern digital tool to set the quality and experience example to DH teams

Working to embed a minimum digital skills requirement in all job adverts and job descriptions

Coordinating the questions in the Annual Skills Review across a number of central government departments to make a meaningful benchmark that can be used to check the level of digital capability against ourselves and each other.

Department for Business Innovation and Skills

BIS funded digital skills programmes, although open to all, have been aimed specifically at the unemployed and those individuals with low skills who make up a large part of the digitally excluded numbers. These are not work-place specific, although the basic digital skills set they provide would be valuable in the workplace (and in gaining employment).

Activity is aimed at developing basic digital skills, with further targets for encouraging progression to learning and employment. Progression to jobs and employment activity is presently at 64% against a target of 65%.

In addition over 5,200 individuals have successfully gained the Online Basics qualification - an Entry Level 3 qualification developed by the Tinder Foundation and accredited through City and Guilds, since the qualification launch 18 months ago. Feedback from learners is positive - the qualification is seen as a welcome addition to individuals CVs and improves their employability as proof they’ve mastered the basic skills needed to be confident online. Some learners said this was their first qualification ever, boosting confidence and self-esteem.

In the period 2010-2014 some 1.25m people took part in BIS-funded basic digital skills training, of this approximately 50% were female (although the latest survey figure is 53%), 42% disabled and 16% over the age of 65. Within the programmes, a number of projects have been specifically aimed at older learners such as ‘Baking with Friends which used technology to order the ingredients and to find a recipe.

The key aspect of the BIS programmes has been delivering basic digital skills training at scale to deliver value for money. This is partly because the sheer numbers involved are large – the latest ONS Internet Access Quarterly Update, Q1 2014 estimated 6.4m people in the UK had never been online, while the BBC/Ipsos - Media Literacy: Understanding Digital Capabilities report, estimates a total of 11m people who have either never been online or have lost the skills/no longer go online. There have been some smaller scale targeted programmes to up-skill specific cohorts but these are far more resource intensive and costly.

Later this year, we will launch a pilot to test the impact on skills and employment outcomes of mandating new 18-21 year old Jobseeker’s Allowance claimants with English and maths below Level 2 to English and maths training. The training offered will either be ‘blended’ online with some face-to-face tutor support or ‘pure’ online with virtual tutor support, and is expected to be delivered by consortia of Skills Funding Agency-registered providers and learning technology companies. This pilot will give 10,000 young jobseekers in Kent, Mercia, Devon, Cornwall and Somerset an opportunity to engage with learning in a different way and to work towards either a Functional Skills or GCSE qualification. Although the pilot will focus
on developing learners’ literacy and numeracy skills, the predominantly online nature of the training approaches will also help to develop their digital skills.
ANNEX 3 – Organogram of the Government’s involvement in the digital agenda

8 September 2014
HM Government – Oral Evidence (QQ 250-264)

HM Government – Oral Evidence (QQ 250-264)

Evidence Session No. 20  Heard in Public  Questions 250 - 264

TUESDAY 18 NOVEMBER 2014

Members present
Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Lord Lucas
Lord Macdonald of Tradeston
Baroness O’Cathain

Examination of Witnesses

Nick Boles MP, Minister of State for Skills and Equalities, Department for Business Innovation & Skills and Department for Education, and Mr Ed Vaizey MP, Minister of State for Culture and the Digital Economy, Department for Business Innovation & Skills and Department for Culture, Media & Sport

The Chairman: Thank you very much indeed for coming this morning. As you know, we are nearing the end of our inquiry. There is a bit of housekeeping first. You have a list of interests that have been declared by the Committee Members. They were declared orally at previous sessions and they can be found in the transcripts. This is a formal evidence-taking session of the Committee and a full note will be taken. It will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript and you can revise any minor errors. This session is on the record. It is being webcast live and will be subsequently accessible via the parliamentary website. You are very welcome to submit written supplementary evidence; indeed we may at some point specifically ask for
something if we want further evidence. We are all advised to speak up clearly. Actually I think the acoustics are not bad in here but it is sensible to try to do so.

Thank you very much indeed for coming. I think the best thing to do is if I start by asking you to introduce yourselves and your areas of ministerial responsibility and to make any opening remarks you wish to make. We have obviously had a written submission already.

**Nick Boles MP:** Thank you very much. Thanks for inviting me along. I am Nick Boles. I am the Minister for Skills and so that obviously encompasses digital skills, but I think it is important to point out that Ed Vaizey is the panjandrum of all things digital in the Government. So it is Ed who will lead on most of this but I am very happy to answer any specific questions you have about skills training, apprenticeships and the like.

**Mr Ed Vaizey MP:** My name is Ed Vaizey. I am the Minister of State for Culture and the Digital Economy and I am here very much to support Nick Boles in his role as Minister for Skills. I may not even be here; I may be a hologram. It is a bit like “The Two Ronnies”, “It is good night from me and it is good night from him”.

**Q250 The Chairman:** Thank you very much indeed. I will start with a general kick-off question. We have had a lot of evidence from a lot of people in recent weeks. We have heard about a lot of initiatives, some very good initiatives that are happening all over the place. We have also heard a lot about the importance of creating frameworks and the right conditions for the digital economy to flourish. That is all fine and we have been happy to hear about that. The question we want to pose particularly to you today is—and we have heard that Mr Vaizey is the key figure—to what extent do you think you need one leading Minister to pull together the work across Government rather than it being split in various places? We have been particularly interested to hear how it is done in some other countries.

**Mr Ed Vaizey MP:** I think that potentially you do. I am happy to pitch for that job. I pitched for the job I currently have because I felt very strongly that there needed to be some more joining-up of digital policy. I wanted to get back to being a joint Minister with BIS, which I had been in 2010, and for reasons that were fairly public a lot of my BIS responsibilities moved to DCMS. I think that being a joint Minister is very important in general in government. I am sure you know, Lady Morgan, that one of the biggest difficulties Government has is departments that work in silos, and trying to get something done across two departments is often very difficult indeed. Being back in BIS makes a big difference. It makes a difference in a very prosaic fashion in the sense that you get to see a lot more submissions, submissions that might go to Nick or to Matt Hancock, the Business Minister, and so on. You just know much more about what is going on in another department that is critical to what we are trying to deliver for the digital agenda. That is point number one.

Point number two is that I do think we are getting better, not just by me being a joint Minister but also by the establishment of the Digital Taskforce, which is chaired by Francis Maude, with Jo Swinson from BIS as a vice-chairman alongside me. It is now bringing together three or four different elements of the digital agenda. Infrastructure is one of them, and I do not know how much this Committee will concentrate on that but we have already brought together more than a dozen different digital infrastructure projects in which the Government have an interest. That is not only delivering savings but making sure that we have a much bigger impact for the money we invest. It is bringing together skills—I think Nick is a member of the committee or turns up to the committee when it is relevant—and
issues such as investment in digital technology and various other random issues, if I can put it that way, that are very central to the digital agenda: the Internet of Things, investment in 5G and so on. That is point number two, and that is supported by the Digital Economy Unit that sits across BIS and DCMS.

I think we have made a lot of progress, but in terms of the Whitehall chess pieces you can play, for me, a very entertaining parlour game as to what other issues might be brought to bear. For example, I regard data protection as a digital issue; IP is a digital issue. I worked closely with her predecessor but I work very closely with Baroness Neville-Rolfe on IP issues. Those are two key issues that should be seen as sitting within the digital policy framework.

**The Chairman:** If I can push you on that a little, you have just described a very pivotal role for yourself across BIS and DCMS and then you described Francis Maude’s taskforce, and that is just two. Where would you say the absolute locus is at the moment for digital in government, or where should it be or how should it evolve?

**Mr Ed Vaizey MP:** Nick was right in describing me as the digital panjandrum. I think that it sits with me and that the thinking after the election—I am not talking about me personally—should be about that role and what it encompasses. Essentially, the bringing together of this position of BIS and DCMS has helped in the sense that it has formalised my role with things such as Tech City, the Internet of Things, 5G, as I mentioned earlier, and cybersecurity. It has brought many more things that one would regard as digital at their core into my policy responsibilities, but I do think it is important to work with grown-ups. The extraordinary work that Francis Maude has done on the Government Digital Service and the role that the Cabinet Office can play in engaging with other Whitehall departments is very important. It is not perhaps as neat as you would like it to be but it is a lot neater than it was six months ago.

**Nick Boles MP:** Can I add something? As a reflection, not really anything to do with my job but just as an observer from the outside before 2010 and from the inside of Government, one can overestimate the value of having a Cabinet Minister who has supposedly lead responsibility for an issue unless that is the only issue that he or she is going to have responsibility for. It is not credible in a Cabinet of the size that we customarily have that one is going to have a Cabinet Minister just for things digital. There will always be a Cabinet Minister who has a range of responsibilities, and you often find that while there is a nominal, “Okay, they are at the Cabinet table”, let us be honest, how many decisions are made at Cabinet? Not that many. You will find that you have someone who has a huge range of responsibilities.

The reality of Government is that while institutional architecture and formal positions clearly are important, ultimately it is a human endeavour. Everybody in this Government knows that digital is Ed and Ed is digital. It is just the reality. It has been important that there has been some greater formalisation of that with Ed now having a perch in BIS as well, but ultimately the reality is that that is what everybody knows and so if any of us has an issue we know who to call. I think that that is what matters really. Of course I would love to see Ed in the Cabinet but I do not think that it being a Cabinet position would change things.

**The Chairman:** Would you say that DWP know it is Ed, in terms of workforce planning and the future?
Nick Boles MP: I do. Certainly any Minister would. It may be a reasonable question as to whether an official beavering away on a particular issue does, but I think any Minister will know.

Q251 Lord Janvrin: Could I move from the national to the regional and local and ask you what the national Government’s role is in trying to promote some of these activities at the regional and local level? We have heard about clusters, tech cities, and so on and that a lot of these things are going to happen at a very local level, and just to ensure that you can both answer the question, both in skills initiatives at the local and regional level as well as general policy. The link between what is going on in Whitehall and the regions seems to me to be crucial in this area.

Mr Ed Vaizey MP: Yes, I agree with you, Lord Janvrin. I think it is very important indeed. Again, without wishing to disconcert the Chairman too much, there is another link in terms of my role across BIS and DCMS with Greg Clark, the Minister for Cities. As a result of taking on the BIS responsibilities, I now co-chair with him the Smart Cities Forum, which brings together stakeholders interested in the use of technology to create smart cities. I tend to talk about talking lamp-posts but I was admonished. It is actually intelligent lamp-posts that can monitor air quality, dim or light up depending on who is walking past, monitor noise levels if there is anything disconcerting happening, all this kind of thing. There is obviously much more to it than that, such as traffic monitoring and so on. That is a good link where we are working with the Future Cities Catapult that sits within BIS to work together to support cities in this very important issue.

Greg is the lead Minister on the Growth Deal, so he works with cities and regions in putting together growth deals. That is an issue where to a certain extent it depends partly on my advocacy to work with cities to encourage them or support them, where they see the opportunity, to promote the creative industries and digital industries as part of their growth. There are several cities that make a big deal of that; Birmingham springs to mind.

The third element to this is my responsibility with Tech City. Tech City, particularly since Joanna Shields took over the chairmanship, has very consciously emphasised its work in clusters. It has 13 clusters that work with Tech City where they share experience, and again I want to stress that is not a London-centric dynamic where London is explaining to 12 other clusters just how it is done. It is a meeting of equals where people are exchanging views. I was very pleased when the Deputy Prime Minister announced the creation of Tech City North. In a sense that is partly a point of emphasis to emphasise that there is more to Tech City than just the London cluster. It means money, because there is a small amount of money to support networks developing in the north. That is a third element where we have a clear regional strategy. I would sum it up as the smart cities working with the LEPs and the Tech City clusters.

Lord Janvrin: Can I come back before Mr Boles comes in? Do you see this as a top-down process or are you able to see a cluster emerging as sometimes they do without it necessarily being fed from the centre? Have you done a lot of research on why clusters form and what you need to get a cluster off the ground? That is something that other witnesses have talked about.

Mr Ed Vaizey MP: I think it is much more of a bottom-up exercise. Tech City was not imposed on east London. It emerged as a way of saying here was a cluster and asking what
Government could do to work with that cluster, almost as an R&D centre. Out of Tech City have come things like the entrepreneur visa, for example: people being able to have a direct relationship with Government and explain some of the hurdles they face. I do not think we were picking clusters as part of that cluster alliance; they picked themselves. The same was true with the City Deals. If Greg Clark was here he would tell you that the City Deal is on the table from central government but what you get out of the City Deal comes from those who come to the table to ask for funding or support in certain areas.

There has been cluster research. I am afraid I do not have details in front of me. NESTA, for example, has done a very good piece of work, I think 18 months or two years ago, on what fosters clusters. Clearly it is critical mass but it can be things like rents, the skills-based universities, further education and existing companies with strong research arms, Cambridge being the most obvious and high profile example of a science-led cluster.

**Nick Boles MP:** In the skills area you have—to use that ghastly phrase—a matrix where one axis is industries and another axis is localities. A key part of our reform, which I think is working and is welcomed, is about putting employers in charge of developing the standards, whether it is developing standards for apprenticeships or developing other training programmes. That is what the Digital Partnership is about and all the Trailblazers. We then have six standards that have been approved. Of course, those standards will be offered anywhere in the country where a college or a training provider working with an employer wants to create and offer an apprenticeship.

But there is a local axis, and perhaps the best example of it is the recent deal, announced by the Chancellor, with Greater Manchester, where you saw that they had a very strong desire to have a more active role, as Boris does, in working out what they need locally, where they should be putting their money and which institution should be focusing on which specialisms. I think that is right and proper. The City Deals were one part of that process. If there is a more embedded, long-term way in which we can put local areas with proper electoral accountability in charge of the skills provision in their areas, that is very welcome too, but it should not cut across the idea of putting employers in charge of the standards. It is for them to work out what investments to make locally to unlock those industries.

**Q252  Lord Lucas:** There is a very large number of active and intelligent participants all round the country in this sort of area. I would suggest that what they need from Government is to know what organisation they should be committing their relationships to and that that organisation will last over time and be well looked after and well funded so that they can invest their efforts in building that relationship and know that it will return something. Who do you see as those government actors? Is it local enterprise partnerships or the National Careers Service? Particularly if it is local enterprise partnerships, what do you do if one of them is not performing well locally? How do you bring it up to scratch?

**Nick Boles MP:** Do you mean specifically in relation to skills or more broadly?

**Lord Lucas:** Skills particularly, yes, but—

**Nick Boles MP:** First, there is the careers advice and guidance. I know it is an area that interests you greatly and it is an area in which there is a lot of digital activity and digital initiatives. It is the National Careers Service that leads in this, but we, as the Government, have recognised that while there is a plethora of different organisations, social enterprises and private organisations out there offering services, many of them online but some of them
also offline, there is very little light-touch co-ordination and very little sense that there is one place to go where you can find out exactly who is best at doing the thing that you want in the area you are in. That is something that schools need because they have a lot else on their plates and they are not necessarily expert in this area. While I do not want to jump any guns, something that we are quite focused on is how you fill that gap. Without creating bureaucracies or anything like that, how do you nevertheless fill that gap?

At the moment the National Careers Service is the prime locus, but I think it may be that over time there will be somebody else who takes on that task.

Lord Lucas: Locally is it LEPs that—

Nick Boles MP: Locally, that is a very good question. It is true in all of life, is it not, that you have this permanent tension that if you have local responsibility some people are good at it and some people are rubbish at it, and if you have central responsibility they are very far away and they are probably pretty mediocre, neither good nor rubbish. It is difficult. Where we have perhaps struck the right balance is that we are giving responsibility to localities that show and evidence a willingness and an understanding of what they need to do to raise their game and take the responsibilities. I think that City Deals and this much more fundamental deal with Manchester will show the way.

If you are in an area where the local enterprise partnership is focused on other stuff—and that is not totally unreasonable; their prime needs may be transport infrastructure or whatever it is—it is probably right that you are not pointed to go to the local enterprise partnership because they are not currently engaged in sponsoring digital activity. The broadband initiative, as you know, has not relied on local enterprise partnerships. That is something with contracts that have been let through local authorities in every area because you need to have a certain level of consistency about the programme that perhaps local enterprise partnerships at the moment would not provide.

The Chairman: Just going back to the LEPs for the minute, we have had pretty clear evidence that some local hubs and local LEPs are working brilliantly and doing what you would hope they would do and that others frankly are not. There seems to us to be something of a gap where Tech City or whoever goes in and identifies that there is really good potential here for X industry to move to a more digital stage of development—it could be a great opportunity for this region or sub-region—and the LEP is not going to seize it or put the right partners round the table. They do not have great higher education links. What is the role for Government to make that happen, or are you saying that there is no role and that it can happen only if there is the right energy there for it to move forward?

Nick Boles MP: I think that probably has a whole lot of relevance to other areas that Ed can talk about. Just on skills, ultimately if an LEP is able and willing to take a responsibility, that is brilliant, but I do not want a hopeless or perhaps otherwise focused LEP to be a barrier to this happening. Ultimately if there are employers who are willing to invest and there are colleges and other training providers who want to offer apprenticeships, that can just happen. If the further education college, the private sector provider or the social enterprise provider has a direct relationship with a skills-funding agency that sits with us, they can get the funding for those apprenticeships. The apprenticeships are done according to the Trailblazer standards that we know the industry values, and if they value them they are going to value them in Lincoln and Bristol just as much as they do in London and Manchester.
I think there is quite a lot that will happen through leadership of institutions of training and of skills provision without government direction, but obviously if there is a local government or a local enterprise partnership that is willing to take on a bigger role, we are very willing to work with it.

The Chairman: On the wider point?

Mr Ed Vaizey MP: I am rather enjoying Nick’s reflections on life and how one leads it, so I will try to echo that. There are good people and there are not such good people. How does one deal with that? To a certain extent there is no rulebook. You have to deal with it as you find things. On your specific question of, say, Tech City identifying a cluster focused on a particular technology and thinking the LEP is not up to it, I do think that Lady Shields very much has a seat at the table as the Prime Minister’s lead adviser on technology. She works very closely with me and we work very closely with Greg Clark. To take a hypothetical situation—it has not happened yet—where we say that a particular cluster really needs a boost because we have this critical mass of companies and the LEP is just not engaging, you would probably see us as a ministerial team, if I can put it that way, looking at ways in which we could get the LEP to recruit more skilled people to help us, because we would need the LEP’s help.

What I am saying is that there is no prescriptive solution. It might involve working with the council or direct negotiations with the LEP. I think that would be how you would address an issue like that, but it is quite a tight group; all of us are effectively focused, with BIS and No. 10, on supporting those clusters.

The Chairman: It was her chief executive who left us feeling that there was something of a gap in the process. He did not say that but we were left after the evidence thinking, “Where is the follow-through in this situation?”.

Q253 Baroness O’Cathain: This Committee was set up to ensure that we got up to speed on digital skills and were aware that the digital economy was here, particularly in terms of our industrial competence and competitiveness with countries that are much more advanced in digital skills and digital knowledge. What I am hearing from you is that if the LEPs want to take it up, that is fine. The reality is that it is so important for the future of everybody in this country, particularly those who are excluded at the moment and the young ones who are coming through who get to the age of 14 and then fall off a cliff. There is no continuity. I just wish that you would come and say, “Digital is probably the most important thing facing us. If you ask us what the most important things are to deal with in this economy to ensure our competitiveness, jobs and growth, it is digital skills”.

Nick Boles MP: I fear, Baroness O’Cathain, that there has been a misunderstanding, which I am very glad you have raised because I need to clear it up. We are not saying that if an LEP is not going to take the lead we are not going to do anything. We are saying, “This is going to happen anyway. If you, an LEP, want to have a role in taking a lead, great. Come forward with a proposal and we will entertain it, but it is happening whether you like it or not. The curriculum from primary school has been changed universally, for every single school, whether you like it or not. The offer of apprenticeships and Trailblazer standards is happening throughout the industry, whether you like it or not”.

We probably should not be too Eeyore-ish about our standing in this. The embrace of the British people, British businesses and British non-businesses of digital everything far
outstrips almost all our natural competitors. This has not happened as a result of
government direction. It has happened because everybody out there is grabbing this. That is
why we are investing a lot in broadband so that everybody has access to broadband, and
why we are changing the curriculum in the way that we have done and changing the
approach to skills.

I think the specific question was about where local government or authority leadership is
going to come from, and I am saying that if it is there, great, but if it is not there we will just
get on and do it anyway.

**Baroness O’Cathain:** You did mention en passant about us being leaders. Do you have any
information that shows that we are leaders internationally? We are finding those statistics
rather difficult to come by. I am asking you now, and if you could send them to us we would
be grateful.

**Nick Boles MP:** I was more talking about the use of digital in shopping and everything else
rather than specifically skills, but I will look and see if we have anything.

**Q254 Lord Kirkwood of Kirkhope:** I was very disappointed that Nick Boles was trying to
discourage us from playing the parlour game of who goes into the Cabinet and who does
not. I thought he was selling his colleague short by not promoting the interests of Mr Vaizey.
The evidence that we have heard suggests that the skill challenge does require direct
Cabinet interest. We have heard evidence, and the potential impact on employability levels
over the next five years surprised me, and continues to surprise me. We have heard that as
many as 30% to 35% of existing current jobs may be at risk because of the threat from
artificial intelligence and its impact.

I know a little about this because as a constituency Member I represented a seat that
manufactured cashmere knitwear at high volumes. They were completely wiped out over a
10-year period by Chinese competition. Everybody saw it coming, no plans were made, and
we ended up with an emergency. I think Gus in the Scottish Office helped us with some
Scottish Enterprise job relocation schemes. My point is that it devastates communities, and
if some of the evidence that we have heard is true, what happened in towns like Hawick in
the Scottish Borders will happen across the country.

It is reassuring and I am sure it is important work. I absolutely agree about dealing with the
silenced nature of some of these problems, because joint working across departments will help
you to do that, and you are working very hard on some of these second-order issues, but are
the Government up to the scale of the challenge? I think you will be interested when you see
the written evidence that we have received. Is the current response at a strategic level at
central government up to dealing with what could happen to employability?

In parenthesis—an important point made by the Chair—the Department for Work and
Pensions is responsible for work and that is in another silo perhaps. Convince me. I know you
are all working hard and I am convinced about that, but I am talking about the strategic
challenge over the next five years at a central government level. Are we doing enough?

**Mr Ed Vaizey MP:** Yes, I think we are, and I obviously would not give you a different answer,
given that we are from the Government and we are here to help.

**The Chairman:** Tell us what the Government could be doing more of.
Mr Ed Vaizey MP: Adopting the philosophical and reflective tone that is coming from your two Ministers on what you do about new technology changing the job market, to a certain extent there will be changes in the job market and people will be doing different skills. You mentioned Scotland. I was up in Liverpool yesterday and containerisation fundamentally changed Liverpool’s economy. Government has to be alive to these changes, but we also know that the Scottish economy lost one sector of jobs but also gained in terms of silicon chip manufacturing for a period of time, so jobs will change. I was at a technology conference recently where Mike Lynch, formerly of Autonomy, was talking, and he said that when computers came in people said that they would take the place of the accounts department, but of course what they did not say was that you are then going to be recruiting lots of people to run the computers.

The fundamental point is that we have to prepare for a shift in jobs and a lot of them will be knowledge-based and IT-based, so what do we do about skilling up people in this country for those jobs? There are three or four things I would say in response to that. First of all, going back to my earlier answers about clusters, I think that the Government focusing on clusters is a very good thing, because you work with your partners locally to put some energy behind skills training and recruitment in those areas. For example, the Digital Catapult that we have just launched has also launch with three regional centres. One of them is in Bradford, because it has a cluster of health technology companies. Brighton is another good example. That is one thing you can do.

The second thing is this point about putting computer coding into the curriculum. It was a hard-fought battle within Whitehall to get that change and I was delighted that it happened, because in opposition I had been told time and again by people recruiting in this area that too many of our kids are learning how to use computers but not how to write the programs that sit behind them. That is an important change. It will need investment. There is some investment going into training teachers and that change will take time to come through, although one should not underestimate the ability of our children, as I am sure you are aware, to teach themselves how to do a lot of this stuff.

The third thing is that technology will change how we do further education and higher education. We have a massive emphasis on apprenticeships, and I think those two changes come together by saying that in this world of digital technology, where things change so quickly, you can no longer have an education where you simply sit in a classroom and learn from a teacher. You have to engage with the world of work, not to earn some money while you are a student, not to get it on your CV, but actually as part of the way you learn the skills you are going to need in the workforce. We are looking at innovative ways of reshaping further education and university courses to very much include that. A lot of that will also include the opportunity to learn online as well, because we have to be conscious of people already in the workforce who need to gain the kind of skills to take their businesses forward.

It is a massive challenge, I agree with you, but we are very focused on it. I would say—and I hope this does not come out wrongly because I do not want it to sound like complacency—I think that every developed economy is facing these challenges. I do not think we can pretend that the grass is greener on the other side, that some other country has somehow unlocked this and realised what to do. In fact, the perennial thing we always get is, “Look at Korea”. I was pleased to learn the other day that the South Koreans are looking to us and saying, “It is very smart of the British to have put computer coding into their national curriculum. We should be thinking about doing the same in Korea”.

615
Q255 Lord Kirkwood of Kirkhope: As a result of this inquiry and the experience I have had, I would be looking for more urgency for the next five years. What do I know? I am a social security specialist. I think the answer is fine as far as it goes, but we could be facing a transformational change in employability in this country and I am nervous that we do not have a grasp of just how different this will be.

Mr Ed Vaizey MP: Nick is going in in a moment, I can tell, and having both of us outside the Committee trying desperately to get the other one to answer the questions, we are now so fired up by the discussion that we both want to dominate.

I would meet you halfway, Lord Kirkwood, in the sense that one of the pieces of work that the Digital Taskforce is looking at is literally a map—perhaps a very analogue approach—of where courses sit and which courses are successful in getting people into the kind of jobs they need. What we want to do is grip this, and it goes back to another theme that is dominating this discussion, which is the role between central government and local government. From the centre, we do want to grip this sense of urgency to make sure that these courses are up to scratch. The other thing I want to do, which Baroness O’Cathain and others might be interested in, is grip with employers. There are so many initiatives coming from employers and there needs to be an element of coherence as well—lots in skills, lots in further education—and fundamentally to bring these two together, the quality of courses in further education and higher education, plus the really now important role that employers have to play in skills. What I am taking from your questioning is not just urgency in pushing our reforms even further and faster but also perhaps a shouting from the rooftops about why this is important, and I do not think we should underestimate that. When we talk about things like 5G and the Internet of Things, I do not only say that Government is investing but that Government is talking about them, and just talking about them helps people to focus and push forward.

Nick Boles MP: You may well be right, and in a sense you are right. If you have not heard it, we are somehow not communicating it. But I think there has been a dramatic shift in the last four years, and this is not really a political point; it is more about time passing. Four and a half years ago digital was an industry. It is not an industry; it is the way life, all of life, is going to be. Whether you are a farmer, a factory worker, a teacher, a care worker, a mum, a pensioner or anybody, digital is how life is going to be. That is why I think it is important that it is not just a BIS thing where BIS thinks about the digital industry when it then thinks about the automotive industry. It is not like that.

The one new element that I would focus on is that where I feel the greatest sense of urgency is in English and maths, particularly the maths end of English and maths. I am about to go to the Association of Colleges conference, and they are quite grumpy with us because we have made it very clear that if you leave school without a C in GCSE English and maths we expect you to go on studying for GCSE English and maths throughout the time that you are at FE college until you get it, unless you are in such a position that you cannot do GCSE, in which case you need to do something else. You need to do another high-quality but perhaps more practical English and maths qualification. It is the idea that you are literally handicapped, it is like cutting off a leg, if you leave school or full-time education without being numerate. Once upon a time you could work in a warehouse, you could stock shelves, and it did not really matter if you did not have great English and maths. Now you will have a handheld computer and you will be completely stuffed if you do not have some basic facility. I think you are
right; it is absolutely urgent, but I generally believe that we are seized of that, even if perhaps we have not managed to communicate it to you.

**Q256 Lord Aberdare:** I love the idea of launching a catapult. I am trying to get my mind round that.

Can I ask you about some of the risks involved in the new digital economy and what you see as Government’s role in managing those? We have heard a lot about the challenges of cybersecurity, cybercrime, personal risk such as online bullying and identity theft. Two messages have been coming across very strongly. One is that these need to be absolutely central to the educational and skills-building process, that people need to understand how to use digital safely and with security. The second is that there is a really strong opportunity here as well, which the UK could perhaps build on because we have some real strengths. The question in that context is what Government can and should do to foster those two things.

**Mr Ed Vaizey MP:** I would echo what Nick said earlier: that it is not a partisan point but that over the last four years we have seen these issues come to the fore and be absolutely central to what Government does in policy. If you talked about cybersecurity five or six years ago it might have been a kind of noises-off issue. Now it is absolutely front and centre, because so many of us, whether as a business or an individual, need to be secure online. I think we did something very good in the early part of this Government in 2011. At a time when we were looking at having to make savings, a really significant sum of money, £860 million, was put behind the national cybersecurity strategy that we launched. A lot of that is for national security, for very obvious reasons, but a lot of that money also goes to support businesses and individuals.

We work with SMEs, mainly online, to give them checklists about the kind of things they need to keep themselves secure, whether it is a complicated password or antivirus software. We work with business and internet service providers, with consumers and parents in particular about staying safe online, and with schools. We work with professional agencies, lawyers and accountants, because we see them as a gateway. One accountancy firm will be advising potentially hundreds of small firms, so we work with them to say, “As part of your professional advice to your clients, you should be talking to them about cybersecurity”. We are working, as you may have seen reported in the press recently, on an identification scheme for government services called the Identity Assurance scheme, which is work in progress. The Department for Education takes issues such as cyberbullying very seriously, as does the Director of Public Prosecutions. So there is a whole range of activity.

On your point about this being an opportunity for the UK, absolutely it is, and at the end of this month I will be going to a cybersecurity trade fair in Qatar. I co-chair, with Gavin Patterson from BT, a cybersecurity export committee. We work with businesses in the UK that have expertise in this area. A lot of these businesses work with Government and with businesses in the UK. We have a great deal of expertise that is an opportunity as an export market for the UK as well.

**Q257 Lord Holmes of Richmond:** I would like to look at the level of ambition. We have touched on this a little. There is evidence to suggest that the UK is falling behind other economies. What can the Government do with the digital strategy and any other means to ensure that the UK is positioned as a global leader?
Mr Ed Vaizey MP: I hesitate to take on Lord Holmes, but I would question whether there is evidence that we are falling behind. Nick already mentioned that the UK consumer drives a lot of innovation in this country. We are ahead of the game in our adoption of e-commerce and new technology. Funnily enough, a lot of that comes from the bottom up. I would say that the UK is probably the technology capital of Europe. It is where a lot of companies come to scale up and grow. While I think we are among the leaders—and certainly I feel that about our dealings with, for example, the European Union where people look to the UK for leadership on a lot of digital policy areas—where I would absolutely agree with Lord Holmes is that there is no room for complacency.

To answer your question, what are we doing, first of all, to echo what I said earlier, is talking about it, which again sounds prosaic but is really important. We talk about how the UK wants technology investment, how we want to support technology companies not just starting up but scaling up. We invest in the future, so we work with universities and other countries to invest in research in things like the Internet of Things and 5G, smart cities and so on. We create a business-friendly climate in terms of straightforward corporation tax reduction and things like the Enterprise Investment Scheme. We work with employers on skills, for example in the Tech Partnership, and in building digital infrastructure, which we have talked about in passing, the rural broadband programme and the like. I think that we are among the leaders in the world, but we are not complacent and we continue to push forward on many fronts.

Lord Holmes of Richmond: I agree with all that you have set out. That is all good stuff, but we heard earlier about the obvious importance of literacy and numeracy, and we would all agree with that. Do you think that within government there is the same level of urgency and understanding about digital to make it literacy, numeracy and digital? Much of what will be literacy and numeracy, the way people will adopt and gain those skills, will come through digital. It is almost literacy, numeracy and digital, with digital underpinning literacy and numeracy as well. Do you honestly feel that in government you can see digital absolutely alongside that level of importance with literacy and numeracy?

Mr Ed Vaizey MP: Yes, I do. Again, to a certain extent one might stretch the definition of digital here. Sometimes Education Ministers get themselves into trouble, and I straddle what I do not necessarily regard as a divide of the cultural world, the arts world and the digital world. Sometimes when Ministers are straining themselves to emphasise the importance of science, technology, mathematics and engineering they can be criticised by my colleagues in the arts world of somehow saying that the arts are less important. I do not think by any stretch of the imagination that it is an either/or; nor do I think my colleagues are saying that. I think they are trying to make up a gap in how perhaps some of the science and technology subjects are seen.

One of the unique characteristics of the UK, which again puts us in the lead in digital, is this blending of the arts and technology. It is why a lot of companies want to come here to invest: because of the creativity. Whenever I go to a school to talk to them about the importance of the arts and digital, I have to get out my iPhone and explain that it is a hot seller not just because of the technology it contains but because of the beauty of its British design. We do strain every sinew to try to get the message across that digital is now absolutely part of the core skillset, and in fact Nick said that very forcefully in one of his earlier answers. It is part of the skillset that you really should be leaving school numerate as well as literate and digitally savvy.
Q258 Baroness O’Cathain: There are few resources to invest in digital skills, with more cuts pledged after the next general election. In this context, how do the Government plan to meet the immediate needs of the tech sector to realise the ambitions of the industrial strategy?

Nick Boles MP: First, it is important to say that in general more cuts are going to be needed, whoever is in government after the next election. There are no specific plans for cuts to further education and skills budgets, but it is reasonable to say that they have been a target for some cuts in the past and they are unlikely to escape entirely unscathed. Having said that, within the skills budget there is quite a lot of scope for movement between different areas. The biggest emphasis that we have had so far, and which we will continue, is on shifting funding away from qualifications that bluntly did not really give anybody a skill that was going to be of any use in a job towards qualifications and programmes that are going to add value to people and make them more employable. It is very likely that we will see a continuing shift in resources into apprenticeships and traineeships, more employer-based learning and fewer full-time courses at colleges.

Also on apprenticeships and traineeships, I would be delighted to see digital apprenticeships that critically—relating to the previous point—do not just prepare you for work in the digital industry but prepare you for work in the banking industry, in retail or whatever it is, and those will take an increasing share of apprenticeships funding. That ultimately is going to be demand-based. The more employers who want to offer apprenticeships that accord to some of these new digital standards, the more we will be able to fund those rather than slightly less high-value apprenticeships of the traditional kind.

The Chairman: Do you not need to get your foot on the pedal a bit more on all this? We have had a lot of evidence about FE skills, and the tiny number going into digital apprenticeships at the moment, and the clunkiness of the system as it stands, and that there are good changes happening but still an awful lot of people going through courses and coming out not really prepared for things. It is not nimble enough and it is not fast enough. Is there not a case for a much bigger shove to shake this whole thing up?

Nick Boles MP: I hope it is not entirely cheeky, Baroness Morgan, to point out that you started a revolution in schools, and that it took several terms of a Labour Government and this term of a coalition Government and it is still not complete. We have only just over 50% of secondary schools that are now enjoying those academy freedoms. Big changes to a complex and mature country do take time. We are replacing apprenticeship standards with Trailblazer standards that have been formed by employers. All apprenticeship standards are due to be replaced by these new standards by 2018, but not the idea that one can literally just sort of switch completely from one system to another system overnight.

Our biggest challenge, particularly on apprenticeships, is persuading employers to do them. We have only roughly 10% or maybe 13% of employers offering apprenticeships. We need it to be 20%, 30%, 40%, 50%, but that is a matter of persuading them that it delivers for them, that it is relevant to them. What is interesting is that you never find somebody offering apprenticeships and then pulling out, but it is getting them over the line. We are all possible speed, but equally we need to get it right and we need to be realistic about how quickly you can transform a system. We have had 2 million apprentices in this Parliament. That is quite a lot of people to move from one system to another.
Q259  Lord Macdonald of Tradeston: Looking forward to the next Parliament, 2015-20, we have heard that they need to try to prioritise this and have more urgency attached to it. You described the co-ordination in Whitehall, which made a bit of sense and I can understand completely why Mr Vaizey, who is an excellent communicator, has this role. But looking forward, we are finding that there is a lot foreboding around. It is very bewildering and people do not know which initiative they should be pursuing or cannot find one that suits them at all. It needs probably in the next Parliament more central direction and reassurance. With all due respect to DCMS, that is not where the Minister should be put in the next Parliament. That Minister should be in the middle of the Cabinet Office, leading perhaps the Digital Taskforce with a much stronger platform and a much louder voice.

Do you not have to turn up the volume here, partly to persuade colleagues but also to persuade the general public, who I think are directionless and rather fearful at the moment, just to say, “We will try to protect you, to advise you, to make sure the budgets are protected that will help you through this critical stage of our national journey.”?

Nick Boles MP: It is for the Prime Minister to decide. I am going to save Ed’s blushes by saying that I would not be more delighted than to see Ed Vaizey as the Secretary of State for the Digital Economy and the Creative Industries after the next election, but ultimately the Prime Minister will decide.

Mr Ed Vaizey MP: I know that if we do win the election, Nick will be the Skills Minister. We need him to do the job for five years to ensure that we have continuity in this role.

What I would say, Lord Macdonald, is that the enjoyable thing about appearing in front of a Lords Select Committee is that it is not an inquisition, it is more of a dialogue. I think you make a very important point about reassurance. Nick and I can tell you about all our initiatives, and I do think we are making real progress, but the challenge put forward from this Committee is a narrative and the challenge is this reassurance point. We are going through a period of deep transition. From where I am sitting it looks like a land of great opportunity for the UK. From where other people are sitting it looks like change and uncertainty. So we need to bridge that gap and I think the point is well made.

Q260  Lord Haskel: Can we move on to the question of HE and FE colleges? What is your view about ensuring that education colleges deliver the skills that are needed in industry?

Nick Boles MP: I should point out that my specific responsibility is further education, not higher education. I think there is a difference between universities and colleges, because universities have traditionally been less tightly regulated by Government. Ultimately, with the way the university system is now set up, with tuition fees and loans reflecting the true cost of an education, or at least much more closely than before, there is much greater ability and likelihood that universities will be forced to respond to the consumers. I do not know if you have noticed this, but I have noticed in every conversation I have with somebody between the ages of 16 and 22 that they are much fussier customers than certainly we ever were about what they are actually getting from their universities. If their universities are putting them on programmes that do not lead to jobs, the faster that we can publish the destination data—some key measures are going through in the small business Bill at the moment—the more likely it is that the market will work and that students will drive out courses that do not prepare them for a life of fulfilling employment and back those that do.
In FE colleges, the way we are riding that is we will do that too. We will also have destination data about the different courses, but the key driver is apprenticeships. I am sorry to bang on about it, but that is the most important thing. Ultimately, if you have apprenticeships, they are jobs, not training programmes. They are offered by employers and if those employers have both designed the standard—or at least their colleagues in the industry have designed the standard—and are offering the jobs, I think we can be reasonably confident that the training that will be provided as part of those jobs will be relevant to an actual piece of work rather than just theoretical. I think that is the way to do it: to drive up the share of apprenticeships in the total further education pot—and that is what we are trying to do.

**Lord Haskel:** I am old enough to have been to a technical college before they became universities and that is precisely what they did. You worked at a company and you were taught at the college. Would you not think that if you want to get more firms to do more apprentices, the way to do it is to get FE colleges to help them along the way by sharing the load?

**Nick Boles MP:** Obviously FE colleges are critically involved in providing the formal training for apprenticeships, but I agree with you. Yesterday, for entirely personal reasons, I was at Birkbeck College for a graduation ceremony that my partner was going through. Birkbeck College is one of the most extraordinary institutions of learning in this country. How does it do it? It does it by offering part-time courses to people who are holding down jobs, who are often a bit older when they are doing it and may take a little longer to do it. It gets consistently rated as one of the best universities in the country by its students and it is producing value. To some extent, I am surprised by how slowly the university sector has changed. I would have expected, and do expect in the next 10 years, a much more rapid embrace of sandwich courses, shorter courses, longer courses, more part-time courses, so that people can be learning alongside working rather than just having this stage at the beginning of your life that you leave behind and never returning to a textbook or a lecture.

**Lord Janvrin:** Can I follow up, Nick, on something you said earlier about the length of time it takes to embed real change in apprenticeships, for example? I think that is what you were referring to. It is a philosophical point, but the fact is that we do not know what the jobs that you are now preparing for are going to be—the old argument—because things are changing that quickly. How are we addressing that fundamental problem? It takes time to change, yet the world outside, the world of work, is probably changing faster.

**Nick Boles MP:** It is always a fascinating tension, is it not, because on the one hand there is the idea that employers will have the best idea of what skills are relevant, but if those employers themselves change and disappear or are merged, if the jobs are completely redefined, how relevant is it? The answer is that there is much more common at the heart of work than perhaps we think. Of course you need specific skills and you are going to have to update those consistently, and just doing an apprenticeship at the age of 19 or 20 is not going to mean that you will have all the skills that you will need at the age of 40 or 60 to hold down the job you have then. But if you have acquired those skills in employment, your chances of being able to make yourself consistently relevant, to understand what is happening around you, to go and fill in the gaps where you need it, are much higher than if you had done it in an entirely separate institution that is an institution of learning where, for the best will in the world, most of the teachers have been working in the institution of learning and have not been working in the world of work. I think there will need to be
constant updating, but the apprenticeship is more likely to offer you skills of immediate and lasting value than a theoretical course.

**Q261 Lord Lucas:** I would be interested to know, as an aside, whether Mr Vaizey has been pleased with the response of universities to the Next Gen report that put a fair old bomb under them when it came to games courses.

Mostly I wanted to ask Nick, several things you have said echo what witnesses have said to us—notably Karen Price of e-skills—about the need for up-to-date, industry-standard, short, funded courses, so that people who want to change career or return to work can prove to themselves and an employer that they are up to whatever new job they are looking at. Is there any hope of getting such a thing?

**The Chairman:** That is really what I was talking when I talked about the clunkiness of the system at the moment. It was not really about apprenticeships; it is about the rest. It is the courses that they are all slogging their way through where industry are saying, “We really think you could do this in four months and it would be very useful”.

**Nick Boles MP:** I accept that. The key word you used from the point of view of a Government in our circumstances is “funded” and funded by whom. I think we have to be very clear that if you have already received a qualification of some kind and you are therefore trying to update, renew and refresh your skills, we want to make it as easy as possible for you to take out a loan to fund your further learning. We are not going to be in a position where taxpayers are funding people to go on taking short courses throughout their working lives. It is simply not the reality, but I think expanding the availability of the loan system to help people do that so that they can call it off on roughly similar terms to the student loans is the way we are moving, and we will need to move further.

**Lord Macdonald of Tradeston:** But the piloting of that has been pretty unsuccessful. Do you have any theories as to why it has not been more successful?

**Nick Boles MP:** What was unsuccessful was the switching of apprenticeships for people of that age group on to loans. Bluntly, we decided that was a mistake and we have gone back to the previous system. I do not think it is clear what other courses might come later. If you are somebody who is doing an apprenticeship and therefore doing a qualification at that level for the first time in your life, given your other circumstances it may be rather hard. The whole point of an apprenticeship is a job, and the idea of having to take out a loan to get the training for a job where you are being paid less than you would otherwise be if you were fully trained was perhaps a bridge too far. I think the idea of a 35 year-old who already has a set of qualifications taking out a loan to do a one-month course or a three-month night course or whatever it is to give them a particular set of relevant qualifications is something that we should explore, and I suspect that will be more successful and will take better.

**Q262 Lord Macdonald of Tradeston:** We have heard the evidence that SMEs are vitally important to the future of the UK’s digital economy but are facing numerous challenges. How can the Government better support SMEs?

**Mr Ed Vaizey MP:** I gather than in 2012 website sales amounted to £164 billion, so SMEs are doing very well. We have something called the small business capability programme, an elegantly phrased programme, where we are working with industry to reach more than 1.5 million businesses, and that is taking place over the next five years. Echoing some of the
earlier answers, we work with LEPs and with Go ON, which as you know is the charity that promotes digital inclusion, and we are about to launch a nationwide campaign to maintain our momentum. That is what we are doing.

The Chairman: We have heard that there is some great stuff but that in other places SMEs do not have a clue about digital really. It is a bit back to the point of what works and what does not. Where there is a strong chamber of commerce, they are doing some quite interesting stuff, and where there is not they are a bit in a hole. It is really back to our earlier point, is it not?

Lord Aberdare: It also applies to apprenticeships, of course. Everybody is trying very hard to get the SMEs involved, both in the skills and in the apprenticeships, and it is proving very difficult. I do not know what the answer is.

Nick Boles MP: The key thing we want to come up with and we are making pretty good progress on, although we have perhaps gone down a couple of blind allies, is the funding reforms for apprenticeships. We need to basically get the money to employers as simply as possible, consistent with basic checks that they are not spending it all on trips to Rio. The challenge I set officials is that I just want to write a cheque and send it to the company to provide an apprenticeship. Then I want a proper assessment at the end to make sure that the apprenticeship they delivered was the proper one and was according to the standard, and if they monkey about they do not get any money next year for apprenticeships, rather than creating some incredibly elaborate system. You are not going to get small companies to do it if it is complicated, but equally we do need to have them in the driving seat. That is the tension.

Lord Aberdare: I think that mechanism also needs to take account of the way SMEs work in this area. You need to look specifically at ATAs and GTAs and how they can be part of this.

Nick Boles MP: Absolutely. It is particularly important for small companies; that is exactly right. We want to encourage intermediary bodies that in effect will employ the apprentices and then place them with perhaps more than one employer, if that is the way it should work, in order to complete the apprenticeship. The key element is that they have to be separate from training providers. They cannot be the marketing front end of a training provider, because if that happens you get locked into a particular training provider and we do need there to be a competitive market in the providing of the training that is attached to the apprenticeship.

The Chairman: I am going to make this the last question, because I am conscious of the time, which means that we will not come to careers as such but I think we touched on it earlier on. If you wanted to send us anything extra around careers, that would be very helpful.

Q263 Lord Lucas: How do we get teachers up to speed so that they can support the learning revolution, and how do we make sure that all kids have access to the internet at home?

Mr Ed Vaizey MP: Lord Lucas, I agree with you that that is the big challenge. It is one thing to say that we are going to put computing into the national curriculum, it is quite another thing to deliver it. I am pleased that the Department for Education—I will speak on behalf of the Education Minister sitting next to me—has put in more than £3.6 million to help existing teachers to get ready for the new curriculum. This includes £2.1 million for computing at
school, to expand the network of teaching excellence in computer science and to create 400 master teachers, and a further £1.1 million to develop the Barefoot programme, which gives primary teachers the opportunity to develop their subject knowledge through 800 workshops across the country. We are also working with Microsoft, Google and the Raspberry Pi, which goes back to my point about getting clear coherence about which companies are working. We are also working with Code Club, which as you know has volunteer expert trainers and they are training 3,000 primary schoolteachers. We are also providing bursaries for teachers who want to teach computer science.

As to how can every child get the internet, that is down to me full square, and the biggest part of my job is the rolling out of rural broadband so that people have access to broadband. I think that it is a good thing in this country that broadband is relatively cheap. We have a competitive marketplace that means that it is cheaper, but I recognise that there will be households for whom either broadband is not seen by the head of the household as something to have or it may be too expensive and we need to look at that in terms of digital inclusion. We also need to promote organisations like libraries, where there is a huge opportunity to go and use your library to access the internet. I was in Liverpool yesterday talking to people who had been to Birmingham the day before. They are two new central libraries around with students using the internet, and I think libraries are a very important part of that.

Q264 The Chairman: Can I push you a little on two things? I thought we would get those stats, because we have had them before. I do not know whether you know how many schools there are. Do you know how many schools there are?

Mr Ed Vaizey MP: Off the top of my head, around 18,000, slightly more.

The Chairman: About 25,000.

Mr Ed Vaizey MP: About 25,000? Eighteen thousand primary.

The Chairman: We have had Code Club and we have had all the people you would expect in front of us, who are doing great stuff, but again the question is how we kick the system to get there faster, because on this one we cannot wait. We have had some great teachers, but they are honest enough to say that not many of them are able to do this at the moment. The strong view of the Committee has been that there is some great stuff, but how are you going to give this a much greater emphasis than you are at the moment and make it happen faster?

Mr Ed Vaizey MP: Is that a rhetorical question or—

The Chairman: You can give me a little answer.

Mr Ed Vaizey MP: As I say, it is the great challenge. We are at the early stages; it has just come on to the curriculum. My colleagues at the Department for Education have put money behind training teachers, but I agree with you that with 25,000 schools there is a big ask. It is not as if this is landing from out of space. There will be teachers teaching IT already, so there is already a core group. This is to give teachers who do not have those skills the opportunity, particularly in primary schools. But again it is part of the beauty of the computer science environment that there are a lot of people like Code Club who can come in and help. So there are lot of big society type initiatives that are already well under way in engaging pupils with computer science.
**Nick Boles MP:** Ultimately, we operate a decentralised but inspected system. It is part of the curriculum. They will be assessed by Ofsted on the quality of their teaching and the delivery of the curriculum, and they are used to that. The curriculum has changed over time and they have been asked to do different things. They have to gear up and working with all these different programmes is a way of doing it. Also it is about getting the teacher training programmes, Teach First and all the others to take this seriously so that everybody they send into the system has these skills. Not every teacher needs to be able to teach coding. You need to have some in each school, and with the number of new teachers coming into the system there is a good chance of making sure that those are coming through.

But it is an absolutely urgent priority, just like equipping further education teachers to be able to carry on teaching English and maths GCSE. That is a huge challenge too, but once it is part of the expectation they do need to be able to get organised.

**The Chairman:** Thank you very much indeed. That was a very constructive conversation.
On the 18 November, Nick Boles MP and Ed Vaizey MP provided oral evidence to the House of Lords Digital Select Committee. The Committee requested to see any available supplementary evidence on how the UK compares internationally on the digital agenda.

In a response to one of the questions, Nick Boles highlighted Manchester as an area that was working well in terms of delivering the digital skills agenda. Supplementary information on the work that Greater Manchester is doing on digital skills is also provided.

Key international comparisons:

**Digital sector:**

Exports: the UK is second in the EU behind Germany, and globally fourth behind Germany, the US and India. The UK has by far the largest trade surplus in Computer and Information Services ($9.7bn) in the G7 and the EU and it is bigger than even in China.\(^{281}\)

Foreign Direct Investment:

- The UK has by far the largest stock of FDI in the Information and Communications sector in the EU with £67bn – which is over 30% of the EU total (2012).\(^{282}\)
- Six UK universities ranked within the world’s top 60 for engineering and technology.\(^{283}\)

**Digital entrepreneurship:**

London is emerging a premier location for digital entrepreneurship - London’s tech/info sector rivals in employment size (282,000) the tech sector in New York (411,000) and San Francisco-Silicon Valley (397,000).\(^{284}\)

UK tech companies are starting to choose to issue an Initial Public Offering (IPO) in the UK rather than the US - No UK tech companies have listed in the US since Jan 2011 to April 2014, apart from one (King); in the same period, over 20 UK technology companies listed in London (the majority on AIM, the junior market).\(^{285}\)

There are greater rates of investment in FinTech in the UK than similar investments in Silicon Valley - The annualized growth rate of the value of FinTech investment in the UK and Ireland (51%) was more than twice that of Silicon Valley (23%).\(^{286}\)

The UK Venture Capital (VC) market is improving: UK VC is getting more specialised e.g. in cloud computing and big data; funding from VC firms for London tech sector has tripled in the last financial year.\(^{287}\)

\(^{281}\) 2013. UNCTAD, a UN stats agency

\(^{282}\) ONS

\(^{283}\) Cambridge, Oxford, Imperial Collage London, University of Manchester, UCL, University of Edinburgh. TechCity 2014

\(^{284}\) Bloomberg Philanthropies 2014

\(^{285}\) Deloitte May 2014

\(^{286}\) Accenture March 2014
Digital infrastructure:
The UK, with 70-75% of households covered, has the highest level of superfast broadband coverage for households amongst the EU5, overtaking Germany (65-70% of households covered) and Spain (60-65%)\(^{288}\).

New digital technologies:
Assisted Living – the UK is the 2\(^{nd}\) biggest market in Europe for assisted living technologies (after Germany) and one of the fastest growing markets in Europe\(^ {289}\).

Cloud computing

The UK data centre market is currently estimated to be the second biggest in the world after the West Coast, USA\(^ {290}\).

- The UK has been ranked as the lowest-risk destination in Europe, and second lowest in the world, for businesses to locate their data centres\(^ {291}\).

E-commerce:
UK consumers are active and confident online shoppers. 68% of customers in the UK buy over the internet. The UK ranks among the top 3 European countries in this respect (after Denmark and the Netherlands) and is well ahead the EU average of 53%\(^ {292}\).

The World Economic Forum’s (WEF) Global Technology Report 2014 cites the UK as having the best developed e-commerce in the world: the UK ranks first for business-to-consumer (B2C) internet use.

Cyber security:
Both the UK cyber security sector and UK cyber security exports are forecast to grow faster than the global cyber security market during the period from 2013 to 2017.

Open data:
The UK is leading the world on open data and has made more public datasets (over 15,000 to date) openly available than any other country.

In 2013, the UK came top out of 75 countries in the Open Knowledge Foundation’s Open Data Census, which assessed countries against commitments to open up data, the type & format of data, and the volume being released\(^ {293}\).

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\(^{287}\) The Economist June 2014
\(^{288}\) Ofcom March 2014; includes UK, France, Germany, Italy and Spain
\(^{289}\) Arup 2013
\(^{290}\) Datacenter Dynamics 2012
\(^{291}\) Data Centre Risk Index 2013
\(^{293}\) http://national.census.okfn.org/
In the same month, the World Wide Web Foundation published its ‘open data barometer’ which measured the impact of open data initiatives and in which the UK was ranked highest out of 77 countries\textsuperscript{294}.

The UK has some of the most sophisticated health data analysis, planning and programme implementation systems in the world. The NHS has been a pioneer in the development of a single, comprehensive and instantly accessible and analysable database\textsuperscript{295}.

**Digital industries in Manchester:**

**Background:**
Greater Manchester has developed its creative and digital industries to the stage where they represent the UK’s biggest centre for the industries outside the Greater Southeast.

Creative and Digital Industries account for **105,000 jobs** in Greater Manchester (GM) and generate **£4.7bn per annum** of economic output.

This specialisation is forecast to increase over the coming decade as MediaCity UK and other assets continue to develop.

The Digital and Creative sector is one of Manchester’s priority growth sectors.

**Key activity underway:**
Through its Employer Ownership of Skills Project, Man Diesel/ GM Chamber have developed an **Employer Skills Group** bringing employers and training providers together to develop skills programmes; this ESG is led by ANS Group, an award-winning cloud expert with offices in Manchester and London.

The **GM Apprenticeship Hub** (funded via the City Deal) is supporting local training providers to deliver Advanced and Higher level Apprenticeships in relevant subjects including IT Software, Web & Telecoms Professionals and Creative & Digital Media.

The Skills Funding Agency has recently consulted LEPs regarding their priorities for additional funding to allow providers to deliver greater volumes of Higher Apprenticeships in priority sectors. As part of this exercise GM LEP requested funding for an additional **187 Higher Apprenticeships** for the Digital and Creative sector; the Agency is currently finalising allocations to providers in response to this, and other, LEP requests.

GM’s recent Growth Deal included **£1.3m Skills Capital Local Growth Funding** to support Salford City College in the creation of a £4m state of the art creative and digital media centre for traineeships, apprenticeships, other skills and management training. The centre will recreate live working environments and act as the primary academy for creative and digital media employment skills training at Media City UK. Funding is subject to submission of a successful business case by the College.

\textsuperscript{295} UKTI 2014
Key local sector representatives, including from UK Fast and Sharp Futures are engaged by the Agency as Apprenticeship Ambassadors, promoting the benefits of Apprenticeships and Traineeships to the sector, supply chains and beyond.

9 December 2014
Professor Tim Hitchcock, Adam Crymble, and Dr Jane Winters – Written evidence (DSC0021)

Submission to be found under Adam Crymble
The Humber has a fast growing digital sector and is building a reputation for digital innovation and creativity. The region has significant grouping of companies working in digital branding, online marketing and advertising, packaging design, digital media, web design and build, app and game development, software development and other forms of digital content creation. The status of Hull as UK City of Culture 2017 offers a unique opportunity to develop and promote the region’s creative and digital sector. There are also significant opportunities for digital companies to support innovation in traditional industries with a strong presence in the region, such as food, chemicals and engineering, as well as the growing renewables and offshore wind industry.

The Humber LEP has contributed the development of the Humber Digital Education Proposal. This document was produced in consultation with education providers and employers in the region and sets out a vision for how the delivery of digital education in schools. The Humber will seek to become a national test bed for the approach detailed in this proposal (Annex 1).

The changing technological landscape

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

The pace of change in digital technology we are experiencing at the moment is rapid and likely to increase as more and more electronic devices become 'connected'. The incredible growth of mobile device usage such as SmartPhones and Tablets has generated opportunities for digital media production companies to create solutions for these types of devices. These have mainly been in the form of apps or websites. As more and more household items (toasters, fridges, hoovers) become 'connected' more software will be required to manage users’ data and usage habits.

In January 2014, the CBI launched a new strategy for creative industries (The Creative Nation). The UK’s creative industries are found in every region and nation of the UK and are thriving in a number of ‘creative hubs’. The expansion of digital platforms presents opportunities for creative industries – gaming, communication design, marketing and PR, e-commerce and the internet economy. British consumers are some of the most ‘digitally savvy’ in the world - smartphones, internet on the move. Creative industries are trailblazers in embracing this expansion of the online market place.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

Nil response.

3. What is the employment impact on the UK’s labour market? What are the regional differences?
The region currently produces a considerable talent pool of people with relevant high level skill sets. HE providers in the region (including the University of Hull, Hull School of Art and Design, Hull College and Grimsby Institute) have particular strengths in software development, gaming, digital creativity, digital media, simulation and visualisation, and dependable and intelligent systems. This provision is supported at FE level by NextGen computing courses at various institutions.

However, this provision is set against a background of generally low skill levels and aspirations in the region. Although aspirations and skills levels are rising as optimism about the region’s economic future returns, there is still a tendency for highly skilled young people to seek employment outside the region. Anecdotal evidence from local education providers suggests that many students are recruited directly on graduation into major employers from outside the region, and internationally in some cases. In some cases, over 50% of graduates on a given course leave the region.

Conversely, it is noted that major local employers who have built close links with education providers are successful in recruiting graduates to local jobs. This suggests that one way of retaining talent in the region will be to forge closer links between employers and education providers. Our conversations with employers indicate that, while larger employers find it relatively easy to engage, the small and micro businesses which make up the vast majority of the digital sector regionally find it difficult to find the time and resources to engage effectively.

**Future workforce**

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

Local digital sector employers tell us that the digital skills they need most are computer programming skills and creative design. They recognise the need for a strong pipeline of talent to provide a skilled workforce for the growing digital sector. This starts in school, with high quality computer science education which inspires young people to study industry relevant courses and HE and FE and pursue careers in the digital sector locally. Local colleges are experiencing dramatic increases in the numbers of registrations for digital courses, with one provider seeing a 100% increase in enrolment for Level 3 Computing courses from 2013-14 to 2014-15.

There is evidence nationally of a deterioration in the skills base, coming from industrial leaders within the computing industry who have raised their concerns that the lack of skills, such as programming and software development, impede the UK’s potential to maximise opportunities within this globally competitive market.

A report by the National Endowment for Science, Technology and the Arts (NESTA) highlights how the creative computing industry is no longer able to maintain its position as a global leader. As part of its recommendations it states that there needs to be significant investment in computing skills development within secondary schools at Key Stage 4 and the Further Education sector within the UK.
As a consequence of underinvestment, highly skilled labour is now imported into the UK; a direct result of the lack of home grown talent. Currently 90% of digital courses in the UK focus on “softer” skills and fail to effectively bring both the STEM and creative arts disciplines together. The lack of emphasis on more academically challenging areas such as developing programming skills and gaining proficiency in the software packages most commonly used in industry means that these courses fail to provide the level of skills needed to meet the needs of industry.

The creative skillset is an essential counterpart to coding in terms of the skills required in the digital sector. This issue was highlighted in the 2011 Next Gen report into the skills needs of the gaming and SFX industries, and is key to transforming the UK into the world’s leading hub for videogames and visual effects. The same combination of technical and creative skills has applications across a wide range of industries.

In this context, it is important that students are not conditioned to view the digital and traditional creative skills sets as being separate and discrete: they rarely are at a highly professional/industry level. They work hand in hand, and so need to be taught that way from the start, rather than leaving it to further education providers and employers to re-integrate these skillsets.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

Local employers find that University graduates come to them equipped with a solid background and understanding of fundamental computer programming languages. However, they are lacking in commercial programming languages such as Objective C for iOS App development or Java for Android App development. Employers believe that aligning the computer programming courses to more 'real world' requirements will give greater benefit to the students and businesses.

Educational institutions in the region are already working to build closer links with employers to ensure that their provision meets the needs of the local economy. In response to consultation with local employers, Hull College Group has recently launched its Digital Manifesto, which refocuses digital provision around:

- **Digital Creativity**: Offering contemporary curriculum which explores technological innovation and convergence in arts & the creative industries.
- **Software Design and Development**: High-quality and relevant skills development and training to provide the regional economy with highly capable software developers.
- **Digital Infrastructure**: Curriculum and facilities to produce technicians skilled in managing today’s advanced digital networks.

The digital manifesto also demonstrates the College’s commitment to training and development, research and development, a talent bank and search and selection matching skills to jobs. Hull College has a Cisco Networking Academy, which delivers industry recognised certifications.
Two FE and HE colleges in the region, Hull College and Grimsby Institute of Further and Higher Education, host incubation spaces for creative digital start-ups run by Platform Studios. These incubation spaces offer a bridge between education and employment, offering talented people opportunities to work alongside established businesses and support to start their own companies.

The Centre for Digital Innovation in Hull works with Hull College, University of Hull, and local secondary schools that teach Computer Science curriculums, developing apprenticeship schemes, supporting Young Enterprise, securing internships and mentoring start-ups. They have observed that technology and education are changing, with increasing recognition that graduate employment is not the only option. The team at C4DI advise and guide students on alternative routes including apprenticeships, placements and employment post GCSE and A Level.

It has been suggested that greater use should be made of Massive Open Online Courses and other digital learning tools to deliver teaching and learning in schools. In addition to offering access to high quality teaching resources and expertise, MOOCs have the advantage of allowing students to learn at their own pace. This is particularly relevant to the teaching of digital skills due to the challenges faced by teachers in mastering new material and the existence of a significant minority of self-taught students whose digital skills are more advanced than the content suggested by the curriculum. The use of digital learning tools across a wide range of subjects is also effective in introducing “non-techy” learners to the capabilities of digital tools and building familiarity with their usages. This has the potential to develop a non-digital workforce which has the skills and knowledge to use technological solutions effectively.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

The increased emphasis on computer science, rather than ICT, in the school curriculum from September 2014 poses considerable challenges for schools. Many schools lack teachers with the necessary confidence and expertise in teaching computer programming to teach the subject well. Schools and colleges need support to teach computer science, in a way that not only equips students with vital skills, but inspires them to become the digital pioneers of tomorrow.

In order to deliver the computer science curriculum confidently, effectively and in a way that engages and inspires students, teachers need to become experienced and competent programmers with a good understanding of how to teach computational thinking. Learning computer programming is analogous to learning a language and requires a significant personal commitment from the teacher to fully grasp the subject. Furthermore it requires continuing practice, to build the skills, until proficiency is achieved.

In early 2014, the Department of Computer Science at the University of Hull, responding to a significant demand from schools in the Humber region, created and delivered a small pilot programme to help address the skills gap in teachers moving from ICT to the new computing curriculum. The pilot involved 29 teachers from 17 local schools, and consisted of 2 hour weekly evening workshops in the autumn and spring terms, with the aim being to teach how
to programme in Python. Further details of this programme and the proposed next steps can be found in the Humber Digital Education Proposal (Annex 1, p.14-16).

7. How can the education system develop creativity and social skills more effectively?

Initiatives to help the education system develop creativity and social skills, such as collaboration and teamwork, have a major role to play in teaching relevant skills for the digital sector, as well as inspiring ambition and entrepreneurialism.

The Humber Digital Education Proposal (Annex 1, p. 17-18) suggests that a broad programme of enrichment activities in schools and communities would be effective in giving young people the opportunity to apply their digital skills and learn more about the challenges and excitement of working in the digital sector. Activities of this type are essential to engaging young people in learning digital skills through participating in creative projects and offering opportunities to apply coding skills to solving real life problems. Furthermore, by developing skills such as teamwork and problem solving, these initiatives will increase the employability of young people in the region.

The Humber has a strong portfolio of existing events and initiatives, but aspires to deliver a more comprehensive package. Current initiatives include:

- **iDEA Award scheme** - Hull City Council and the Be Enterprising Group are working closely with Nominet Trust to deliver their iDEA Award scheme. The scheme will pilot training for teachers in the delivery of digital skills badges. Each badge will be based on gaining a specific digital or enterprise skill, and be endorsed by an industry-leader known for its expertise in the area.
- **Platform Expos** – Platform Expos is the largest gaming and content creation expo in the north east of England, with 6,000 visitors over 2 days, including over 1,000 students from local schools attending workshops, speakers and discussion panels.
- **Game Jams and Hackathons** – events in which participants create a game in 48 hours. The 2014 Global Game Jam Hull had over 200 participants, with judges from major industry players Microsoft, Jagex, Boss Alien and Sony.
- **STEM Ambassadors** – a programme supporting STEM industry professionals to get involved in activities in schools.
- **Big Bang and Teen Tech Events** - learning experiences run in schools across the region and as larger regional events.
- **Local volunteer-led programmes and initiatives including Code Clubs and Saturday clubs.**

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

Please see response to Question 5.

**Short- and medium-term support to the digital sector**

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

Please see responses to questions 12 and 13.
10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?
Nil response.

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

The Humber LEP runs a Women in Digital, Gaming and Tech Group, which has begun exploring ways of supporting and encouraging girls and young women to pursue careers in the digital sector. This activity is likely to focus on raising the profile of female digital role models in schools, mentoring, raising awareness of careers in the digital sector for women and running a programme of extra-curricular activity aimed at engaging girls and young women though digital creativity and real world projects.

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

LEPs have a vital role in leading and co-ordinating skills delivery models. They are ideally placed to drive connections between local authorities, education and skills providers, higher and vocational education, national colleges, industry, and industrial policy.

The Humber LEP has established a number of successful initiatives linking industry and skills provision. The Humber Skills Pledge enables businesses to connect with skills and training organisations by signing up to a number of pledges, including employing a local graduate, taking on an apprentice or offering a work placement. A new online CEIAG portal is currently being developed by the Humber LEP in partnership with local employers. The portal aims to raise the profile of local opportunities in priority sectors such as digital, as well as providing access to career and course information.

Through the Humber LEP Growth Hub, digital businesses in the Humber can access information and advice about accessing national schemes to support the sector, including funding for apprenticeships, support to trade internationally from UKTI, access to finance and general business support.

**Industry**

13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

The Humber LEP Digital Sector Group has identified the following areas of activity that the Humber LEP could deliver to assist digital SME to overcome barriers to operating in a knowledge-driven economy:

Promotion and marketing

- Raising the profile of the Humber offer nationally and internationally, promoting the Humber as a great place to base a digital business and to raising awareness of the quality of our local digital businesses.
Showcasing the Humber digital offer locally, with the aim of retaining talent, promoting collaboration between digital businesses and demonstrating the innovative capacity of digital technologies to businesses in other key sectors (e.g. engineering, health)

Access to Finance

- Facilitating access to finance at three distinct points in the life of a business: start up, mid stage investment, incentives for traditional businesses to invest in digitally based innovation.
- Establishing a digital investment fund, matching private investment with public sector funds. This should be a flexible fund, allocating funding with the aim of developing new products and services, stimulating collaboration and increasing efficiency and profitability

Skills

- Developing a programme of activity to assist schools to deliver high quality, relevant digital education to meet the future needs of industry.
- Supporting SMEs to improve their visibility to students in order to encourage school, college and university leavers to build their careers in the region.

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

Many UK firms are not confident about accessing high-skilled employees in growth areas in the Creative Industries, hi-tech and IT. Closer links between employers and skills providers are necessary to increase employer understanding of the education system and facilitate the co-design of skills provision for the existing workforce. The government can actively boost the development of in-work skills: the apprenticeship reforms will support this if apprenticeship training supports sectors like the creative industries.

Infrastructure

15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

Nil response.

Contributors

Humber LEP Digital Sector Group (Membership comprises industry, education and sector support representatives from Sonoco Trident, Strawberry, Sypro, Missing Mojo, Kcom, Gateway Interactive, University of Hull, Platform Expos, C4DI)
Humber LEP Digital Education Group (Membership comprises University of Hull, FE colleges, secondary schools, STEMNET, Education Business Partnership)
Eon Visual Media
Hull College
Platform Expos
Bishop Consulting
C4DI
1. Proposal

This proposal was requested by Graham Stuart, MP for Beverley and Holderness, from Lindsay West, Founder of Platform Expos, Platform Studios and Platform Doha, Joint Managing Director of Garthwest Ltd., Partner of the World Trade Centre Hull and Humber and Board Member of the Humber LEP, to outline responses to the challenges faced by schools in implementing changes to the computing curriculum and equipping young people in the Humber to contribute to and benefit from the growth of the digital sector in the region.

The programme aims to inspire the digital pioneers of tomorrow: young people who aspire to careers where they can create and innovate in some of our most exciting and fastest moving industries. We aim to equip young people in the Humber region with technical and digital creative skillsets that are essential to the growing digital sector as well as raising aspirations and showing young people the real opportunities to build a career in this industry within their local area.

We propose that the Humber region is utilised as a test bed for innovative approaches to digital education, by piloting the proposals outlined in this paper with a view to developing and sharing best practice.

The proposal was developed in consultation with the Humber LEP Digital Education Group, comprising representatives from the University of Hull, FE colleges, secondary schools, STEMNET, Education Business Partnership and the Humber LEP. The proposal was compiled by Lindsay West and Sarah Clinch, Humber LEP.

2. Issue

The increased emphasis on computer science, rather than ICT, in the school curriculum from September 2014 poses considerable challenges for schools. Many schools lack teachers with the necessary confidence and expertise in teaching computer programming to teach the subject well. Schools and colleges need support to teach computer science, in a way that not only equips students with vital skills, but inspires them to become the digital pioneers of tomorrow.

In this context, it is important that students are not conditioned to view the digital and traditional creative skills sets as being separate and discrete: they rarely are at a highly professional/industry level. They work hand in hand, and so need to be taught that way from the start, rather than leaving it to further education providers and employers to re-integrate these skillsets.
The Humber LEP has identified the digital sector as a priority sector for driving economic growth in the region. The Humber has an excellent digital sector offer, encompassing excellent connectivity; educational institutions teaching programming skills and digital creativity to a high level and a rapidly developing support ecosystem for creative and digital businesses. There are significant opportunities for growth in gaming and digital content/asset creation; digital media; and emergent applications in healthcare and tourism.

Furthermore, digital skills are essential to supporting innovation and competitiveness across the regional economy, for example, in the applications of visualisation and simulation in training for the engineering sector and the offshore wind industry. World class digital education is vital to the future economic growth of the region.

3. Programme Aims and Ambitions

The programme will establish the Humber as a centre of excellence for education in computer science and digital creativity, equipping young people with high level skills and offering them excellent opportunities to apply and develop those skills throughout their careers within the region.

The programme will deliver four main outcomes

Outcome 1: Teachers will be equipped with the skills, confidence, resources and support they need to deliver high quality computer science teaching.

Outcome 2: Children and young people will be confident and skilled in coding, programming and using digital media to solve real world problems.

Outcome 3: Children and young people will be inspired to explore careers in the digital sector and will have an excellent grounding in the skills they need to do so.

Outcome 4: Employers will be able to recruit skilled and motivated young people with industry relevant skillsets and a good understanding of the realities of working in the creative industries and other sectors which utilise digital skills.

Lessons learned in the Humber will be used to develop a national programme of support for the teaching of computer science.

4. Programme Elements

This proposal outlines a holistic programme comprising the following elements:

- Supporting schools and colleges to deliver the programming elements of the computer science curriculum by teaching existing teachers programming skills and equipping them with the confidence and resources the teach coding effectively, linking local expertise with support from the national Computing at School community.
- Supporting schools and colleges to integrate digital creativity and digital media into the computer science curriculum by teaching existing teachers to use digital creative tools and equipping them with the confidence and resources the teach students how to use these tools effectively.
Partnering with major industry partners both nationally and locally to deliver an inspiring, engaging and relevant curriculum, which offers children and young people access to industry standard equipment and provides insight into careers in the digital sector.

- Developing skills and inspiring ambition and entrepreneurialism through a broad programme of enrichment activities giving young people the opportunity to apply their digital skills and learn more about the challenges and excitement of working in the industry.
- Establishing a Humber Digital Education Network to provide an online collection of programmers, teachers, and resources to assist in the teaching of the new computing curriculum.

### 5. Scope

The programme will initially target children and young people aged 11-18, working alongside and supporting schools, colleges and sixth forms in the Humber region.

The programme will predominantly aim to support providers that do not currently have staff from computer science backgrounds and who may not be able to deliver the new computer science based curriculum without support.

In the first year, a pilot programme will support 20 schools and colleges in the Humber region.

### 6. Resource Implications

Delivering a programme of this scale requires considerable resources in order to cover the costs of tuition for teachers to develop their skills; offset the impact on school and colleges of releasing teachers for training; provide the relevant kit both to teach and for the classroom; and contribute to delivering a comprehensive enrichment programme.

We will work closely with partners including the University of Hull, Sony Computer Entertainment Europe, Microsoft and local initiatives to deliver this programme. The cost of running a full pilot programme for one year will be in the region of £820k.

<table>
<thead>
<tr>
<th>Programme Element</th>
<th>Outline Cost</th>
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<tbody>
<tr>
<td>Supporting schools and colleges to deliver the programming elements of the computer science curriculum</td>
<td>£500,000</td>
</tr>
<tr>
<td>Supporting schools and colleges to integrate digital creativity and digital media into the computer science curriculum</td>
<td>£100,000</td>
</tr>
<tr>
<td>Partnering with major industry partners both nationally and locally to deliver an inspiring, engaging and relevant curriculum</td>
<td>Costs covered by industry partners and existing local initiatives</td>
</tr>
<tr>
<td>Developing skills and inspiring ambition and entrepreneurialism through a broad programme of enrichment activities</td>
<td>£200,000</td>
</tr>
<tr>
<td>Establishing a Humber Digital Education Network</td>
<td>£20,000</td>
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</tbody>
</table>
7. Programme Details

Supporting schools and colleges to deliver the programming elements of the computer science curriculum

Based on proposals developed by the University of Hull Computer Science Department.

In order to deliver the computer science curriculum confidently, effectively and in a way that engages and inspires students, teachers need to become experienced and competent programmers with a good understanding of how to teach computational thinking. Learning computer programming is analogous to learning a language and requires a significant personal commitment from the teacher to fully grasp the subject. Furthermore it requires continuing practice, to build the skills, until proficiency is achieved.

Schools and colleges face a range of challenges in delivering the new curriculum. Discussions with education professionals from across the region established that many secondary schools lacked members of staff with computer science qualifications. Others had only one teacher with a computer science qualification, placing considerable pressure on that staff member not only to develop and deliver programming modules, but also to support the professional development of other members of staff. There were also examples of schools with excellent reputations that were planning not to offer computer science as an option due to fears that the challenge of teaching the subject would lead to a drop in performance and impact on the school’s position in the league tables. Furthermore, anecdotal evidence suggested that schools were actively seeing out approved qualifications with the minimum of programming and computer science elements, thereby limiting the potential positive impact of the increased emphasis on computer science in the curriculum.

Some schools were currently buying- in support from private providers to deliver session direct to students. While we recognise that these providers make an important contribution and offer at a diversity of learning experience, in the longer term we believe that it is more sustainable for schools to be confident in using their own staff to deliver the core curriculum, using external provides to enhance, supplement and extend the learning experience of students.

In early 2014, the Department of Computer Science at the University of Hull, responding to a significant demand from schools in the Humber region, created and delivered a small pilot programme to help address the skills gap in teachers moving from ICT to the new computing curriculum.

The pilot involved 29 teachers from 17 local schools, and consisted of 2 hour weekly evening workshops in the autumn and spring terms, with the aim being to teach how to programme in Python. Although the limited pilot was a success in terms of beginning to equip teachers with the programming skills required to teach the new computing curriculum, it highlighted a number of issues. The most significant of these was the time commitment in learning to programme to a sufficient level where-upon a teacher can educate others in the art of programming. Expecting teachers to pick-up these skills in a few hours proved unrealistic: what was required was dedicated time per week for teachers to undertake self-study, away from the demands of their classroom, to support and reinforce the weekly workshops.
Building on the University of Hull pilot, the programme will:

- Provide a year-long programme of training for teachers from 20 schools and colleges in teaching programming in Python
- Offer support to schools to offset the cost and wider implications of releasing key teaching staff for one day per week
- Build a peer support network of computer science teachers across the Humber region

Over the course of the next year, we will establish a CAS (Computing at School) Hub. The Digital Environment at Hull College, which combines a Centre of Excellence for Digital Skills with an incubation space for digital start ups, has been suggested as a home for the Hub.

The Humber CAS Hub will build up a local network of CAS members to share expertise and create a community of computer science and digital creativity teachers in the Humber.

The Hub will:

- provide a venue for training and events delivered by teachers and industry professionals from across the region
- grow specialisms within local schools and facilitate sharing of specialist expertise
- support local teachers to apply for CAS funding to become Master Teachers
- support Master Teachers to build links with local primary schools, ensuring that teaching expertise spreads across the education system

**Supporting schools and colleges to integrate digital creativity and digital media into the computer science curriculum**

*Based on proposals developed by the Hull School of Art and Design.*

The creative skillset is an essential counterpart to coding in terms of the skills required in the digital sector. This issue was highlighted in the 2011 Next Gen report into the skills needs of the gaming and SFX industries, and are key to transforming the UK into the world’s leading hub for videogames and visual effects. The same combination of technical and creative skills has applications across a wide range of industries through the use of gamification and augmented reality.

Digital creativity spans across Art and Design, Media and Design and Technology. However, the curriculum content itself is often quite traditional in terms of both the frames of reference and the outcome that is expected from the students. Within the school curriculum the integration of digital “tools” within the creative curriculum tends to be supported at a very low level. Historically this has been due to lack of access to technology. However, in recent years, new build schools in the region have been equipped with high specification technology but lack the experienced staff to utilise those resources to teach children and young people effectively.

For many people who are disengaged or discouraged from pursuing computer science qualifications by traditional perceptions of the subject as “geeky”, isolated and male dominated, digital creativity is an important route into learning programming and computer science skills. The space in which technology is experienced is also important. The idea of
being in a “lab” environment alienates and discourages many creative people, and reinforces negative stereotypes of the digital industry and the people who work within it. This is particularly apparent among women, who are notably under-represented in tech and digital careers. Many women who work in computer science or programming have followed non-linear paths, often starting from creative arts backgrounds or by learning coding in order to resolve a practical or social issue. Offering alternative routes into computer science is vital to ensuring that the future digital workforce is diverse and inclusive.

The programme will:

- Establish a regional Adobe training centre
- Offer a “train the teacher” parallel to the Python proposal, offering Adobe Training and Certification for teachers on a cascade training model
- Introduce a yearly “digital creativity” related project within each school’s curriculum including a contextual study, with projects including fashion and textiles and well as gaming and web design

Partnering with major industry partners both nationally and locally to deliver an inspiring, engaging and relevant curriculum

This programme aims to inspire the digital pioneers of tomorrow: young people who aspire to careers where they can create and innovate in some of our most exciting and fastest moving industries. Young people are very aware and sensitive to the relevance of the subjects they study at school and college. In order to engage young people in learning vital digital skills, it is essential to show how the skills they are learning can be applied in the real world.

As part of this programme, we are partnering with multinational companies including Microsoft and Sony Computer Entertainment Europe to provide young people in the Humber with access to industry standard equipment and training delivered by industry professionals.

Moreover, the programme will build on existing connections with local professionals and employers in the digital sector to offer young people access to work experience, mentoring and CEAIG. The programme will raise awareness of opportunities and careers in the digital sector within the Humber, ranging from large enterprises to microbusinesses and freelancers.

The programme will:

- Provide industry standard games development consoles and devices for teaching programming skills in 20 pilot schools
- Expertise, advice and support from industry partner commitment including dev workshops for students and teacher; ongoing access to advice and support; and access to teaching resources.
- Give young people the opportunity to learn about local digital success stories. This is essential to raising aspirations and showing young people the real opportunities to build a career in digital creativity within their local area.
- Support local initiatives to increase the representation of women in the digital, gaming and tech sectors through raising the profile of local female tech role models
• Build on and develop existing initiatives including the Humber Skills Pledge (whereby employers pledge to a range of offers, including mentoring an entrepreneur, employing a local graduate, offering an apprenticeship or providing a work placement)
• Improve awareness of careers in the digital sector in the Humber through information and case studies on online CEIAG portals (Log on | Move on and Lincs 2) and by supporting the representation of digital sector SMEs at college and university careers fairs.

**Developing skills and inspiring ambition and entrepreneurialism through a broad programme of enrichment activities**

In addition to providing a strong and relevant educational offer, this proposal includes a broad programme of enrichment activities giving young people the opportunity to apply their digital skills and learn more about the challenges and excitement of working in the industry.

The Humber has a strong portfolio of events and initiatives to inspire and encourage young people to pursue careers in digital and STEM, including:

• STEM Ambassadors – a programme supporting STEM industry professionals to get involved in a huge range of activities, which can all have an impact on young people’s learning and enjoyment of STEM, including giving careers talks or helping at careers fairs; providing technical advice or practical support to STEM projects in the classroom; and supporting projects in after-school STEM Clubs
• Platform Expos – held annually in Hull, Platform Expos, the largest gaming and content creation expo in the north east of England, with 6,000 visitors over 2 days, including over 1,000 students from local schools. Platform Expos offers a varied programme of workshops, speakers and discussion panels for local schools, with workshops provided by staff from the University of Hull, Hull School of Art and Design and Hull College.
• Big Bang Events - run in schools across the region and as larger regional events, the Big Bang offers an exciting learning experience that is full of interactive science, engineering, and technological activities, aiming to stimulate and encourage young people from all backgrounds to study science, technology, engineering and maths.
• Game Jams and Hackathons – events in which participants create a game in 48 hours. These events offer students from local colleges and universities the opportunity to develop their skills and showcase their work. The 2014 Global Game Jam Hull had over 200 participants, making it one of the biggest in the UK. Judges included representative from major industry players Microsoft, Jagex, Boss Alien and Sony.
• Teen Tech events – held annually in Hull, TeenTech events are highly interactive experiences designed to inspire young teenagers and their teachers about careers in the contemporary world of Science, Engineering and Technology.
• Local volunteer-led programmes and initiatives including Code Clubs and Saturday clubs.

This programme aims to build on existing activities by developing a deeper and broader offer of enrichment activities specifically designed around developing digital skills. In addition to large one-day events, we aim to deliver an ongoing programme of activities based in schools and communities.
Activities of this type are essential to engaging young people in learning digital skills through participating in creative projects and offering opportunities to apply coding skills to solving real life problems. Furthermore, by developing softer skills, such as teamwork and problem solving, these initiatives will increase the employability of young people in the region. The programme will:

- Support volunteers to run Code Clubs in schools and colleges across the region
- Deliver a programme of Saturday Art clubs with an integrated digital “feel” and a buddy scheme between digital creatives at higher levels of education and schools
- Increase the number of digital industry professionals in schemes such as STEM Ambassadors (the current programme in the Humber is heavily engineering based)
- Support existing local initiatives and events to further develop their digital and digital creative offering

**Establishing a Humber Digital Education Network (DEN) to provide an online collection of programmers, teachers, and resources to assist in the teaching of the new computing curriculum.**

*Proposal developed by Apple Pear Ltd.*

The digital education network is an online collection of programmers, teachers, and resources to assist in the teaching of the new computing curriculum from September 2014.

There are plenty of resources for teachers online, TES records over 700,000 resources.

However, there are very few resource sites for the new computing curriculum, and none at all which rely on the key to the Humber DEN proposal: collaboration between education and business.

We want to create a system that enables this collaboration. A place where teachers can find resources and activities which have been created by programmers, edited by teachers, and rated by both. So here’s how it works:

A programmer creates an activity or resource and uploads it to the Humber DEN.

A teacher finds the resource and downloads it to use in their class.

After the class, the teacher decides to change some aspects of the resource to encompass good teaching practice.

They re-upload it, rating the original resource as they do. The resource now has the best of both worlds and we’ll give it a badge to say so.

Furthermore, the system is designed to be as quick and easy to use as possible. By using a huge variety of search algorithms to find the resources, plus factoring in ratings and popularity, we can create a system that seamlessly delivers the service.

All of the systems we create are also designed to be usable by anyone with a basic knowledge of IT, and they look great too. So users will not only want to use the DEN, they also enjoy it.
By using a three colour indicator system, members can immediately see whether the resource is from a programmer, teacher or, best of all, both.

That’s how we would like to see DEN, the Humber Digital Education Network, come to life.

Making it Work

The Humber region has a wealth of developers, most of whom would be able, and willing, to contribute to the system, the first step would be to engage these companies so that, at launch, the system is already full of resources.

After this, social media engagement and email engagement will be the most effective steps to continued engagement of professionals and teachers, linking in with the Humber CAS Hub.

Down the Road

This system doesn’t have to purely be a system for downloading files. We can use this system as the backbone for a strong local network of businesses and educational establishments for the purposes of growing tech in the area. A place for advertising, networking and sharing, the Humber DEN will become a successful community based around the Humber CAS Hub with events and seminars organised online, all supporting teachers, industry and young people to develop the skills they need to grow.

5 September 2014
Humber Local Enterprise Partnership, Manchester City Council and Tech City UK – Oral evidence (QQ 192-204)

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Members present

Baroness Morgan of Huyton (Chairman)
Earl of Courtown
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Lucas
Lord Macdonald of Tradeston

Examination of Witnesses

Angela Harrington, Head of Regeneration, Manchester City Council, Gary Warke, Board Member and Business Development Board Member, Humber Local Enterprise Partnership, and Gerard Grech, Chief Executive Officer, Tech City UK

Q192 The Chairman: Gary Warke is stuck on a train somewhere that has not moved for at least 40 minutes, so if he comes from the LEP in Humber, then we will just slot him in and we will just keep going. We cannot wait for him, in case the poor soul never arrives, so we will have to ask for some written evidence, if necessary, I think.

So, welcome and thanks very much for coming. I will do a bit of background first. You have a list of the interests that Committee Members have declared. That was done back in July. That is in the transcripts. This is a formal evidence-taking session of the Committee and a full shorthand note will be taken. It will be on the public record in printed form and also on the website. You will be sent a copy of the transcript and you can revise it in terms of any minor errors. This session is on the record, it is being webcast live and will be accessible via the
parliamentary website. You are very welcome to submit written supplementary evidence and, indeed, we may ask for it if there is anything in particular we are interested in that we want to follow up. I am advised to tell you—and in fact all of us—to speak up clearly just to make sure we all hear each other. That is by way of background.

I will get you to introduce yourselves, and if you wish to make any opening remarks, you are very welcome to do so. If you do not want to, we will head straight into the questions, so it is entirely up to you. Ms Harrington?

**Angela Harrington:** Hello, my name is Angela Harrington. I am Head of Regeneration at Manchester City Council. By way of background, we work with a range of partners in Manchester and across Greater Manchester on digital skills and how we engage, how we develop and how we future-proof our skills.

**The Chairman:** Thank you. Mr Grech?

**Gerard Grech:** My name is Gerard Grech. I am CEO of Tech City UK. If that is okay, I would like to make an opening statement.

**The Chairman:** Yes.

**Gerard Grech:** The future of any nation is creative, innovative, efficient and forward-looking. The UK has a history of being at the forefront of innovation and openness. Tech City UK was established by the Government in 2010 to promote and accelerate digital growth in Shoreditch in East London. In 2014, our remit was extended nationwide, precisely because of the growth in digital innovation around the UK and the opportunities it offers. As an organisation, we work in partnership with the tech community, the wider business community and with Government to support digital growth at every stage of a digital business, from idea, to start-up, to IPO, and everyone from solo entrepreneurs to first-jobbers, to mid-career professionals, to future billionaires.

Our purpose is to accelerate the growth of digital businesses in the UK. We do this in three ways: first, by delivering programmes that help entrepreneurs progress to their next stage of growth. As an example of this, we are launching the Digital Business Academy with Cambridge University and UCL precisely to teach anyone to start, grow or join a digital business. Secondly, we facilitate a responsive dialogue with Government; and thirdly, we champion and connect digital growth businesses across Britain. Specifically on regional growth, our Cluster Alliance programme has identified 13 distinct clusters with potential right across the UK. They are at different stages of development, with distinct strengths in different aspects of the digital economy.

Finally, there are four crucial components in building a successful tech cluster. They are: local leadership committed to digital growth and an existing digital community, local infrastructure, including transport, broadband and property, access to finance, both seed capital and growth capital, and finally, a talent pool. Thank you very much.

**Q193 The Chairman:** Thank you. Your list of four is very much some of the things that we will be pushing on and trying to find a bit more out about today, so thank you.

Perhaps I can start with a general question which is probably fairly obvious: how significant do you think the digital economy is as an economic priority for your area and what prospects do you see for jobs, businesses and investments on the back of that? Also, on the flipside,
what are the barriers at the moment to realising the objectives that you are setting yourself?

Perhaps we will start with Manchester.

Angela Harrington: In terms of Manchester, there are about 7,500 to 8,000 digital businesses and enterprises employing about 45,000 people. Our estimate is that there are probably another 45,000 people in other sectors who work in digital as their background. The Greater Manchester Forecasting Model expects the sector to grow by 70% between now and 2025, and employment growth of about 16%. Currently we estimate it is worth about £2 billion, and so it is a very significant sector for the Greater Manchester economy and is probably the second-largest, just behind financial and professional services. Greater Manchester is the second grow point outside London for digital growth.

The Chairman: In terms not of digital specialist businesses but of the wider skills agenda and the inclusion of digital within that wider skills agenda, how important is that in Manchester?

Angela Harrington: Hugely important. I agree with my colleague, it is one of the pillars in terms of facilitating or enabling the growth. I suppose there are a couple of challenges or opportunities in the digital sector from a Greater Manchester perspective. The challenges are that the sector is fast-paced and technologically fast-moving. It is difficult for the traditional skills and education system to keep pace with that and the funding mechanisms do not allow that to happen fairly easily. The digital sector itself is predominantly small and some is micro. It tends to recruit graduates as a preference and there is not a lot of investment traditionally in developing their own skills base, but recognises much more that that is where they need to go and have a much better grasp of what they need to do locally.

I think, in terms of opportunities, the Greater Manchester Employer Ownership of Skills pilot, for example, invested in 165 new digital apprenticeship starts in new sectors. That included bringing in specialist providers from Sweden, around the games programming sector, and doing higher level and advanced skills. There are opportunities both to engage better with employers and to be more responsive in terms of how digital skills are developed.

The Chairman: Thank you. Mr Grech?

Gerard Grech: It is estimated that the digital economy is currently worth about 10% of GDP. It is set to grow to—

The Chairman: Mr Warke, welcome; we have just started. I am sorry to interrupt you, Mr Grech.

Gerard Grech: No problem.

The Chairman: I gather you have had a terrible journey, so settle yourself down. We will keep going, but we are just on the first question. Sorry, Mr Grech.

Gerard Grech: Just to repeat that, there are current estimates that show the digital economy is worth around 10% of GDP. It is set to grow to around 16% within the next five years, growing at around 11% a year, and it is one of the fastest-growing in the G20. When you look at London, in the last three years 27% of new jobs were created in tech and, according to some publications, it led the recovery in London. What we are seeing is that digital technologies are crossing over into established industries, like financial services, so we are seeing that London is quickly becoming the epicentre of FinTech, which is the crossover between financial services and technology.
One publication based in New York argues that there are more people working in FinTech here than there are in New York or Silicon Valley. To put some numbers against that, it is about 44,000 people working in FinTech in Greater London, versus 43,000 in New York, versus 11,000 in Silicon Valley. I think the reason for that is that you have very established industries that are being very open to the digital innovation that that brings, and how that crossover and collision is happening that is driving the next wave of digital innovation.

It is very important, and clearly London gives us a great story to tell. But we are seeing complementary skills in many other cities and regions. Cambridge is obviously very strong in hardware; Edinburgh is extremely strong in artificial intelligence; Belfast is extremely strong in cyber security; Manchester is clearly very strong in digital media, among other things, and Bristol is strong in robotics. I think the combination of these skills is what is very important for the UK Government to see. It is making sure that we are joining up all those skillsets to offer up a joined-up technology proposition to anyone who is looking for investment and hopefully create jobs here.

**The Chairman:** Mr Warke, are you ready to kick off?

**Gary Warke:** Yes, I am. My apologies for a late train.

**The Chairman:** No, not at all. No, we understand completely. We have just had a general first question about the importance of digital to the economy. Can you talk to us about that from the background of the LEP?

**Gary Warke:** Yes. The LEP that I represent is the Humber LEP—Hull and Humber LEP—and the region has identified the digital economy as the second fastest-growing area in our region, after the renewals and offshore wind. For us, it is the fastest-growing sector outside London for the digital sector. As such, the Local Enterprise Partnership, Humber has established quite a significant infrastructure around a strategy group to drive that around skills, around investment and around marketing for our particular region. The region has a strong area currently with digital gaming and content creation, and the creative sector is quite strong. Also the region benefits from the biggest investment through Kingston Communications, which is our infrastructure in terms of IT, which is the fastest broadband investment in the UK; so building on the investment we have within our region for that, coupled with what we see as a significant strength around the skills of what we have within digital, huge investments are going in from the LEP to take that to the next level.

**The Chairman:** Tell us about the Kingston infrastructure. Who is funding that?

**Gary Warke:** It is a privately owned telecommunications company. The Humber region is quite unique in that it is an island itself, in terms of its telecommunications infrastructure. That investment is significant because of what that will do for the region, in terms of its connectivity and the broadband-speed reach that will have.

**The Chairman:** Thank you very much.

**Q194 Lord Haskel:** You have told us about the importance of the combination of skills and facilities to create a worthwhile hub. Can you tell us: what are the roles of the different stakeholders in the hub; for instance, the university, the Chambers of Commerce, local government, LEPs, the third sector? What role can each of these play and, indeed, how are you going to bring them all together?
Humber Local Enterprise Partnership, Manchester City Council and Tech City UK – Oral evidence (QQ 192-204)

**Angela Harrington**: In terms of Chambers, if we start there, the key role is employer engagement and the ability to have employers actively shape and contribute to the skills development of their existing and future workforces. That is hugely important in this sector. In Manchester, the Chamber has a liaison with Manchester Digital, which is one of the trade bodies that represents the digital sector, and they have come together and set up an employer skills group. That was established to develop the programme around the Employer Ownership of Skills pilot for the digital sector and the work is continuing.

For example, Manchester Digital runs a skills festival every year, where it surveys its constituent organisations and identifies where the skills shortages are and what some of the opportunities are. It has a conference and a talent day where young people in the region are invited to present themselves to some of the sector, in terms of meeting some of the opportunities. Also, it works with schools so that young people in schools understand what the pathways might be and what the opportunities are, and then it has open days in the digital industry so that the wider public can see what the opportunities are. There is a huge amount that is very important in terms of employer engagement and employer contribution, and many of the active businesses also support code clubs in the city’s primary schools, so they provide some of the volunteers and the resourcing for that, and increasingly recognise the need to get upstream and to be able to shape some of that curriculum.

In terms of local authorities, I think the local authority’s role is manifold. One is creating the right infrastructure resources to attract investment in the digital sector. Again, if I use an example from Manchester, the Sharp Project is an example of use of a large old industrial warehouse that supports the creation of a large number of businesses in the digital sector. The local authority also has a role in terms of facilitating and bringing together businesses, the education providers in the city and ensuring that demand and supply are talking to each other and can better develop the responses. The local authority clearly has a role with schools, so we have worked very closely with the Manchester Schools Alliance and we have a strategic education partnership for the city, which very much has digital and digital skills on its agenda and looks at how it could and should develop those further. Do you want me to go on or to pass it to the next—

**Q195 The Chairman**: Let me push you a little bit. In a sense that all sounds fine, but I think one of the things that we are concerned about is how do we make sure that—what we are told is a great opportunity for the country in many ways—it is not just nice things happening in various places, but how do we get beyond the London-Oxford-Cambridge triangle to drive prosperity and competitiveness around the country? What is it that enables a regional hub to take off in a significant way?

**Angela Harrington**: Partly, I think it would be further devolution of skills funding to the region. It is at the city/region level where you can articulate best the demand and supply. I think there are examples on the ground, good examples around some of the work of the Chamber, but also the apprenticeship hubs through City Deals have done on this. I think further devolution of the skills budget—particularly if it is underpinned by a very robust labour market analysis—can help drive this sector.

There should be an ability to be able to incentivise certain route ways and pathways. So currently, if you look at the way FE funding is distributed, you are not particularly incentivised to be innovative, to take risks. The pace of technology in the sector far outstrips what you might do in your average FE institution. At a local level how can you deploy your
skills budget so that you reward people who take risks? On the other end, you may equally need to invest more on people who are digitally excluded and who have a much longer journey to take. Again, for us at a Greater Manchester level, we are in a fairly good position to be able to do that, and bring together the sector and the education and the skills sector in a much more coherent way.

**The Chairman:** Thank you. That is helpful. Do you want to come back?

**Lord Haskel:** It is obviously a very complicated matter and there are a lot of elements involved. Whose job is it to make up for the shortfall? Is it central Government, is it local government or is it local employers? To get a cluster working, whose job is it to make up for shortfalls?

**Angela Harrington:** I am not sure there is a single answer to that, to be honest. In terms of any sort of skills deficit in the sector, clearly there is more that we could be doing at the education level, and that will be driven by the national Government and schools, and the school system in particular. The question there is: how do you get the kind of systemic work across the school sector, the right relationships with employers within what is a fairly crowded sort of reform agenda? Within that, how do you make sure that you do have employers going into schools, you do have young people going out to the digital sector and you do have the right careers information, advice and guidance? Once people are in work, focusing on the bridge between young people leaving school and moving into work, then employers have a much greater role to play in terms of shaping and contributing funding to upskilling and their own workforce and the future workforce.

**The Chairman:** Mr Warke?

**Gary Warke:** My view is that currently it is the Local Economic Partnership that will play a pivotal role in drawing that together in a vacuum of no glue within our regional economy. I think we see the LEP as playing that significant role. Within the Humber, the digital sector group that we have formed is in some respects trying to pull all that together. It comprises education providers, all the key employers and the key investors, and it has three key priorities in there. It is about raising the profile in terms of marketing, about what the regional hub can be for digital, for investment. Secondly, it is using our business development arm to help with set-up business, start-up business and so on. Thirdly, it is driving the skills agenda, so we are just about to set up a university technical college in the city, which has a digital technology specialism. We have launched our digital manifesto strategy for the region, so there are strong collaborative partners coming together to work. In the current environment, which is competition-driven in terms of skills education, the LEP are trying to bring that together into some form of a partnership for the region.

**Q196 Lord Janvrin:** Perhaps I can follow up and ask Mr Grech to comment on this, because in your introductory statement you said you were looking at 13 clusters. Are there common threads, along the lines that we have just been hearing about, as to why those 13 are where they are and why they have grown and so on? What has defined their establishment, if I can put it like that?

**Gerard Grech:** Absolutely. There are definitely factors that play into what becomes a tech cluster. If you take Edinburgh, there are very good computer science courses producing great PhD students with extreme knowledge in artificial intelligence, which is one core capability of the digital economy. In fact, there are many, many digital capabilities that you
Humber Local Enterprise Partnership, Manchester City Council and Tech City UK – Oral evidence (QQ 192-204)

need: AI, artificial intelligence, machine learning, data science, visual design, user experience, and application development. There are multiple types of skills that you need in order to build the digital economy for the nation.

**Lord Janvrin:** Are you saying that the university is key? What else?

**Gerard Grech:** Universities play a role. That is the case very much in Cambridge. If you look at Manchester, obviously the arrival of the BBC is creating a huge cluster of knowledge and a critical mass of expertise around digital content development. ITV is now there, there is clearly a lot around television production and that is becoming quite critically known for digital content development. So there are factors; and on your previous question, Lord Haskel, it is very important to identify those assets very quickly and then foster them, nurture them and harvest them as soon as possible.

When I spent some time in Sheffield with the LEP there, they put up a slide and showed me that there was a critical mass of expertise around international distribution centres because of its location; it is literally by the M1 and the M62. Clearly there is a lot of knowledge there in international logistics, but if you cross that over with digital technologies, you could become known for digital innovation in international logistics, so that is an asset. I think it is important for local government and local councils to understand that as an opportunity, to make themselves distinctive enough around the UK and around the world for being known in that particular area. That is the combination of bringing in universities and making sure that they are producing perhaps courses in that line of business. Those are assets in themselves but may not be recognised immediately. That is my point.

**The Chairman:** If we take Sheffield, what you have just said is interesting. You identified an opportunity with the LEP. You went to a meeting and you discussed that with them. What happens next? What is your role? What is anybody else’s role? How do we then make something happen? How does it get lifted up or how could it be lifted up? What is missing?

**Gerard Grech:** It is a great question. Yes, it was covered in the *Yorkshire Post*—which again increases the promotional aspect of the opportunity that Sheffield has in that particular instance. But I think it is local leadership that is quite important, and for that to be led by entrepreneurs in the area rather than by local governments stating what needs to be done. I think it has been proven, even in the United States, that these clusters form because entrepreneurs take the lead and government facilitates the growth and development of a cluster. I think that is quite important. It needs to be led by the community, and the role of local government is to facilitate and convene the right people and broker the right partnerships. But again, it is always led by the community.

In fact, TechNorth, which was announced last week by the Deputy Prime Minister, was very much led by the community. As part of the Tech Cluster Alliance, we facilitated that proposal into national Government and accelerated the proposal, but it was led by the community. I do not know if this is helping, but—

**The Chairman:** It is helping a lot, and Lord Macdonald is going to follow this up in a second. Lord Lucas, you want to come in. Is it on this?

**Lord Lucas:** Yes. I was looking at the two different models of the cluster, which is based around a particular technology, say Google Campus, which is based around a multiplicity of technologies and where you get a lot of cross-fertilisation. What balance should we aim for between them? If you just get particular technologies dotted around the country and they
are not really talking to each other, that is not a functional system, and if you just have
general groups like the Google Campus thing, you never develop a real expertise.

**Gerard Grech:** I think that is why it is important, and it is the role of local councils to identify
what they are very distinctive in, or what are their differentiation points when it comes to
the digital economy. Otherwise, if everyone is doing the same thing, then we are in
competition with each other, and that is exactly the opposite of what we want. UKTI, the UK
Trade and Investment organisation, is clearly selling the whole of the UK as a network of
digital excellence and not pockets of innovation around the country. It is looking to promote
a joined-up tech proposition. Obviously cities and regions are good at many things when we
look at these things in digital, but what I am always encouraging cities to do is to tell me:
what are you even better at? That in itself will make your proposition a lot easier for anyone
to understand. So do you have a critical mass of expertise in data science? Do you have a
critical mass of expertise in machine learning? This is quite important because when people
come to look at the UK as a potential opportunity for investment, they will ask that question
straight out: how many data scientists do you have in this country? How many machine
learning scientists do you have in this country? That is clearly what they need in order for
their headquarters or their local company to grow.

National Government has a role to play—and I think this is where we are seeking to play a
role and will be issuing a report on this next month—as to the co-ordination of where this
expertise lies around the country, which will help guide the local councils, as much as
possible, about where we see a critical mass of expertise around the digital capabilities that
you need in order to have a joined up digital proposition.

**Q197 Lord Macdonald of Tradeston:** You seemed to be arguing a bit earlier for a more
purposive role for Government, because it had been essential in some of the clusters that
had already been formed. When you think of it, whether it is the funding for universities or
the direction pointed by UKTI to inward investors, or the various grants given to local
authorities and so on, is it not for Government then to have a more purposive overview of all
of this, to make sure that the perhaps under-informed councils are not wasting their time
trying to compete with FinTech in London? You are obviously the most natural cluster in a
sense sitting in Shoreditch just north of the mighty City of London. But when we get out to
Sheffield, Belfast, Bristol and so on, do you not need a Government role that is more evident
and more purposive than it seems at the moment?

**Gerard Grech:** A lot has been learned from Shoreditch and clearly that has put London on
the international map, for sure. What we are doing through the cluster alliance programme
is sharing those best practices and those learnings very quickly with other cities. TechNorth
is the next step because it is only in this year that we took a nationwide remit in doing what
we can to promote other parts of the country in the area of digital.

**Lord Macdonald of Tradeston:** But what I am saying is a lot of the areas that you talked
about in terms of stakeholders are reliant on central Government money and leadership.
Even the BBC going to Manchester had to be backed by Government, because there was a
great deal of metropolitan and media hostility to that move. So should the Government be
more prominent in saying what it would like to see and where it thinks people should be
clustering together and active?
Gerard Grech: No, because every city has its own DNA, every city has its own history, every city has its own legacy, and I think the formation of a cluster has a lot to do with what it has been known for. You cannot really create clusters, you can accelerate the growth of clusters and you can stifle it, so you have to be very careful. I think, when you look at Shoreditch, the role that Hackney Council has played has been very progressive. Next month we are running a hackathon with the council and that is the council saying, “We have some things that we would like the community to come to us and provide us with solutions to some of the things we are trying to solve. We do not want to do this on our own. We do not want to do this in isolation. We are letting the tech community come up with the ideas that we are looking to solve”. I think that comes to local procurement, so that is another way of funding the growth of local businesses and for local government and local councils to be open to testing and trialling new technologies with local companies or any types of companies around the UK.

Lord Macdonald of Tradeston: What is the role for the Government then?

Gerard Grech: For national Government? The co-ordination part is quite important and we are trying to do that as much as we can in our role, but again it is being led by other communities in different cities, and working with UKTI—to the point that my colleague was talking about—and when it comes to skills, I completely agree that that is obviously important. We have been very particular about our programme that we have put together, which is nationwide. It is open to anyone in the United Kingdom and it is available online, but local government can take that content that we have produced online and make it available face-to-face in venues all across the UK.

Helping universities, perhaps, play a more crucial role is quite important for me. I do not believe that entrepreneurship life and campus life are mutually exclusive. Universities are real conduits to businesses. Cambridge University and what it has been able to create around it is a very good proof in point.

I am probably not specifically answering your question but—

Q198 The Chairman: In some ways this is not entirely your remit so in some ways it is not fair, but I suspect what we are collectively struggling with is: you have described Cambridge and you have described Edinburgh and they both make complete sense. You then described a potential opportunity in Sheffield. I do not think you have helped us understand how that opportunity will be realised because to say it should be led by some entrepreneurs, if they are not there in Sheffield at the moment—

Gerard Grech: They are, for sure, and the question is: how do you encourage that?

The Chairman: Who is doing that? What is the role of the LEP? What is the role of the council? What is the role of Sheffield University? What is the role of Government? We are trying to understand what we should be recommending for that sort of opportunity to be realised.

Gerard Grech: I am assuming that LEPs have the right representatives to take those initiatives forward. The composition of the LEPs is quite important. It is not about protecting established industries; it is about also focusing on emerging industries in their local area. I do not know what the composition looks like but it is a must that the composition is balanced in the right way.

The Chairman: Lord Janvrin, you want to come in and then I am going to come to a LEP.
Lord Janvrin: I was going to ask what the Humberside experience was, yes.

The Chairman: Again, it will be different so far as you are concerned in the present structures.

Gary Warke: As I said earlier, I think the Sheffield example would be no different from Humber. The LEP I would see as the way of facilitating that. On the role of Government, ultimately, all 39 LEPs have developed their own strategic economic plans; they have been approved by National Government; so I would hope that Government has taken a helicopter view of what that means to each of those regional economies in terms of delivering skills, delivering investment and delivering impact. That is the way I would see that would happen.

Where we struggle a little bit, and where perhaps Government perhaps could help a bit further, is around ensuring that some of those investment decisions are joined up. So if you take something around skills, you might be investing in the UTC, you might be investing in a studio school, a plethora of initiatives that may not be the best return of funds in terms of ensuring you have that impact in terms of a skills agenda. There are some more intelligent decisions around joining up those types of decisions, which will allow us to free up some of the entrepreneurial work that we want to see in terms of investing in creativity in the schools and FE sector, which is largely unfunded and is relying on the goodwill within our region of some really exciting entrepreneurs and business people who lead and drive that.

Going back to what I think is getting all those variables around the table—around having the right skills people, having the right business people and having the right drive, passion and enthusiasm to take that forward—the only other thing I would say is that what we find in our area is that, while we have a large supply of high-quality graduates, they ultimately get jobs in London, so we are developing them but we are not retaining them. That is the key bit for Humber LEP; the investment part is critical to ensure that these excellent graduates we have in creativity design will stay within the Humber.

The Chairman: That is back to our Sheffield point—if there is an opportunity for new industry to develop in a different way then it is a matter of joining that up, is it not?

Gary Warke: Yes.

Gerard Grech: Also making sure that you are fostering the right conditions for growth in a particular distinctive area of expertise, so that people know you for what you are and what you are known for. That has a viral effect. You are attracting the best and brightest to that place.

The Chairman: Clearly in Manchester, presumably, with a digital media, people work there rather than are just skilled up.

Angela Harrington: Yes, absolutely. There is still some leakage of graduates but we retain more. The other refinement on that is you can keep them in the city but can you keep them in the sector, in terms of the smaller fast-growing businesses in the sector? So they have to compete with the large corporates who increasingly need people who are skilled up in this area. So there are two areas to focus on there.

Lord Lucas: What do the research councils do to contribute to this? Are they prepared to concentrate funding for a particular technology on the area where you are trying to develop expertise?
Humber Local Enterprise Partnership, Manchester City Council and Tech City UK – Oral evidence (QQ 192-204)

The Chairman: That is a good question. Do you want to come back to us on that? For example, it would be very interesting to know whether the research council has had any strategic view of developing AI in Edinburgh, or has it just happened because there happens to be somebody in Edinburgh who has been good at getting cash? Any insights on that would be very helpful. Thank you. We shall move on.

Q199 Earl of Courtown: We have touched on various areas but how can local businesses, particularly SMEs, outside of the tech industry, be brought on board? We have mentioned apprenticeships and there is also the role of catapult centres.

Angela Harrington: My view is the growth hubs are one of the ways of bringing local businesses more on board because the critical issue is: what is in it for a small business if it is not a tech business? I think there are a range of preconditions that would help. The first is access to superfast digital broadband. How do you stimulate demand for that? How do you ensure you have supply, in terms of areas of your city or your conurbation where that is not currently possible? There is quite a bit that a growth hub can do in terms of demonstrating the advantages of a well-connected business SME, whatever your business is; you can showcase your product better, you can engage with your customers better, you can use digital in terms of how you communicate beyond your immediate core. I suppose flexible working reduces your premises costs, whatever. There is probably a list of things for your average SME where digital has a contribution to make. I think that support to be able to access that, to skill up and use it in the most appropriate way should be integrated with other businesses.

Earl of Courtown: Of course, in these hubs you all have superfast broadband anyway, which is at the core of your ability to make the most out of it.

Angela Harrington: Yes.

Gary Warke: Certainly for us in the Humber region, it is a matter of having that digital sector hub. The vast majority of our businesses in Humber are SMEs, and to a certain extent they feel disconnected around advice about things like funding for apprenticeships and how they might get support. So digital was about meeting that need of SMEs. The hub is also trying to address the issue of gender balance between male and female—it is pretty much male dominated—and that stereotypical view of what working in the digital sector might be. It has a particular focus around narrowing the gap around gender participation as well as ensuring that SMEs are fully engaged in that.

Gerard Grech: It is about culture for me. Every company has its own culture. It has its own set of values and, in my opinion, it takes leadership from the top: the CEO or the managing director saying, “Digital is an area of growth for us and, therefore, everyone needs to participate in this growth”. That is to do with skills training and identifying the right courses. There are courses online, some of them are free, some of them are very good, but then there are other courses that we are seeing in the evenings and at weekends, which managing directors and CEOs should encourage their employees to attend. They should pay for them and perhaps there should be some way of subsidising those courses. The digital economy is only 10% today but it is growing at quite a rate.

Earl of Courtown: You mentioned the gender imbalance, which is something that is of great concern. Do the three of you have any views of how we can improve the gender imbalance in this area?
Garth Warke: Certainly in terms of my day job as Chief Executive of Hull College Group, one of the largest FE colleges in the UK, we put a huge amount of work into what we do in terms of career choice and breaking down stereotypical views around that. That is all about positive role modelling, positive promotion and engagement. For us it is using successful alumni who have come through the college and come through the university sector originally. That is a key part of what we do as well. It is very much like a lot of those particular types of profession; it is about continuing to look at how the promotion is effectively deployed on a local and regional basis. The use of impact, we find, is one of the key influences that helps drive that decision.

Angela Harrington: For me one of the things is, the earlier the better: support code clubs in schools; how can we ensure that digital computing is part of the primary curriculum; in terms of content, that it interests girls as well as boys; and in terms of route ways through and role models, what are the role models in the digital sector, and how do we make sure that they go out and visit schools? Also that young people can engage with them and, equally, that young people have access to those on a regular basis. For example, on International Women’s Day last year, there was a Digital Teapot that was held to encourage women of all sorts to come in, see and experience what women digital leaders were doing in the city. That is just one very small example, but I think you have to deal with it fairly broadly from the ground up.

Gerard Grech: I would agree with my other panellists.

The Chairman: A work in progress, yes. Thank you.

Q200 Lord Janvrin: Coming back to the relationship between the development of hubs and developing skills—skills delivery, not just schools and university but the lifelong-learning, FE sector and so on—and whether this is seen as an intricate part of the hub development process, how do you connect up with the local education providers to provide not only the schools agenda but also the lifelong learning agenda?

The Chairman: And/or how it could be improved further.

Gary Warke: Certainly, within our region, the employment and skills board of the Humber LEP has oversight for ensuring that all the skills providers across the region are collaboratively working together. We have identified a number of key strategic priorities. As I said, first is renewables and second is digital, so within the digital strategy that partnership works together. We have established now the manifesto, which is around what educational opportunities are there within the region. We have a collaborative hub now about sharing good practice around developing online materials and resources, and so on.

The big issue is, and remains, about impartial advice and guidance. It is a real struggle in terms of the schools area. It is about being able to get into schools and describe the career pathway and choice, bearing in mind it is quite a competitive educational environment that we are currently in. That represents a barrier because that inhibits things around apprenticeship delivery and awareness of apprentice delivery. From an employer’s point of view, that is something that we continue to work through.

With the business development part of the LEP, what we are working with there is to ensure that where there are specific new emerging products, like higher-level apprenticeships and
Humber Local Enterprise Partnership, Manchester City Council and Tech City UK – Oral evidence (QQ 192-204)

digital, the partner colleges are developing that, in partnership with locals, to provide bespoke solutions for a number of companies in the region.

The Chairman: Is the funding nimble enough to be able to do that at the moment?

Gary Warke: It is.

The Chairman: You are the only person that has said that to us, I have to say.

Gary Warke: It is, in that each LEP will be different in the sense of what they have asked for through the growth deal. Our LEP had asked for innovation around how its funding could be used. For example, we have some waivers around how funding is used for setting up some particular specialist courses, and the 16-hour rule, and so on, has been waived in our region. So that allows the opportunity for some creativity and innovation in terms of how that delivery could work.

Having said that, there is always work to do, there is always clearly more on the careers advice and guidance. There will always be people trying to pull them together to make sure there will always be institutional interests that will be above a collaborative approach. We have North Bank and South Bank, so having to make sure that you have those two areas working together collectively always remains a significant challenge. But the appetite is there significantly. I think the region recognises now that the City of Culture 2017 for Hull is another catalyst that is driving the digital economy to work together.

Angela Harrington: The approach in Greater Manchester is very similar. Skills is the second biggest sector, and there is a lot of focus in terms of the skills needs to drive its growth. I would just add two points to what my colleague has said. The first is around using good labour market intelligence to drive what the skills delivery is in terms of this sector. We have certainly worked in the city with our local providers to look at where demand is and what supply currently looks like, and what we might need to do to invest in any kind of gaps. The second is what we are doing with schools and how we are getting an appreciation of digital from a very early age in schools. So what does the curriculum need to look like? Not because you will be able to create children and young people with the technology that is going to be in use in 2017, but to create the young people with the attributes and skills so that they can compete and contribute to the growth of the digital sector in the city. That is very much for us around how you create an immersive curriculum so that ordinary young people are digitally savvy, wherever they end up or whatever they end up doing. It has been mentioned a few times, how you have a really strong stem in terms of making sure that there are broad pathways for young people, there are proper technical skills and vocational pathways, and I agree, in terms of the careers information advice and guidance, how you make sure that is of good quality, it is up-to-date and the people delivering it are upskilled so that they understand what the opportunities are.

Then for us I think enterprise is the last strand. There are lots of people who work in the digital sector who are not on long-term employment contracts. How do you create people who can work in that sector, be fleet of foot and ensure that they can compete for and drive growth in the sector? That is all that I would like to add but I agree, in terms of the broad things, it is bringing it together and articulating how you get the collaboration to drive it in your city region.

Gerard Grech: We always run the risk of applying old norms to new industries and that is the biggest danger here. When talking to entrepreneurs and CEOs we find that in this specific
industry of digital, in some instances there is less concern about qualifications and more concern about proof of what they have achieved. So that is putting an interesting point on this, which is: how do you ensure that people can prove what they are capable of without necessarily saying that they just have a qualification? You have companies saying, “Yes, great computer scientist from XYZ University, but they are just not hitting the ground running fast enough for me. We need to train them for at least another year before they are quite practical in their work and they can solidly solve a problem”. I am just repeating what I have heard directly from CEOs and entrepreneurs, “They have great lateral thinking; just practical skills, please”. Some universities are doing a great job of this and they understand this.

If you take Manchester Metropolitan University, they are putting together a digital hub—I do not know if it is launched yet but, if not, it is on its way—and that hub in itself, which is a physical space, is bringing together entrepreneurs, corporate companies, university lecturers all together in one place to be able to share ideas, so there is a level playing field in understanding where this industry is heading and how quickly it is moving. What we want to make sure of is that there is no time lag between what universities are producing in terms of graduates and what universities need. It is a classic issue, obviously. These physical spaces, like Manchester Metropolitan University is investing in, are a great way to do that.

As for the point about lifelong learning skills, I could not agree more, especially in this industry. Even myself, I have gone back to evening courses and weekend courses to keep up with the ever-changing landscape of skills that you need to stay ahead in this space, which is why we are seeing the emergence of private sector digital skills schools—like General Assembly, like Makers Academy—who are filling this gap. They are expensive courses, I have to submit. But General Assembly: within three months 95% of those who graduate, after doing their full-time 12-week course, find a job. So they are filling a need.

**The Chairman:** What level of education is needed to do that course? What sorts of people are going into that level?

**Gerard Grech:** The courses are very practical. They are taught by people who are working in that sector. I would argue they are much less academic and more practical. They are teaching you the terms and conditions of how Google Analytics has changed when it comes to digital. I will give you one example. In the area of digital marketing, they are quite up-to-date in how the terms and conditions have changed with the tools that you are using. That is how real time the course is, which is why they are able to find work quite quickly because they can hit the ground running.

**The Chairman:** Is that online?

**Gerard Grech:** No, these are physical courses that you attend.

**The Chairman:** Where are they?

**Gerard Grech:** General Assembly has a place in London and they have people coming from Germany, from all over Europe, to General Assembly here in London because of—

**The Chairman:** On one level what you are describing is brilliant but the danger feeds into our concern, which is: this is being delivered in London and we are in danger of doing more traditional courses in other parts of the country, putting lots of Government funding into it but it is not delivering what is needed.
Gerard Grech: We are trying quite hard to bring General Assembly up to Manchester, for example, but they need scale. They need to prove that there is a market from their point of view. At the same time, there is nothing preventing universities doing what they do. It is being able to recognise that need, working with local industry to figure out what kind of courses are going to be extremely useful and launching them. There should not be any time delay in that respect.

Q201 Lord Lucas: When Karen Price of e-skills saw us she said that what she would like to see is public, up-to-date, short courses that would be good enough for a returner or a career-changer to find out that they really could do this and good enough to show an employer that they would be worth training in it. Why do we not have them? What is getting in our way?

Gary Warke: Some of the funding will be a barrier for that, particularly for adult funding, which has been significantly reduced over the last number of years. That would be the main driver to that. Having said that, there are other ways in which that can be drawn down; perhaps through a self-funded role.

One of the other key areas—just picking up on the point of employers around that lifelong learning—in terms of being prepared for the world of work is around employability seal. One of the things we have done in the Humber, to pick up exactly the point that has been made about: we might be turning out a lot of graduates, we might be turning out a lot of people with A-levels and so on, but do they have skills to make that step into the job market? Employers bemoan the fact that team working, attitude to work, all that is missing. What we have developed in the Humber region is an employability passport, so that anyone who wants to finish their course in the institutions will have to meet a number of criteria that is around that transition, being prepared for work. That has been well received by employers—and is only awarded against a gold, silver, bronze list of criteria—and that is not just having qualifications, it is about the attitude for work as well. That is a key part of that development.

The Chairman: We are going to have to move on; we still have quite a lot of questions unfortunately.

Q202 Baroness Garden of Frognal: You all made mention of the importance of creativity. How can different regions be supported to foster creativity? Mr Warke, we read here your Humber is building a reputation for digital innovation and creativity. What are the elements that have helped that and are there things that you can recommend to other regions to put together a similar success with creativity?

Gary Warke: Yes, the key variables of the Humber have been that we have a huge amount of passion and commitment by some large and small and medium-sized organisations. So they have been the driving force behind pulling together and working together to set up this digital sector group. Within that creativity, for example, we host platform studios. Platform studios are an innovation hub for the region where young people can come in and set up their own businesses around creativity innovation. That has developed hugely. It is hosting one of the major gaming fairs in the world from that connectivity. So we have a platform and we now have a £15 million building set up called C4DI, which is about the creation for digital innovation. That is a new £15 million building in the City of Hull, which is going to accommodate all that innovation and creativity around the digital part of that.
The University of Hull and the colleges are now working collaboratively with all the investment joining that up. The digital manifesto maps all the curriculum pathways that exist from 14 and beyond to do that. We are also putting a proposal in at the moment to support the skills at school level, as we make that switch from ICT to computer at a compulsory point in school education. It is a matter of how that can be supported in all our schools in the region as well, to ensure that the skillset is there for the teachers in the schools and also by creating that awareness of moving right through.

The buzz within our region around the City of Culture, as I said earlier, is a catalyst and a huge amount of commitment and creativity. The thing that we do not have—and I am sure that creativity is probably in all the other LEPs—is a forum for drawing that in and sharing that. Perhaps that is something at a national level, how that can be facilitated through national LEP roles or through other partners because I am sure there is a great wealth there but we do not have an opportunity of sharing it.

Baroness Garden of Frognal: Presumably that work helps careers information advice and guidance as well, does it not, if you bringing employers into schools and so on?

Gary Warke: Yes, absolutely. There is still more to do in that area, significantly more. But, yes, that is very much the ambition that we want to do. In fact, Graham Stuart, chair of the Education Select Committee, launched in Humber last Friday our first portal for creating impartial advice and guidance for all schools across the region, very much to address that issue about young people not getting access to the career pathways and choices.

Angela Harrington: The only thing to add to that is looking at how you bring the creativity and the digital together and how they can drive each other in a place. I think it has been mentioned already, the city has the advantages of having the BBC located in the city region. They are driving a lot of creativity around digital content and wider programming in the city. Also, it is the spinouts from the university. The universities in Manchester are clustered together along a corridor in a very small area within the city, and that spins out a lot of creativity and innovation. The question for us is how to capture even more of that to stay in the city, drive it further and link it with a wider infrastructure in terms of supporting the businesses but also wider infrastructure in terms of a culture and creative offer that makes the city a good place to visit, work in and grow a business in. That is the virtual cycle that we are striving to create.

Gerard Grech: Just to add two things—I do not want to repeat the great things that have been shared by the panel. First of all, obviously, we put a lot of focus in this country on numeracy and literacy but we do not do enough to perhaps put a focus on creativity at schools. I welcome this Coalition’s introduction of coding in schools because I think coding is not about creating a nation of computer science programmers, far from it. What coding allows you to do is to be creative through logic. I think you have instant gratification for the work that you have put in, in terms of what you create. That is very positive.

We do not know what the problems of tomorrow are, so we need to create a workforce of problem solvers. To that point it would be good for local councils to say to themselves, “We do not know all the answers. We need to find a way of engaging the community to come up with some of these answers, especially in technology”. Developers and people in technology, they love problems to solve and that is how they are creative. As long as they are recognised for it they are fine with it. I would like to see more local councils do hackathons. Hackathons are one day where you bring the tech community in to solve specific problems that have
Humber Local Enterprise Partnership, Manchester City Council and Tech City UK – Oral evidence (QQ 192-204)

been articulated quite clearly by the local council. “We would like to have dustbin trucks run more efficiently. How do we do it? Here are the datasets that we will open up to you. Could anyone come up with some solutions to this problem?”

The Chairman: It explains how the application can work.

Gerard Grech: Absolutely, and having that confidence in political leadership to say, “We do not have all the answers but we are inviting you to be creative in how we solve these problems together”. I think that builds trust, that builds collaboration and the level of understanding increases a substantial amount. One example of how we did this is we ran a flood hack when this country was experiencing some of the worst floods in this country for many years. We worked with Government Digital Services and the Environment Agency, and we ensured that some of those datasets were opened exclusively to the tech community and in one day we came up with 18 solutions, three of which went live within 48 hours. Clearly the understanding between the two groups increased substantially and that is always a positive sign because there is no gap. That, in itself, allows local communities to be creative. So when they see that their local council is ready to engage in that way you will be surprised by how willing the local tech community is ready to engage.

Q203 Lord Holmes of Richmond: Good afternoon. I would like to turn to inclusion and inequality. We know how the digital revolution has potential to increase inequalities and also, looking at the General Assembly course, is incredibly effective but it obviously costs quite a bit of dough. How do you think regional hubs and public funds can be better deployed to increase equality in this space?

Angela Harrington: I absolutely agree with your point. It is about to become even more important as people will only be able to access the universal credit online, so anybody who does not have online access is going to be seriously disadvantaged. There are a number of ways that local government or Government can improve digital inclusion. First is access, clearly. So how do we ensure that all of our population have access to high speed internet? We do that through libraries and we work with our partners such as registered providers in terms of housing access. What does our planning system do when somebody wishes to develop a new residential development in terms of stipulating or ensuring that broadband access is part of that development? The other area is around the skills development. For example, our adult education services include digital as part of employability skills. So where they are working with somebody who is out of work—and we know that people who are out of work and people who are older are those who are likely to be digitally excluded—digital skills are an integral part of the work that they do, so that people have at least a basic level of skills and understanding. So those are the two: it is access and the skills.

Gary Warke: Yes, I would agree with all of that. Social inclusion takes stock of a wider group in terms of the under-representation of women, BMEs and so on, and there is a real need to push that. At the Humber LEP we have now established women in digital and gaming to raise the profile, using some businesswomen across the region to work with schools and colleges to say, “This is a serious career pathway for women as well as men coming into this particular sector”, as well as targeted work in BME. So I think it is a broader issue, not just about access to digital infrastructure and so on, although schools are doing a lot more with that now in terms of accessibility, but ensuring that under-representation is absolutely critically stressed.
Gerard Grech: Just two things, because I agree with the panellists. First is helping organisations like Code Club and Apps for Good who do a lot of work inside schools, and obviously students at school. They bring that information home and they will share it with parents. That in itself helps to increase the knowledge of these skills and what is happening in the digital economy. I have been a mentor for Apps for Good for over three years, working directly with people aged between nine and 15, and it is amazing how advanced their thinking is. They do not think about computers as PCs, like we do. They literally just think of computers as mobile phones. That, in itself, is quite amazing. It is quite staggering. I have lost my train of thought.

The Chairman: Do not worry, we will move on to the final question as we are overrunning.

Q204  Lord Lucas: What one thing would you ask us to recommend that would make a difference to the UK’s competitiveness in digital skills? How would it be achieved and at what cost?

Gary Warke: For me, it would be around supporting creativity and enterprise among our graduates. I described earlier that we have platform studios, and that the platform studios in Humber are in an incubation area for graduates who are not quite ready for work but are buzzing with enthusiasm and ideas but they have nowhere to go with all of that. None of that is funded. So we have a qualification framework and an education system that is all about outcomes and qualifications but we do not fund it. I talk about the schools sector and I talk about FE and beyond, so it is about how we can invest energy, commitment and resources into funding that business start-up and to enhance competitiveness is what I would really like to see.

Angela Harrington: We would like to further devolve the skills budget, so that we can build on the unique strengths, which I think have come out through our discussion here this morning, and make sure that we enhance digital skills in our cities and in our regions.

Gerard Grech: Hopefully I will not lose my train of thought this time around. If it is just one thing, I think more institutes that have a centre of excellence. The Alan Turing Institute is very welcome. That obviously will have excellence in computational science, but we need to recognise that, to be first in digital as a country, there are many digital capabilities that we need from machine learning to user experience and user design. If we were to have these institutes that are attracting the best and brightest talent from around the world, we will certainly be recognised for being at the forefront of digital innovation.

The Chairman: Thank you, that is really helpful. Thank you very much indeed, all of you.
1. The number of female students on various digital-related degrees.

(A question arising from Dr Gerard Gorman’s presentation):

To clarify, Dr Gorman had been speaking in the context of the travel awards given out by the ESPRC UK-USA High Performance Computing Network to the annual Supercomputing Conference. In this context his statement about ‘50%’ was about a national activity rather than an Imperial College activity. The website references the 2014 awardees of which 6/12 were women, whilst the 2013 awardees had 1 female from 11 awardees. Dr Gorman believes the change came about because of the newly established Women in High Performance Computing network who were proactive in encouraging more women to apply.

For information regarding Imperial College’s diversity statistics see the College’s Annual Equality and Diversity Report (http://www3.imperial.ac.uk/equality/reports) contains ‘at a glance’ information about the representation of women in the College (page 7 of this year’s Report), specific information about women at Imperial incudes our Academic Gender Strategy Committee and details of our Athena Swan Awards may be of interest too.

2. Funding Streams

The Committee were interested in how you are funded, including barriers and challenges.

**Funding Sources:**

The College Annual Report 2013-14 provides details on funding; of particular interest should be the 5 year summary on page 6 and the Financial Review on pages 7 to 11, more specifically income is discussed on page 8. Income is also referred to on pages 40 and 46-47. Some year-on-year statistics can be found on our website Research Grants and Contracts Income.

Our Research and Grants income for 2012-13 can be found on page 11 of our 2013-14 College Statistics Pocket Guide

**Some of the barriers and challenges include:**

- Government politics require agile planning ahead e.g.
  - Tuition fees introduction
  - International VISA restrictions (affects the calibre of staff and students)
- \£/other international exchange rate affects supplier costs and global attractiveness.
- Efficiency measures placed on research funding from Research Councils
- Location specific challenges include:
  - political pressures to spread funding on a regional basis away from the capital
  - the cost of estate and infrastructure (especially for multidisciplinary and research work)
  - staff and student related costs (accommodation, childcare etc)
- Philanthropic giving environment in the UK
- Post-Graduate recruitment and financing for this (concerns about spreading funding too thinly)
3. Capital Investment & Expenditure

Q - Capital investment from Government, Research Councils and other partners: what might the Government and its agencies do better to facilitate capital expenditure/investment in key facilities/subjects?

A - Capital funding to research intensive universities has seen significant reductions over recent years and further direct allocations of capital funding are vital to ensure sustainability of research infrastructure within institutions. Providing an appropriate amount of capital funding on a recurrent basis to institutions is essential to ensuring the long-term sustainability of the UK research base and attracting internationally excellent researchers and funding to the UK. Funding should be based on the criterion of excellence. Recurrent capital funding to institutions should therefore be increased, and more funding for research equipment should be provided as part of research grants. Substantial damage could be caused by short-term fluctuations in funding.

A strategic approach that allows a longer-term perspective to be taken and in which new areas of science can be given the time they need to grow is needed. If increased funding is not to come directly from government, then inevitably HEIs will need to take on more debt; although HEIs are seen by the market as “quasi government” already, more explicit government backing for loans would improve margins and give greater confidence for long-term planning.

In particular, investment in small-scale and mid-range facilities within institutions is crucial to the health of the national research base as it supports core underpinning research infrastructure. National and international facilities are essential for the undertaking of research in a large number of subject areas and hence need to be resourced appropriately; these facilities and universities co-exist and are interdependent. In addition, universities and research institutes need to work together to set up collaborations; clusters of peer institutions in close geographical proximity and covering a range of subjects are a good approach. It would be helpful for the Government and Ministers to work together with a high-level science advisory committee made up of expert academics to establish an agreed and common set of priorities for research funding.

The UKRPIF funding, in which the government capital needs to be matched with third party money raised, is also very welcome, although it is recognised that this will be more applicable to some areas of the research portfolio than others.

Finally, it is vital that recurrent funding to cover operational expenditure should be made available alongside capital funding. This is particularly important for HPC facilities, since without training users and adapting codes to make the most efficient use of new hardware architectures, best value for the capital expenditure cannot be achieved.

4. Immigration

Q - What would it take for Imperial to be able to improve high level skills capacity and/or to retain best talent?
A - The ability to continue to attract the most academically able students from across the world combined with the provision of world class facilities and globally competitive remuneration structures are required for retaining best talent.

As mentioned above we need to be funded sufficiently to maintain programmes of staff development so that the capital investment in HPC is leveraged with appropriate skills. Imperial College is attractive to the best minds if it able to maintain a balanced portfolio of leading edge equipment, support facilities with appropriate skills and a reputation for world class research carried forward by collaboration amongst the best researchers. This capability must be visibly sustainable and part of our profile.

5. Presentations

This link gives the original source of the statistic that 98% of all products will be manufactured digitally by 2020 which Dr Gorman mentioned during his presentation after attending the Super Computing 2014 conference.

9 December 2014
1. Innovate UK (formerly known as the Technology Strategy Board) is a business-led organisation with a leadership role to stimulate technology development and innovation for the benefit of UK business in the areas which offer the greatest potential for boosting UK growth. In line with our strategy ‘Concept to Commercialisation’ the organisation operates across Government and advises on polices which relate to technology, innovation and knowledge transfer. Innovate UK is the UK innovation agency and acts as the prime channel through which the Government incentivises business-led technology innovation.

2. Innovate UK was established in July 2007, as the Technology Strategy Board, and has committed more than £1.3 billion to date, the majority of the funding being matched by business. We have directly supported over 6,500 companies and work with nearly every University in the UK.

3. The commercialisation of research and the support of innovation across the economy is vital to deliver future products and services and to generate economic growth. Innovate UK welcomes the Committee’s inquiry.

4. Innovate UK recognises that the digital economy poses significant opportunity for UK businesses to innovate and capitalise. A transition to a more digitally-efficient economy will also provide a wide range of openings for new businesses and stimulate growth. It is in response to these possibilities that Innovate UK has created a number of programmes and projects to stimulate the digital economy.

5. We make the following points in response to the specific questions raised by the Committee.

**The changing technological landscape**

**What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?**

6. Technological advances in communications and computing capabilities continue to rise exponentially. We can expect over each 5-year period an approximately 10-fold increase both in the communication speeds and computing speeds available to the public and to businesses, with little change in overall cost.

7. As this capacity is put to use, we will see a corresponding increase in the volume of data that is transmitted and processed. The pace of change is such that most of the data in the world at any time is no more than 2 years old – we have unprecedented amounts of current information about our world, and its analysis can create an increasingly detailed view of what is happening in our lives and in our surroundings.

8. This flow of information is accelerating beyond our human capacity to monitor or to control it directly. However, as techniques evolve to analyse this “big data”, it is possible to generate knowledge and insight from it that can inform decisions in an increasingly
Innovate UK (formerly known as the Technology Strategy Board) – Written evidence (DSC0070)

automated way. Advances in robotics, “informatics” and machine learning will allow us to automate our surroundings and cede control of more of the information-handling and processes that currently require a human decision maker.

9. We are currently also experiencing an exponential increase in the number of devices that are connected to one another through the internet, trebling over each 5-year period. These additional devices are being connected wirelessly, and many are mobile because they are attached to moveable objects or we carry them with us. The internet is evolving from a population of computers wired together; it is currently in a transition where the wires are discarded, and it will continue to evolve over the next 15 years to become a pervasive communications and service environment that surrounds us – the “internet of things”.

10. The UK leads in the development and the adoption of many of these technologies, so it is the UK population who will be among the first to experience both the positive and negative impacts that result.

What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

11. Already, there is almost no section of the modern economy that has not embraced computers and mobile communications to handle enterprise management and the relationship with customers. Whilst paper has not disappeared from the office, the bulk of information now moves and is stored by electronic means.

12. Looking forwards, we will see a more fundamental effect on the structure of businesses, as technology disrupts, reconfigures or even replaces more and more transactions amongst the networks of people involved in day-to-day business.

13. The recent history of creative industries and media show us what challenges we may face in the coming years. The internet allowed consumers to connect directly with the producers of music, books, news and other information, bypassing intermediaries (publishers, bookshops etc.) whose businesses had relied upon managing the traffic between the two. This created greater intimacy and the possibility of a richer, two-way conversation between producer and consumer, but the established ways to turn this into a profitable business have had to be fundamentally rethought.

14. We can see a similar revolution now taking hold in retail, as shoppers connect directly to producers and wholesalers, bypassing the entire retail supply chain and long-established commercial routes, arranging their supply of both goods and services directly. Citizens are also taking more direct control of their finances, dealing with automated systems to manage their money online and removing the need for retail banking intermediaries. Early signs of transition can now be seen in health, in transport, in education, in the delivery of public services, and in many other sectors of the economy.

15. We are also seeing a rise in customers’ expectations of service quality. We demand that services in the internet-mediated economy should be available to us continuously, rapidly, with ease and fluidity, and at ever decreasing cost (or indeed for free). Suppliers have little choice but to raise their game in service design, as the public has become more choosy, and competition for customers’ attention has reached new heights.
16. A side consequence of online transactions is that they can generate insight into customer behavior; big data analytics is driving a rise in targeted advertising and consumer profiling as a way to capture and trade value, as businesses compete to attract and retain our attention. However, this in turn can be seen as an invasion of privacy and our society is in the midst of an uneasy public debate, seeking a balance that is satisfactory for all. This is one aspect of a broader challenge faced as we increase our reliance on electronic transactions and allow more data to circulate about our activities and preferences – trust is difficult to establish and to retain, and the security of data is an ever-present concern.

17. The same pressures are being felt within businesses and in business-to-business interactions. As business processes are first converted into digital information flows, and subsequently are automated, we will see information-handling employment functions being bypassed. What has happened previously to the typing pool will next happen to the accounts department, the sales department, IT, HR, and even the manufacturing line. Each of these can already be bought in as a service, operated for multiple clients through the universally accessible “cloud”, and delivered at lower cost due to automation and new economies of scale. This will shift profitability around supply chains, including across national borders, in ways that are still not fully established or understood.

**What is the employment impact on the UK’s labour market? What are the regional differences?**

18. These changes will have a transformative effect on the workplace. In principle, workers and managers will be able to operate a business remotely from their homes, meeting rooms or coffee shops. The office will then join the high street and the classroom, declining in importance as a location for a particular activity or function, persisting mainly because of its social importance in our lives but with a functional need that has been greatly eroded by remote digital transactions.

**Future workforce**

**What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?**

19. Digital technology is advancing far more quickly than companies can even incorporate it into current businesses, let alone restructure their business approaches to use it effectively. This can mean that new businesses, with digital technology designed in from the start, may be more successful than long-established businesses that have to learn how to change.

20. Innovate UK is working to encourage change through digital transformation. We are investing not only to help businesses develop new technology, but more importantly to help them address the barriers that prevent them from innovating by using it. This includes repeating themes of business risk in the adoption of technical capabilities such as cloud computing and remote working, and a need for systems and infrastructure to support new business processes for technical areas such as internet of things and data analytics.

21. Innovate UK can invest to support innovation in technology and business practice, but this needs to be complemented by an injection of skills, or businesses will be encouraged to
Innovate UK (formerly known as the Technology Strategy Board) – Written evidence (DSC0070)

develop and adopt innovative products which they themselves are not sufficiently equipped to operate. Alongside technology development skills, we need to invest to make businesses resilient to change. There is a skills element to this, but it’s more about business skills than technology skills. Skills of leadership and change management are needed if a business is to embrace fundamental change and disruption brought about by new technology. We need business leaders to be comfortable with technology, which requires a grounding outside their core discipline. We also need business leaders and investors to be agile and comfortable with change. Examples of government support to develop these business and entrepreneurship skills have been advanced through Tech City UK Business Leaders programme, alongside proposals to the Information Economy Council to support leadership skills during business scale up.

22. Innovate UK are committed to support SMEs with high growth potential, this includes mentoring and coaching support giving companies the capability to progress, attract potential investors, grow and succeed. This is helping innovative companies innovate, and commercialise products of the future, whilst developing the business models and business skills to manage rapid growth and change.

How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

23. There is a significant demographic imbalance in the IT industry. Compared to the general population, programmers are more white, middle-class, educated, and overwhelmingly male. This monoculture is a problem for many reasons, not least because these engineers tend to design things to suit themselves and the people around them; modern technology is designed to be used by white, middle-class, educated males.

24. Google have started to tackle this by investing $50M to train female programmers, but since 83% of their technical staff are currently male, there is a long way to go before the diversity issue is fixed. We need to start with creating the right atmosphere in schools to encourage girls to study these subjects alongside boys, but that will take 10 years to feed through into the workforce.

How are schools preparing to deliver the new computing curriculum in an innovative way?

25. “ICT” (i.e. the ability to use computers) is a basic prerequisite to function in a 21st century economy. For many pupils, this will be learned in the family environment just as much as in the school, but for those families that suffer social or educational deprivation, targeted measured may be needed. The e-Learning Foundation provides a possible model. This is a charitable foundation that works with both children and their parents to instill basic digital skills.

26. The shift of the school curriculum to include coding is welcome; to build confidence throughout the populace that they understand the fundamentals of how the technology that surrounds them operates, as well as providing the opportunity to specialise into computer science as a discipline.
Innovate UK (formerly known as the Technology Strategy Board) – Written evidence (DSC0070)

**How can the education system develop creativity and social skills more effectively?**

27. Beyond “Coding” (i.e. ability to write software), we should seek to develop the skills of “Computer Science” (i.e. ability to write good software). We need students to have the right thinking skills as well as technical knowledge, so that they can analyse problems and design efficient and elegant solutions, which satisfy the needs of users. This is an essential adjunct to the purely mechanical, technical skill of coding to translate these ideas into an engineered outcome, and it requires design creativity and empathy for user needs. These are difficult skills to teach, as they go beyond knowledge and extend into thinking skills and vocations of practice. They require a different teaching approach, less didactic and more practical and experimental.

**How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?**

28. It is necessary to reexamine the structure of discipline boundaries, faculty boundaries and academic career structures, to encourage interdisciplinary education and subsequently interdisciplinary research.

29. In the 1959 Rede Lecture, C P Snow recognised that academia had separated into “Two Cultures” of science and arts, and the gap was widening. In 2013, the AHRC-funded Brighton Fuse project presented evidence that successful digital companies now “fuse” the technical and creative skills of their staff. This provides evidence of a need to reunite the two cultures. It is not sufficient for software engineering businesses to develop products that just function correctly; in a competitive economy these products must also be emotionally engaging, accessible and intuitive to use, which requires creative and design skills seamlessly integrated with technical and engineering skills.

30. In academic research, the Digital Economy programme of RCUK incorporates contributions from three research councils (EPSRC for engineering, ESRC for economics/social research and AHRC for arts/humanities research). This supports interdisciplinary research, and creates interdisciplinary postgraduates, spanning these disciplines. However a problem exists in that faculty boundaries don’t lend themselves to crossing of disciplines; the business school has no history of talking to the computer science department or the history faculty, and academia seems to discourage the multidisciplinary academic that tries to progress a career with a foot in two camps.

**Short- and medium-term support to the digital sector**

**How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?**

31. Technical and programming skills requirements evolve more quickly than training which industry can adapt. Academic training is particularly a problem; it takes 4-5 years to devise a new course and train students through it, by which time the knowledge of new graduates is already obsolete. Therefore the need is for training very close to the workplace, which is agile and adaptive and on the same timescales that the industry itself adapts.

32. For example, video games development studios have reported to Innovate UK a need to retrain their graduate recruits on the job. Despite the excellent degree courses at institutions such as Bournemouth and Abertay universities, there is still no substitute in the
Innovate UK (formerly known as the Technology Strategy Board) – Written evidence (DSC0070)

education environment able to instill the right mix of technical, artistic and business skills for a games developer, and at the same time to keep all of these skills current to the state-of-the-art.

33. The structure of the technical training institutions and courses should therefore be scrutinised. Do we bring students to the workplace to train? Bring the workplace to students? Second workers out for short courses? Train online so that course materials can be changed in flight? There are many options to create a more responsive further and higher education environment, and these should be investigated and developed.

Is there a need for increased high skills immigration in the short-term? What are the implications of this?

34. An alternative to training a technically skilled workforce is to attract them from overseas. If the companies recruiting for such skills are in UK, and if we have low barriers and incentives to relocate, then we may be able to import skilled personnel from other countries, especially lower wage economies like the BRIC countries, who are investing strongly in such education.

35. The UK, especially London, is a major global attractor of tech talent currently, and remuneration and standards of living are high. If we can sustain this, we will be able to build a technical workforce that is not only highly skilled, but also rapidly adaptable and more diverse than anything we could home-grow. However, labour mobility works both ways – if for any reason the UK stops being an attractive place to work, a brain drain could strip us of these skills with alarming speed.

36. The recently published “Startup Manifesto”, edited by the Coalition for a Digital Economy (COADEC) puts forward proposals sourced from the community of startup businesses, for practical measures that may address this and related issues facing such businesses.

Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

37. In the short-term, we should expect that general functional literacy with IT will become a universal requirement in the workplace. Office workers, shop workers and factory workers will all be expected to operate handheld devices that record their transactions, to create and manage records and to communicate with colleagues through a keyboard and screen. Even to search for and apply for a job is becoming an online activity, so a lack of these basic skills and access to the equipment and infrastructure to use them will become a serious handicap for employment. Currently, 14% of the UK population lack basic literacy in the use of the internet, and whilst 70% of these are beyond working age, there remain around 2 million people in the UK, of working age, who are excluded from the digital economy as customers, workers and citizens. This is a severely disadvantaged group in society, with strong correlation to poverty, disability and other factors of social deprivation. Given these correlations, there is also a regional element to this problem, with the greatest levels of digital illiteracy pertaining in the North-East, grading down to become less of an issue in affluent areas of London and the South-East. This is not primarily a gendered issue; in the working-age population it affects men and women equally.
Innovate UK (formerly known as the Technology Strategy Board) – Written evidence (DSC0070)

38. For the majority of the working population, however, basic IT literacy is less of a problem. In fact, the UK working population overall has a good level of familiarity with mobile technology and basic computer usage. As consumers we have been early adopters of internet services, which we have taught ourselves to use, and we spend a disproportionate amount of our time and money on online activity, based on international comparisons. This stands us in very good stead as the same technologies are adopted into our workplaces. So whilst training is still needed in the use of specialist software applications or equipment, it is not generally necessary to provide additional training in fundamental skills for the majority of the working population.

39. To maintain the UK’s lead in digital adoption and the progress of the digital economy, there are a number of measures that UK economy should take.

40. Users of technology shouldn’t need to make technical decisions. Innovate UK therefore emphasises, and encourages businesses to invest in, good design, to make technology easy to use without training. Design means thinking about users, so that perfectly designed technology is invisible. The solution to the skills issue in the workplace is to deskill the technology in the workplace.

41. In parallel, we should press forward to support digital transformation across government and all business sectors, so that new, attractive services and experiences keep drawing people in. We should also press forward on deploying advanced internet infrastructure (especially mobile; 5G; Internet of Things) so that services are available to the public as they are developed.

42. With these measures progressing, most of the population will then be motivated to teach themselves how to use the technology, which will help keep any reemergent digital inclusion issue at bay.

**What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?**

43. To engage on basic skills and inclusion issues, it is important to build confidence amongst learners, which requires close-quarters coaching, delivered at a local level with an understanding tailored to the local community. Therefore the most successful models have been devolved to local responsibility, often with volunteers working in community centers, local libraries or schools. It is nevertheless possible to coordinate such efforts at a regional or national level, and it is cost-efficient to create shared management structures and course content on a larger scale.

44. One successful model, which may provide a template, has been through UK Online Centers, which is a national operation franchised to local level, grant-supported by government. This strategy has reached over 1 million learners over just a few years, at a manageable cost with significant benefit of overcoming digital illiteracy.
Industry

What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

45. All sizes of business may experience barriers to the adoption of new digital technologies. Lloyds Bank UK Business Digital Index 2014 extensively surveyed and characterised the digital preparedness of the UK’s SMEs. This was in partnership with UK government through the Go On UK campaign: http://businesshelp.lloydsbankbusiness.com/news/launch-of-uk-business-digital-index-2014/.

46. Key facts from this study:

- almost 1.5m UK SMEs in the UK invest significantly in their digital infrastructure;
- but 1/3 of businesses are without basic online skills and 75% don't invest any money in improving digital skills;
- only 50% have a website and on the whole, those that do are only providing basic functionality;
- 29% of SMEs/charities believe being online isn't relevant for their business;
- digitally mature SMEs/charities have more confidence in their own enterprise in the UK economy as a whole; and,
- 2/3 of digitally mature businesses rate themselves as above or significantly above their performance expectations.

47. These results show that we are still only midway through the first phase of business transformation, where SMEs establish digital communications and data management channels both internally and with their customers. Early pioneers have shown the way, and the majority are now following, but the transformation is ongoing and laggards have not even begun to make first steps towards operating in a knowledge-driven economy.

48. Just as with individual skills, specific measures can make it easier for SMEs to adopt change, building their confidence, simplifying the business transition, and dealing with their concerns which are often centered on trust and security. Innovate UK has been active in driving business service providers towards developing simpler and more trusted solutions in areas such as cloud computing, mobile commerce, data analytics, remote working and other elements of digital business operations.

49. Innovate UK have also worked to ensure that new and emerging technical and business infrastructures, such as the Internet of Things, are developed with design characteristics that encourage SME adoption. For example, new technologies need to inspire confidence in their security, the technical and business barriers to entry must be addressed, and the infrastructures should be developed to support SME business scaling, by means of robust standards, appropriate regulation and interoperability of the technical key elements. It is then necessary to directly stimulate adoption of the new capabilities by the SME, for example by further innovation activity to address any remaining concerns and barriers to adoption. Innovate UK continues to work to stimulate and direct business-led innovation towards these ends.

50. There is also a role for government to set an example in the conduct of its own operations. Government is a major actor in the knowledge economy in its own right, and the
decisions made by the UK public sector in the adoption of digital technology and working methods, and the approach to outsourcing and procurement, set an example that commercial businesses can then follow. In this way, government can help to reduce the risks of change for the wider business population.

51. The Cabinet Office’s Government Delivery Service (GDS) provides a template for how this can be managed. GDS has set a globally recognised example taking government transformation through the difficult early trailblazing stages but, as with the UK’s commercial business transformation, the digital transformation of government is still only in its early stages and the opportunity remains open for a continued leadership role.

52. The SBRI (Small Business Research Initiative) mechanism provides a possible next stage for government leadership. Public sector organisations can procure innovation activity to stimulate the development of technical and business solutions that can be used by them as lead adopters, and which can then also be made available for use across the wider commercial economy.

53. As the transformation to a knowledge-based economy takes hold, it will be essential for government to also lead efforts to address digital inclusion issues, or there is a risk that the excluded public will become isolated not only from the commercial and employment benefits of the digital economy, but also from public services.

**How can businesses help equip the workforce with new skills in a rapidly changing environment?**

54. It should not be necessary for the entire workforce to have the skills to develop technical solutions; we do not all need to be able to code in order to survive in the workplace, any more than we need to be able to engineer or even service our own cars in order to drive them. However, it is important that basic technical literacy of the workforce keeps pace with the rapid change which is a feature of digital transformation. Otherwise, there is a risk that new inclusion gaps will open in unattended areas or for sections of the public, for example those not in employment, who are isolated from whatever skills development support is on offer.

55. One way to assure that digital literacy develops together with digital transformation is to ensure that where changes are implemented, this is done in such a way that does not create new skills burdens on those who will need to adopt them. Well designed technology does not require training courses or operations manuals for its users; it is intuitive to use and it builds on their existing skills and expectations of usual practice. Any complexity is hidden from the user, and dealt with inside the machine.

56. The most important role for businesses is not one of skills development of their workforce to cope with complex technological change; it is to ensure that technological change does not make the workplace complex. This is a challenge of design and innovation, where Innovate UK is in a position to assist. An example is a recent programme of activity around the Learning Technology market, where Innovate UK is working not to encourage more products to be developed, but rather to revisit the product development approach to ensure a good fit to the needs of teachers and learners and to remove any burden on their
Innovate UK (formerly known as the Technology Strategy Board) – Written evidence (DSC0070)

skills, ensuring the new products are a natural fit to enhance, rather than disrupt, their working patterns.

**Infrastructure**

**Does the UK have a competitive infrastructure to support a knowledge-driven economy?**

**How does the UK compare to other countries?**

57. Investment in communications infrastructure in the UK has fallen somewhat behind the most advanced of our international competitors, and the availability of broadband and mobile coverage is not currently world leading. However, this has not inhibited the uptake of digital services and the rise of online commerce, where we are arguably the most advanced nation in the world, with a substantial lead in the use of mobile internet and with a population that spends more per capita in the internet economy than any other country. This leaves our business infrastructure, such as payments handling systems and data management services, in a strong position internationally. However, new waves of technology continue to be developed. It will therefore be necessary for the UK to invest to ensure availability of new generations of mobile communications infrastructure. 4G adoption is underway, and in parallel we are supporting research efforts to develop the next generation of 5G mobile infrastructure for personal communications.

58. Machine-to-machine direct wireless communications are now maturing, ready to underpin the Internet of Things service infrastructure that will support transformative change across many business sectors ranging from transport to retail to health and care. Attention is now turning towards the overlays of data management and business operations infrastructure that will sit upon this communications capability. Proving the commercial and social value of this capability through research demonstrations and pilots will then provide the business case for rollout of large scale infrastructure deployment. If we are to maintain an advanced position for the UK not only in technical capability but also in the continued development of our essential service economy, we must sustain and endeavor to invest in innovation which supports the knowledge-based economy.

*5 September 2014*
The Institution of Engineering and Technology – Written evidence (DSC0049)

1. The IET\textsuperscript{296} is Europe’s largest professional engineering and technology organisation. The members represent a wide range of expertise, from technical experts to business leaders, encompassing a wealth of professional experience and knowledge.

The changing technological landscape:

What is the pace and change of the future digital technology landscape over the next 5, 10 and 15 years? What are the leading innovations?

2. The technology landscape will see increasing society dependence upon mobile digital technology for information, entertainment, e-commerce, health and fiscal transactions, enabled by ubiquitous wireless services with seamless handover between them e.g. fourth generation (4G) and fifth generation (5G) mobile technology, through short range wireless technologies akin to Wi-Fi. To avoid very high infrastructure bandwidth requirements (and thus cost) multicasting technologies will be developed for popular entertainment. See the IET’s Demand Attentive Networks\textsuperscript{297} paper. These services will feature dynamic usage charging.

3. Current broadcast media services will slowly migrate towards on-demand services delivered in the manner similar to that of the Internet. Digital Terrestrial Television is likely to retain a central role over the next 10 years, with a full switch to alternative technologies such as Internet Protocol Television (IPTV) not appearing feasible until at least 2030\textsuperscript{298}. Increasingly, society will become familiar with their choices being monitored and used to offer tailored content and services. Increasingly, digital technology will become a new enabling technology, or essential technology, in most work activity whether driving a vehicle, for example, or carrying out a surgical procedure. The presence of digital assist may be overt or covert. Society will become used to their health being monitored by personal digital devices with preventative healthcare measures being recommended sometimes before they are aware of any adverse health issues. Digital technology will increasingly support the elderly, to live safely, comfortably and well at home, and be less reliant on needing to visit and use health services. Digital technology will develop means for the elderly to remain socially engaged from their home.

4. As we see the number of devices connected to the Internet climb to an estimated 50 Billion by 2020\textsuperscript{299}, the generation of an unprecedented volume of valuable data emerges. This data will be created, as we have already seen, within the current “Internet of People”, and increasingly by the predicted “Internet of Things”. The latter may take just 10 to 15 years to reach the current data size of the former, as “people” will be interacting with the “things”.

5. Storing, handling and processing this amount of data presents technical challenges, however there is an opportunity for society to address these issues.

\textsuperscript{296} http://www.theiet.org/
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\textsuperscript{298} http://stakeholders.ofcom.org.uk/binaries/consultations/700MHz/summary/main.pdf
\textsuperscript{299} http://share.cisco.com/internet-of-things.html
6. Data science also known as “Big Data” will evolve to monitor and analyse in real time geographical surroundings, and the environment, to keep society in general, and the individual in particular, safe from harm. Data science will similarly be used to inform national and local services to improve transportation, energy efficiency, utility and infrastructure availability.

7. There are already examples of Big Data analytics providing revolutionary societal benefits, for example, human genome decoding is about to become economically viable for mainstream consumers. Predictive, proactive medical action is being taken across the community, with the potential to extend and enhance life expectancy. Data analytics is in its infancy. It is envisaged to have great potential as the science; comprehension; and know-how develop over the next 5 to 10 years. Regulatory oversight of many of these applications is envisaged to ensure compliance with various legal statutes e.g. Data Protection Act and the Common Law duty of Confidentiality.

8. The Big Data key digital skills are in software development, rapid algorithm data scanning using averaging and statistical techniques to pin point data seams and extract the value instantly. These are new skills, rare today but will form the basis of societal economic success in the future. These skills are not dependent upon a vast physical infrastructure and can be developed and utilised by a broad section of the population. In addition, their use does not have to be restricted by location. There is a big opportunity in the digital skills gap area and a need to recognise this within the education system before the UK is left behind, as this new industry(s) emerges.

9. Greater use of linked digital technology will necessitate increasingly sophisticated means of ensuring that technology, and society, is not impeded by mischievous or malevolent individuals or organisations i.e. “hackers”. This protection will in-itself be a bourgeoning sector.

10. It seems inconceivable that the current poor standard of software ‘engineering’ could be permitted to persist in its current form for another 15 years. We therefore predict that despite all the challenges entailed, by 2030, there will be a greater demand for digital systems development to have become a true engineering discipline, based on established computing science and mature methods for planning, change control, risk management and quality assurance. A larger quantity of software will be written in ways that can be shown to guarantee that it meets its specification and that it is free from the known classes of errors that lead to security vulnerabilities i.e. is “trustworthy”. “Test and fix” will have been replaced to a greater extent than today by “correct by construction”.

11. A greater demand for cyber-secure systems will create a larger market than today for software components to be supplied with well-founded warranties. This is an attractive market for UK companies, because UK universities taught mathematically formal software development methods for many years (the best departments still do so).

12. The IET is aware of and supports the evidence submitted by UKCRC, stating the generic five levels of digital skills that the UK requires. Noting that the “basic digital skills” are required by all the general public, from early school, throughout work-life and beyond. We further observe that senior management (across all disciplines e.g. general management, technical management, human resources, finance etc.) within large, medium and small commercial organisations, and government departments will need to understand how best to deploy their skilled digital workforce and know what ‘skills’ they need to recruit,
otherwise their organisation will not get the outcomes it needs. Recognition of the need for and value of ‘digital skills’ will be main precursor to becoming a main-stream career choice.

**What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?**

13. The growth and prosperity of economies internationally are driven by Information and Communication Technology (ICT) and organisations and individuals need to have trust in the systems they use and the software that runs on them to benefit from all that ICT and the Internet have to offer. A big challenge is to ensure the trustworthiness of the software that fuels this growth. An aim must be to improve cyber security by making software more secure, resilient, dependable and reliable by design. Trustworthiness of software needs to be an education mantra to allow business to operate efficiently while protecting it from the growing cyber security threats and risks.

14. Skill shortages are a major challenge for economic growth. The IET 2014 Skills Survey[^300] highlighted that despite 51% of engineering employers recruiting in 2014, more are finding it difficult to find the skilled workers that they need to grow their business. Leading engineering companies in the UK have told the Royal Academy of Engineering that they are now exporting a lot of high-value work (and in consequence Gross Domestic Product) because they cannot recruit enough staff to do the work in the UK.

15. Accreditation can play a key role in both ensuring a high calibre of workers and to help employers source highly skilled employees that they need. Course accreditation may help employers see more easily the differences between candidates for a job, their suitability, and likely performance.

16. Boards need to stop overemphasising the importance of time-to-market and thereby risk sacrificing software quality and cybersecurity.

17. There are serious deficiencies in the supply of core STEM skills, especially mathematics. One of the worrying dimensions is the gender imbalance, and it is worth noting that in 2013 it was reported that the proportion of mathematics professors in the UK who are female is in single digits 6%[^301].

18. In-career continuous professional development (CPD) / lifelong learning are key, as the work force must continuously adapt and re-skill to remain competitive.

**What is the employment impact on the UK’s labour market? What are the regional differences?**

19. The IET believes in the future it will be increasingly important for society to understand the potential and economic relevance of e-commerce, Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM). Digital skills at varying degrees of capability increasingly will be required throughout all levels of education, careers, work and domestic life; see the UKCRC’s evidence and their generic five levels of digital skills.

[^300]: http://www.theiet.org/factfiles/education/skills2014-page.cfm
[^301]: http://www.blitzadv.co.uk/LMS-BTL-17Report.pdf
20. Ofcom’s 2014 Communications Market Report\(^\text{302}\) identifies how technology confidence varies with age. This supports the view that individuals throughout their working life will need to update their digital technology skills to sustain their career.

21. The classic business model justification for technologically advancing economies is to increase efficiency, and to generate more output value with fewer people. One of the key challenges is to re-skill and gainfully re-deploy those displaced people within the workforce.

Future workforce:

**What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?**

22. Whilst we do not know for certain what digital skills will be required in the future within some areas of the economy, including parts of the public sector, there are some key digital skills that are needed now, and will be increasingly needed in the foreseeable future. The wider workforce works with the systems prepared by the following workers:

**Business Analysts:** essential to understand and capture business needs and requirements, and use this data to propose effective procedures. In the main these positions require in not only higher education qualifications (science, computer science, mathematics, and engineering) but also sector business acumen, strong communication skills and interpersonal skills.

**Systems Analysts:** essential for generating functional or technical specifications from the output of business analysis. At this stage the whole life cost or whole life longevity is greatly influenced which clearly impacts how competitive the UK is the global market. The extent to which functionality and data models can be specified for configurability, extensibility and reusability is particularly important.

**Data Scientists:** the skills required include mathematics, system thinking, creativity and curiosity, data manipulation to generate knowledge, insight and intelligence.

**Developers:** legacy technologies fade and new technologies emerge, so for developers there is a constant challenge of refreshing skills, learning the new languages and methodologies. Developers tend to be in very high demand and as such can be difficult to recruit, particularly into the public sector where salaries tend to be lower. There is a severe shortage of the skills and knowledge required to develop proverbially cyber-secure systems cost-effectively i.e. are trustworthy.

**System Assurance staff:** who can analyse a ‘system’, devise a rigorous and thorough ‘verification and test’ schedule which will exercise the system to identify weaknesses, implement the test schedule, document outcomes and feed them back to the designers to ensure the system is and remains robust with very high availability, and no catastrophic failures.

\(^\text{302}\) http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr14/
23. The supply chain can only meet the needs if business knows exactly what technical skills it requires, has good links with the local education system, at all levels, to convey its requirements, and if business is prepared to supply sector specific training for its workforce where necessary. Schools, government, universities and further education establishments need to listen to business and other stakeholders, to reduce the lead time between identification of requirements for new skills, digital or other, and the successful delivery of those skilled people into the work place. Workers will often be required to undertake retraining to acquire cutting edge skills that industry needs and as such, may need financial support for this from the state. All too often employers report graduates emerging from higher education lack practical skills, basic academic knowledge, and life skills necessary for work – the so called ‘skills gap’.

24. As cyberspace expands into an all pervasive interactive domain comprising digital networks / systems that are used to store, modify and communicate information, the UK needs a highly skilled workforce which understands how to design, develop, deliver, support and maintain these systems so they are operable, have a very high availability and remain safe. These domains not only include the Internet but also other information systems that support business, infrastructure and services. Digital networks underpin the supply of energy, water, the distribution of food and other goods etc.

How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

25. The IET has provided advice and evidence as a contribution to the new computing curriculum\(^\text{303}\) which is due to be implemented in September 2014. The IET welcomes the new computing curriculum as a means to enable students to learn key digital skills. It is important to ensure that students are able to apply a systems thinking approach and use their knowledge across the curriculum. There are many inspirational methods including interactive tools, by which students can be taught the new curriculum. There is also a need to ensure that workers are able to solve problems and apply their knowledge in a flexible manner. Students should also be taught how to learn independently and effectively to enable CPD throughout their career.

26. Apprenticeship and traineeship stages are important to attract young people and ensure that they are sufficiently motivated from the outset to pursue vocational rather than academic based careers. There are still too few digital / ICT apprenticeships, yet it would be beneficial for both employer and apprentice too.

27. The UK Government’s National Cyber Security Programme is sponsoring the Trustworthy Software Initiative (TSI) to provide tools, techniques and guidance in training both the current and future workforce in the production, supply and procurement of trustworthy software\(^\text{304}\).

How are schools preparing to deliver the new computing curriculum in an innovative way?

28. Teachers and schools will need significant support and resources to deliver the new computing curriculum as many have very limited experience of it, so would be challenged to


\(^{304}\) http://ec2-54-72-253-87.eu-west-1.compute.amazonaws.com/wordpress/
ensure that the new curriculum has the most effective impact on students’ learning. Teaching the curriculum in an innovative way is important to ensure that students are inspired and engaged with the new content and as such encouraged to pursue careers in this field. There are various ways this can be supported, for example via the, ‘Computing at Schools’305 initiative.

29. Parents play a key role in influencing the career choices of young people and should be encouraged by employers, academia and the media to have a positive attitude towards STEM subjects.

How can the education system develop creativity and social skills more effectively?

30. The education system is at its best when the curriculum is broadly based, so that students who read STEM subjects at university have had considerable experience of expressing themselves fluently and students on arts courses have a sound appreciation of mathematics, science and engineering.

31. Following the report ‘Thinking like an engineer’306 by the Royal Academy of Engineering, it would be useful for employers to go into schools and discuss with students the Engineering Habits of Mind (EHoM) to develop skills relating to systems thinking, problem finding, visualising and problem solving.

How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

32. Careers advice is currently failing young people and employers. The advice should be relevant, un-biased and involve engagement with industry. Greater employer engagement with the education system will help to raise awareness about the range of careers available and help to inspire and equip students. Professionals in work should be supported and encouraged to provide mentoring and advice to young people. The Tomorrow’s Engineers initiative307 should be supported as a valuable aid for careers advice in a changing world.

33. Currently too few women are encouraged to take maths and physics A levels, which are enabling subjects to pursue careers in all areas of engineering, regardless of new developments.

34. Professor John Perkins’ Review of Engineering Skills308 has also highlighted the leaky pipeline that exists within the engineering profession. Many students who are inspired to follow the route into engineering are then lost along the pipeline, so that the end result is far fewer engineering professionals.

35. Vocational routes should also be seen as an equal and viable alternative to academia.

36. Future occupations will require many of the same skills and capabilities that current occupations require, so a broad based educational foundation will support many specialisms and provide the necessary flexibility in the workforce.

37. Serious games and simulations help to develop a valuable set of digital skills / tools to help young people understand how real world problems can be solved, in a safe

305 http://www.computingatschool.org.uk/
307 http://www.tomorrowsengineers.org.uk/
308 https://www.gov.uk/government/publications/engineering-skills-perkins-review
environment where failure can be safely learned from. There are a number of players large and small all competing and collaborating in the digital virtual reality world which allows staff to create in-world challenging content that improves their skills in general, and digital skills in particular, within a practical business environment. It is believed evidence pertaining to such a system will be separately submitted to the Committee by a third party.

**Short- and medium-term support to the digital sector:**

**How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?**

38. To address the skills gaps that exist, schools need greater engagement with industry. Employers should be prepared to bridge the gap by providing training and mentoring to up-skill their new recruits to meet the specific demands of the business.

39. Technician-level skills will be in high demand for the foreseeable future to install, configure and maintain digital equipment, networks and systems. Some of the focus on such skills was lost with the abolition of polytechnics. Despite the welcome increase in apprenticeships a mechanism needs to be found to support this career path more effectively.

40. The digital sector professional engineering institutions should be encouraged and supported to create high status for chartered engineers and technicians, and to establish clearer career pathways for staff at different levels of capability, education, training and experience.

41. The TSI has been responsible for launching a Publically Available Specification (PAS754:2014 “Software Trustworthiness – Governance and Management – Specification³⁰⁹) which has been used to develop undergraduate courses. This specification will help UK companies select the most secure, dependable and reliable software for their needs and provide then with the skills to use it effectively. Additionally the specification will find application in CPD and up-skilling the current workforce.

**Is there a need for increased high skills immigration in the short-term? What are the implications of this?**

42. The UK demand for skilled engineers outstrips the UK’s ability to create engineers. The demand is 87,000 engineers per annum for the next decade, whilst the current number of UK engineering graduates per annum is just 46,000³¹⁰. In addition, many, mostly foreign, graduates of UK engineering courses leave the UK within a few months. Without the necessary skilled workforce UK companies will need to put work overseas which will have a negative financial impact on the UK economy in the short term and additionally weaken it in the medium to long term due to expertise and intellectual property erosion. Clearly, appropriate immigration and student visa policies are required to mitigate this risk.

³⁰⁹ [http://shop.bsigroup.com/ProductDetail/?pid=000000000030284608](http://shop.bsigroup.com/ProductDetail/?pid=000000000030284608)
Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

43. Occupational segregation has to be tackled so that wider, deeper talent pools can be accessed.

44. The IET Skills Survey has found each year since 2006 that the number of women in engineering has not significantly changed from 6%. The number of women in IT roles is only 5%, a significant decrease since 2013. A concerted effort is needed to address the stereotypes that exist surrounding women in these roles. Steps must be taken to improve the negative perceptions that exist for parents when considering a career in this sector for their children, particularly daughters. Measures are needed to ensure that those with learning difficulties such as dyslexia are not disadvantaged through the increasing need for digital skills in the workplace.

What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

45. No comment.

Industry:

What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

46. The UK can be an excellent place to start and grow a new knowledge-based company. But SMEs face the same staff shortage problems that larger companies do, and they have greater difficulty finding the time to become engaged in the education system, knowledge transfer programmes and innovation competitions. Access to finance on reasonable terms is a perennial problem in the UK because of a relative lack of angel funding compared with the USA. These and related issues have been widely discussed elsewhere.

47. There is a need to educate large sections of UK industry, academia, and commerce in general, the third sector, and public services about trustworthiness of software. This involves two major costs, and thus barriers for the enterprise: the costs of gaining the understanding; and the cost of implementing the remedial actions. The state may need to be involved in raising awareness that the knowledge economy’s highly skilled workforce must have skills pertaining to trustworthy software.

48. There may need to be action by the state to raise awareness of the issue of the highly skilled workforce in a knowledge-economy being one which is also competent in trustworthy software skills; and, for example, requiring that only organisations which are accredited as having these skills can bid for certain contracts.

How can businesses help equip the workforce with new skills in a rapidly changing environment?

49. Businesses should continually retrain and up-skill their existing workforce to meet the needs of the business. Employers should ensure that they develop and execute digital strategies that maximise opportunities for flexible working, that creates high value, and reaches into deeper talent pools. This will help address the current gender imbalance in science and engineering careers and thus digital skills in general. There might also be an accredited cross-business system of recognition for this.
50. In addition to businesses being responsible for their workforce skills, the professional bodies have a role to play through enforced member CPD requirements and the provision of learning opportunities.

**Infrastructure:**

**Does the UK have a competitive infrastructure to support a knowledge-driven economy?**

**How does the UK compare to other countries?**

51. Some progress has been made across the UK to create the right infrastructure conditions and environment to be competitive in the knowledge-driven economy, however there is considerable scope to do more, especially in terms of creating hubs or clusters that bring together universities, government, established businesses and start-ups. Avoiding start-up failure needs to be supported and de-risked. The Technology Strategy Board is doing good work in this area, and there are already centres of excellence emerging such as those in Scotland for Renewables/ Energy, Life Sciences, Sensors and Informatics / Big Data. However, there is a long way to go, and targets to compare against the UK’s international comparators would be useful.

5 September 2014
The Institution of Engineering and Technology, Cyber Security Challenge and IBM Services – Oral evidence (QQ 173-191)

The Institution of Engineering and Technology, Cyber Security Challenge and IBM Services – Oral evidence (QQ 173-191)
Transcript to be found under Cyber Security Challenge
iRights – Written evidence (DSC0108)

Introduction

The internet, more than any other technology, has created vast opportunities for children and young people to learn, to communicate and to explore. But along with the innumerable benefits come new challenges and risks including open sharing of personal data, invasions of privacy, bullying and exposure to adult content and contact.

Enabling children and young people to deal with the challenges and engage knowledgeably with the digital world is the best way to ensure the full potential of the internet is realised.

This document sets out five iRights, which provide a set of principles by which governments, corporations, adults, parents and young people should negotiate their online engagement. These iRights reflect the rights embodied in several different international treaties and within the existing laws of many countries. Here we bring them together and present them in the context of digital technologies in language that will reach out to a larger audience within civil society.

We look to a future where the internet and digital technologies are designed, delivered and consumed with these rights in mind, making it a more empowering space for children and young people.

The iRights initiative envisages a future where the fundamental right of children and young people to access the internet creatively, knowledgeably and fearlessly is fulfilled.

Why we must act

The internet has become the decisive organising technology of our world. No child or young person should be left out of the huge opportunity it represents.

Children and young people are often presented as digital natives – with fast thumbs able to summon up the knowledge of the world in an instant, build a million dollar company from their bedroom, or topple a corrupt regime with a tweet. Yet the latest research shows that far from being at the forefront of the digital revolution, many young people remain on the lower ‘rungs’ of digital understanding. They lack the skills and knowledge necessary to benefit from the immense opportunities on offer as they move between spaces that are heavily limited and others where ‘anything goes’.

Our young people are poorly served by a public debate which is falsely polarised. We are told there is a stark choice to be made between freedom and protection. In the analogue world we balance this choice by giving children clear rights so that they can flourish in a safe and supportive environment. Twenty five years ago we recognised the human rights of all

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311 United Nations (1989) Convention on the Rights of the Child, Article 1, as every human being below the age of 18 years, unless under the law applicable to the child, majority is obtained earlier.

children and young people by adopting the UN Convention on the Rights of the Child. The iRights principles contextualise these rights for the digital world.

iRights represents a broad coalition of civil society, including children and young people themselves.

The signatories to these principles agree to be advocates for a better digital world for children and young people, from birth to 18, by reviewing their own policies for the design, provision or consumption of digital content and technologies in the light of the five iRights.

Signatories, including politicians, parents, teachers, corporations, and young people themselves, have come together to support the promise of a better internet for children and young people.

The five iRights

1. The right to remove

Every child and young person under 18 should have the right to easily edit or delete any and all content they themselves have created.

Personal experimentation is an essential part of childhood development, yet the internet never forgets and never corrects. It can possess an infinite memory of each individual and all of their online actions. Information is collated and presented, typically without context, regardless of age, time passed or personal circumstance.

Errors of judgment, unhappy experiences and attitudes that were the product of immaturity are saved on the internet long after they have faded from the memory of friends and family. This can make it extremely difficult for young people to get away from their past experience and move on. Online their past coexists with their present, leaving an outdated, un-contextualised public record.

The exchange of information is an essential component of the digital world. However, it is inappropriate for a third party, commercial or otherwise, to own, retain or process the data of minors without giving them the opportunity to retract it or to correct misinformation.

We believe children and young people should have the unqualified right, on every internet platform or service, to fully remove data and content they have created. This must be easy and straightforward to do.

This does not mean young people would have an automatic right to delete reproduced data or content written or produced by others. Where data or content referring to a child or young person has been created or published by others, the rights of under 18’s must be balanced against the right of freedom of speech. It is however essential that there is an easily accessible route for children and young people to resolve disputes or correct misinformation that does not require recourse to the courts.

314 Young Person’s iRights doc, October 2014
It must be right for under 18s to own content they have created, and to have an easy and clearly signposted way to retract, correct and dispute online data that refers to them.

2. The right to know

Children and young people have the right to know who is holding or profiting from their information, what their information is being used for and whether it is being copied, sold or traded.

By facilitating a tick-box culture we are telling children that their personal information has little or no value. Meanwhile companies and organisations gather children’s data at an unprecedented rate.

Online entities have been collecting, selling or using the data of young people for purposes that are unknown and may be potentially unwanted. This data gathering transfers wholesale rights and information (however intimate) from the user to the provider, often in perpetuity, perhaps even for purposes not yet determined or explained.

The terms and conditions associated with the services provided are routinely long and complex. There is little chance that any minor understands their meaning. This business practice is exploitative of young people’s desire and need to use digital technology.

Children and young people routinely share information online without understanding what the current and future consequences may be. Privacy settings and policies should clearly outline the visibility of the user and the ways in which their actions may be recorded and shared by those in their social world and by the broader community (educational institutions, companies, government etc.). Children and young people can take more responsibility for sharing personal information if they are clear about what it may be used for.

It must be right that children and young people are only asked to hand over personal data when they have the capacity to understand they are doing so and what their decision means. It must be also be right that terms and conditions aimed at young people are written so that typical minors can easily understand them.

3. The right to safety and support

Children and young people should be confident that they will be protected from illegal practices and supported if confronted by troubling or upsetting scenarios online.

The routine conflation between what is illegal and what is harmful is unhelpful. For that which is explicitly illegal there is no ambiguity. Nevertheless no child can ever be entirely safe and not every harm is illegal. It is therefore important that children learn how to stay safe by learning to manage risk.

Just as when we reduce the potential harm of crossing the road by holding a child’s hand, it is equally possible to allow young people to explore digital spaces but provide education, support, guidance and representation when needed, varying the strategies by age and maturity.

The UN convention on the Rights of the Child makes clear that, due to their physical and mental immaturity, children require special safeguards, care and appropriate legal protection. However, when more than 1 in 4 secondary school children using social
networking sites have reported being upset in the last year, and more than 1 in 10 of those said they felt upset on a daily basis, it is clear that our current strategies are not working. Provision, while often of excellent quality, is also often under-funded or fragmented.

With or without blocking software, young people are likely, at some point, to be exposed to potentially harmful content, contact or behaviour, whether by accident, through deliberate action, or by the harmful maleficent action of others.

It must be right that children and young people receive an age-appropriate, comparable level of adult protection, care and guidance in the online space as in the offline. And that all parties contribute to common safety and support frameworks easily accessible and understandable by young people.

4. The right to make informed and conscious choices (The right to agency)

Children and young people should be free to reach into creative and participatory places online, using digital technologies as tools, but at the same time have the capacity to disengage at will.

Attention is the currency of the internet. Many online sites deliberately use ‘reward technologies’ to hold and extend attention and deter users from leaving. Checking for progress in a game, a message or just ‘feeling the need’ to click, contribute to a norm that sees children and young people attached and often distracted whether in the classroom or the home. Children and young people need to understand that their attention has value, and know the costs of the exchange.

All generations have raised concerns about overuse of emerging media but the immersive, interactive and portable qualities of digital media have fundamentally changed the dynamic between the technology and the user. Not least because all of a young person’s interactions - educational, social, entertainment and news, coexist on the same device. This keeps their attention in constant play. As a result we are seeing children at a developmentally sensitive stage missing sleep and skipping food because of internet use.

Children and young people have a human right to access information, to communicate with others, to participate as social actors and to learn. Access to the internet is essential in fulfilling these rights. Currently available protective software can improve the online experience, especially for younger children, but it can also deny young people valuable access to the digital world by making snap judgments based primarily on prohibited words. In order to be true digital participants, children and young people should be encouraged to work, play and participate in the web’s creative spaces and not have their attention held unknowingly.

It must be right that the commercial considerations used in designing software should be balanced against the needs and requirements of children and young people to engage and

316 Tim Berners Lee speaking at Web We Want, May 14th, 2014
disengage during a developmentally sensitive period of their lives. It must also be right that safety software does not needlessly restrict access to the internet’s creative potential.

5. The right to digital literacy

To access the knowledge that the internet can deliver, children and young people need to be taught the skills to use and critique digital technologies, and given the tools to negotiate emerging social norms.

Digital technologies are used to socialise, to work, to play, to communicate, to learn and to explore. In short, they affect every aspect of a young person’s life. In order to be a 21st century citizen, one has to be digitally literate.

Building on every child’s right to an education that develops all individuals to their fullest potential, young people should be enabled to engage with the digital world not just as users and consumers but also as makers, confident and skilled enough to create websites, apps, games and other materials.

Equally they should have the chance to learn about the realities of the digital world, with a grasp of the underlying motivations of actors in digital spaces, and the ability to manage new social norms and their own reputation online.

There is a risk of a widening gap between the potential of technology and the reality of young people’s ability to use and understand that it deliberately orchestrates certain responses. Bridging that gap requires a big change in how young people are educated and a commensurate change in what adults understand as the components of digital literacy.

It must be right that children and young people learn how to be digital makers as well as intelligent consumers, to critically understand the structures and syntax of the digital world, and to be confident in managing new social norms. To be a 21st century citizen, children and young people need digital capital.

Articulating these five iRights provides a common framework for the principles by which the web should be designed, delivered and consumed. Embedding them into the DNA of the digital world depends on action by all parties: industry, government, parents, teachers and young people themselves.

These iRights are principles to create a better digital world for children and young people: a world where the fundamental right of children and young people under 18 to access the internet creatively, knowledgeably and fearlessly is fulfilled.

10 October 2014
Kingsmead Primary School, Miles Berry, George Spencer Academy and Naace – Oral evidence (QQ 158-172)

Kingsmead Primary School, Miles Berry, George Spencer Academy and Naace – Oral evidence (QQ 158-172)
Transcript to be found under Miles Berry
The Knowledge Transfer Network – Written evidence (DSC0056)

The former ICT Knowledge Transfer Network (ICT KTN), supported by the Technology Strategy Board (TSB), initiated a ‘sector skills project’ in 2013, aiming to impact the sector skills issues/requirements, restricting economic growth, cited in conflicting quantitative data and some anecdotal evidence.  

Perceived Reasons for Skills Shortages

- Difficult in quantifying shortages/gaps as employers reluctant to admit them.
- ICT/EEE quoted as being most notable skills shortage sectors, specifically in software development/systems engineering (IT), and hardware/systems integration (EEE).
- Conflicting data/misleading media articles (skewed by inclusion of general ICT graduates) indicated CS evidences worst levels of graduate unemployment (17%) at more than 6 months post-graduation, especially in the games/visual effects sub-sector, with other showing EEE/CS faring better than others. However, this unemployment ‘snapshot’ is potentially misleading, as many graduates take longer to settle on completion, remain focused on degree work, put little time into job searches, though remaining unemployed may support development of other sought-after skills in the role of student ambassador.
- Pace of industrial change outstripping course content/outcomes revision, leaving skills gaps/shortages for new jobs/products/industries. Existing graduate staff capable of building apps but unable to cover scientific computing jobs as lack fineness of technology, with application domain knowledge possibly missing.
- UK producing insufficient sector graduates, universities offering too few specialist degrees, specifically not delivering graduates with problem solving/employability skills, with variances in degree content creating difficulties in employer understanding of skills/knowledge offered.
- EEE graduate numbers consistently declining, demand for all types of engineers exceeds supply.
- Approx. 150K senior engineers approaching retirement in parallel with dip in birth rate.
- Only 50% graduates remain in sectors/professions as graduate employees, with managers and technicians moving to other sectors, e.g. NHS/Banks, creating sector skills gaps.
- University places tailored to attract international students to fill university places.
- Hire of foreign nationals to plug interim gaps deterred by Border Agency rules.
- Lack of employer sponsorship for Doctorate programmes, delivering fewer UK/EU graduates.
- Employers believe some qualifications not delivering skills ‘fit for purpose’ and shortfall exists between needs and supply of skills, specifically web-design, relevant embedded programming, leading to time-consuming/costly skills buy-in for specific pieces of work,

For the purpose of this document and any attachments, the term ‘engineering’ refers to ICT, Electronic and Electrical Engineering sectors.
with SMEs competing for skills with large corporates (attractive packages/employee benefits).

- SMEs’ start-up phase may require engineering skills, soon supplemented by entrepreneurship/business skills, rendering PhD/some first degree outcomes unsuitable.

- Employers, unclear on skills needs/wants, aim to satisfy a ‘wish-list’, confuse skills and knowledge, misunderstand flexibility/transferability of skills learned during degree study (graduates able to adapt quickly/easily, e.g. specific programming language skills enables ease of learning/effectiveness in others or analytical and technical skills in Maths/IT graduates, seek 5/10 years experience, when only 5-10% actually need top graduates, with placements capable of addressing some lower level skills needs.

- Employers unwilling to train (unwilling to risk investment as believe upskilled staff move to competitors) to fill skills gaps, seek to recruit the ‘perfect’ person. Fewer large employers offer training, SMEs taking on lower volumes of apprentices, citing lack of funding support, so outsource immediate needs abroad. (Investment in training, mostly non-accredited/recorded, correlates to business size.)

- Job application volumes high but of inadequate standard/quality, applicants lack practical and employability skills, not least “ability to stand out from the crowd”.

- Myriad of careers advice, support and guidance on offer but not in consistent, cohesive, coherent format, creating issues in making career choices, selecting appropriate subjects at GCSE and A Level to ensure progression pathways are not closed-off to students.

- Careers advice, support and guidance is delivered through many events and initiatives but frequently lacks collaboration, meaning no long-term strategy is delivering a large pool of suitably skilled workers from whom specialists can be developed.

- HR staff lack specialist sector/skills requirements understanding, unlikely to select high calibre candidates.

- Broader social issues may inhibit good BME graduates securing employment.

- Changing regional industrial landscapes experiencing revived demand for higher skilled sector workforce. Variable regional patterns/influences exist, e.g. fewer shortages in North East, Birmingham, Yorkshire and Lancashire, following manufacturing demise/shift to service-orientated work, plus other factors such as cost-of-living. Major de-skilling in some areas as result of reduced need for high-level skills created different attitude to recruitment, i.e. inconsistencies, medium term thinking.

**Project Methodology**

*Project activity is structured across three perspectives:*

- **Skills Requirements**: Establishing extent /levels of current and future sector skills requirements

- **Development Provision/Options**: Sampling provision, development pathways and progression routes, and the variable outcomes: knowledge, skills, abilities and aptitudes required to create ongoing skills supply, aligned with changing industry needs.

- **Careers Advice and Guidance**: Exploring the availability of wide ranging careers advice, support and guidance to assist young people make appropriate subject choices and development options to achieve career aspirations and fulfil potential.
The Knowledge Transfer Network – Written evidence (DSC0056)

The initial findings were presented to a Focus Group drawn from a wide range of stakeholders, including academia, industry, professional and trade bodies and employers. This Group made the initial prioritisation of issues identified, with a smaller Working Group, made up of senior figures reflecting and representing the stakeholder profile, developing an Action Plan, since being taken forward.

Submission of Evidence

This section of information presented to the Select Committee sets out the key issues and challenges identified in the initial research. The full Skills Report was published in the summer of 2013, coincidentally with the launch of the government’s Information Economy Strategy (IES). Since publication, in addition to ongoing activity aiming to impact the skills requirements, work has also been undertaken with colleagues in BIS, responsible for ministerial briefings, consultations and development of the IES Skills Action Plan. The subsequent sections provide greater depth of information, together with some suggestions for tackling the digital skills issues and requirements.

SKILLS REQUIREMENTS: Key Issues and Challenges for Employers and Potential Employees

Current Skills Shortages and Gaps

- Most shortages seem to occur at higher levels, e.g. chartered engineer/professional technicians.
- Employer difficulties recruiting post-graduates, appear most acute on M4/5 corridors/hot-spots.
- Majority of businesses need entry level skills, employees need experience of entry level jobs.
- Alleged shortages in software development/systems engineering, Electronics hardware skills and systems integration in Electrical Engineering.
- Skilled technicians in high-tech sectors, may have better access to high-level skills development.
- Strong UK electronics industry lacks supply of high-level skills/required entry level numbers.
- Post-recession, re-emerging science sectors, e.g. bioscience creating new ICT/EEE jobs (Big Data)
- Serious skill shortages in design, attention to detail, problem solving and creativity, and lack of enterprise/entrepreneurial skills. SMEs seek technical skills, CS useful, plus theory and creativity. Some employers require dexterity and maths skills, e.g. for software design.
- Shortages reported specifically in RFID/electronics/telecommunications sectors.
- Heavier, mechanical-engineering focused industries also need electronics/electrical engineering skills for testing and/or ICT skills such as CAD/design aids.
- ICT spectrum segments into ‘creators/developers and ICT systems/equipment supporters, (latter having few code writing skills). ICT systems development is big issue, e.g. database/MRTP
- More holistic skills portfolio, including business/CS skills, sought by large corporates. Technical skills a lower priority as not seen as single skills requirement. ‘New/young blood’ required to replace employees having limited ‘shelf-life’, leaving companies with staff turnover issues.
Employability skills (report writing, presentation, project management, team working) essential.

**Upcoming Skills Shortages**

- Employment in the professions forecast to grow at almost twice UK average through to 2020.
- Opportunities to leverage positive outcomes/successes/skills achieved through engineering/ICT sector efforts/creativity, e.g. Olympics, into new, profitable products/services for competitive global markets, championing UK industry prowess.
- Imminent replacement of UK power sector systems offers huge potential for jobs creation and new systems supply mechanisms, e.g. SMART metering/grids, with energy producers’ hungry for replacement technologies, all affecting people’s lives.
- Employers seek new skills to develop tablets, devices/apps, targeting lucrative global markets.
- New entrants, trained only in programming, are capable of only less-skilled roles leaving gap in design skills/development of ideas to deliver product/service for global markets, compounded by up-coming retirements.
- Informatics skills needs not addressed, as fewer graduate entrants, with Low Carbon and Environmental Goods and Services now growth areas.

**Stakeholder Short-term Remedies**

- Employers recruiting many redundant experienced engineers willing to accept lower pay, rather than graduates, with little/no industry experience and potentially poorer practical skills.
- Businesses revise systems/processes/plans, etc. rather than address identified skills needs.
- Businesses offer employees professional qualifications development to levels 6/7, but seek min. 4/5 years experience to start. SFIA Framework used to identify/define skills needs more accurately, identifying and increasing understanding of development routes available.
- Degree course outcomes often best suited to large corporates, with SMEs needing short/sharp bursts of specific skills, means work in start-ups/SMEs outsourced to non UK/EU contractors. Future development opportunities, specifically of entry-level jobs, may be shaped by this off-shoring, further reducing opportunities for in-house skills development.
- SMEs, competing with corporates, employ ‘worker’ graduates, replacing higher level skills needs
- Companies develop understanding of succession planning/skill levels, for viability/profitability
- Potential post-graduate students deterred by lack of employer sponsorship. Employers rarely distinguish between first and post-graduate degrees, seeking skills ‘wish-list’, whilst universities actively encourage 2:1/better graduates.
- Large Catapult development addressing skills requirements in expensive prototyping (blind trials) phase of product/service development.
International students fill university places (various levels), creating links/relationship development with potential global markets, e.g. South America, Latin countries, Middle East. Non UK/EU graduates retained in UK workforce contribute to industrial infrastructure maintenance, pending development of ‘home-grown’ graduates, though skills acquired by non UK/EU nationals may subsequently be used abroad in competition with UK businesses.

Employers outsource/introduce part-time roles but little evidence of the latter in the sectors.

Large corporate R&D centres plan in long cycles and have shape/size/weight to employ post-graduates, possibly through Knowledge Transfer Partnerships (KTPs), selecting those with skills/potential, maintaining focus on PhD achievement via technical research programmes.

Some large corporates close down UK operations and move closer to market.

SMEs seek to secure good graduates, through university networks offering larger selection pool.

Some SMEs and Tier 1/2 large corporates achieve varied skills profiles through hire of non-UK graduate CEOs.

**Graduate Employment**

- Sector graduate skills highly regarded by employers, with employment rates higher than average for all other related sectors, although unemployment rates also risen from 11.2% to 12.1%.
- Majority of EE graduates entered all-sector professional engineering (36.2%) or IT (19.1%) roles.
- 64.2% CS and IT graduates in employment, higher than all-sector average, marginally up on previous year, with unemployment slightly lower (13.9% vs 14.2%).
- Percentage working as IT professionals is up from 44.2% to 47.3%, with software designers and engineers (16%) being top occupations, analysts/programmers (7.3%), web developers (6.3%).
- Technology/engineering undergraduates believe vacancies do not exist, pessimism exacerbated by missing autumn application deadlines, due to concentration on course work. Universities addressing with recruiter presentations/fairs, and vacancy alerts, (plentiful vacancies existing).
- Finalists choosing not to take placement/internship (deterred by placement year fees) concerned at lack of work experience, though this could be addressed by promotion of transferable skills, gained through part-time work and extra-curricular activities.
- Students attracts to a sector by one particular aspect more likely to seek/expect to work in that aspect, e.g. dedicated software/network engineer. If no demand, may still find employment, but could then be in competition with students awarded poorer results/grades in other disciplines, looking to switch sectors.
- Some graduates reluctant to travel-to-work, specifically if have not studied away from home which may make them less well-linked to employers, e.g. Birmingham University graduates reluctant to travel in excess 1 mile/single bus ride.
The Knowledge Transfer Network – Written evidence (DSC0056)

- Professional engineers’ pay deemed reasonable, second to medicine/dentistry (no free market), continues to rise as degrees rarer, (falling student numbers), with increases for relevant degrees.
- Graduate premium falling overall, except for those from certain universities/courses.
- Salary dynamics appear to play large part in skills issues, with only 50% sector graduate retention, many moving to other sectors, e.g. Law, to increase remuneration, e.g. by 40/50%.
- If technicians not well paid, likely to be lost to business/sector.
- Starting salaries unlikely to influence graduate recruitment as are competitive and rise quickly, e.g. starting salary (£25K), rising in Year 1 by 10%, again in Year 2 to approximately £29K.
- Whilst salaries influence career moves/decisions, losses may be stemmed by good treatment of staff, eroding the ‘dark mills’ sector image (reflected in lower levels of pay in some companies). Growing economy needs ‘good’ jobs in large quantities, driving up economic prosperity.
- PHD level skill shortages perceived to result from student lack of financial acumen and/or remuneration issues during doctoral study. (R&D posts carry tax free stipend of around £18K, plus coverage of tuition fees, (say £6K), allow access to non-contributory pension schemes and other benefits, e.g. Council Tax, claims, rendering income comparable to graduate starting salary. Stipend not eligible for calculation of student loan repayment although may restrict mortgage facility access. Postgraduate/doctorate qualifications may increase earning power.

Recruitment Models, Mechanisms and Issues

Graduate Schemes and Initiatives

- Large companies with formal graduate entry/training schemes and/or R&D facilities, unlike SMEs, still experience less but much needed ‘new blood’ coming through.
- Large corporates recruit higher numbers to create talent pool and make ‘internal’ selections, with individuals working in, say, research prior to (product) development or company exit.
- Good employers support development, building morale at individual/team/organisational levels, through learning/training. Other employers viewed less favourably by capable candidates.

Employer Issues and Strategies

- HR functions do not understand specialist skills needs, placing greater reliance on other skills/qualities more mainstream/familiar to them.
- Recruitment may happen by word-of-mouth/networking, with benefits available from facilitation/participation in SME/start-up clusters.
- Some large companies seek graduates to shape, in preference to PhDs, but company policy rarely overt. May meet needs by using several universities of high-repute, e.g. Russell/1994 Groups or one of own choice, Targeting those most likely to deliver. By working closely with under-graduates, becoming employer of choice, final require less recruitment effort to get best graduates (only 2:1/high calibre graduates), preferring
those with industrial placement experience (placement to job conversion rate may be
less than satisfactory). Same employers may do research work with other universities.
• Large corporates, better able to influence local catchment areas and dominate graduate
labour market, may experience fewer recruitment/skills requirements issues than SMEs,
but may be over-subscribed by graduates seeking career progression opportunities.
• Graduates (especially if have few employer links/not well networked/lacking
placement), seeking employment through jobs pages, if unsuccessful rarely know other
jobs exist/how to secure relevant employment, leaving employers likely to lose out on
potential good staff.

**Public and Third/Charitable Sector Issues and Characteristics**

- Staff in public/third sector roles more likely to receive training, creating ability to switch
to more lucrative private sector roles.
- Aspirational Public/Third sector IT staff more likely to move to business/change
management roles on promotion, creating need for new entry level staff but making it
difficult to recruit ‘rising stars’. Middle managers in increasing number move out to
more lucrative private sector roles, leading to recruitment of school-leavers as
apprentices and graduates, usually from science/engineering fields rather than ICT
related/CS degrees. Definitions used are: **CS=understanding machine/workings, plus ability to write basic programmes.**

**IT=using/applying standard pieces of software to internal applications.**

**IS=planning systems/processes/applications, requires project management/analytical skills.**

but ICT used predominantly, most likely to mean IT exclusive of communications.

- Skills shortages vary and employers need to establish depth of graduate’s
knowledge/capability to make best match (e.g. Small third sector organisation role could
be 50% hands-on IT). Graduates need to consider organisation size/scale vs.
employment offers/opportunities.
- **Impact on Recruitment of Employment Regulations**
  - Non UK/EU Border Agency rules deter employers from recruiting doctorate-level skills,
preferring reliance on first degree experience/skills developed to address technical skills
needs
  - Regulatory changes circulate quickly via social media, influencing graduate decisions on
short/long-term UK residency, needing remedial changes communications through same
media.
  - Ability to gain work permits in certain sub-sectors, e.g. defence, affect recruitment
decisions. Withholding clearance renders employment of non-UK/EU nationals
impossible. Companies require flexibility/ability to move staff, placing those without
 clearance on alternative projects.
  - Difficulties not confined to recruitment outside UK. With improved production quality,
India/China manufacture in competition with UK industry rather than supply parts to it,
whilst UK needs to retain market share, using interim non UK/EU labour to maintain
infrastructure.

**Women in Technology**
Gender issues unlikely to improve in short term from current baseline of 95% male ICT workforce, (same percentage of females in library sector, albeit requiring IT skills to achieve effective performance), yet companies benefit from inclusion of female perspectives.

- Females account for only 1% of engineering sector workforce, mirroring 1:6 female student and applications ratios, though no hard evidence uncovered indicating their superior ability.

- Women returners often snapped up by start-ups, requiring higher-level skills in exchange for more flexible working arrangements, meaning few women reach executive/board level, but may benefit from equity acquisition as business grows. Employing women returners may create financial/resource risk to company should they require extended leave periods.

- Lack of women in managerial roles denies organisational and high-performance management skills and risk aversion to sectors, which may be important considerations, especially where public funds support start-ups and are liable to being turned off at short notice if milestones prior to taking products to market are not met, putting the whole business and staff at risk.

**Networks delivering Employer Support**

- ‘Business’ networks, often closed to professionals, rarely exist alongside technical networks, limiting contact/involvement with peers and personal development opportunities.

- Plethora of professional and trade bodies makes for difficulties with co-ordinated, strategic approaches to sector issues, compounded by fluctuating membership numbers.

1. **DEVELOPMENT OPTIONS, COURSES AND PATHWAYS**

**Programme Recruitment**

**Trends**

- Most HEIs showing downturn in undergraduate applications, e.g. science/technology 40%, with engineering (internationals intake enhancing mechanical) bucking trend, 3%:8%. Views of trends in CS/EEE sector-related courses vary, but claims of falling graduate numbers consistent with downturn over last 10 years. Main competition comes from Physics/Aerospace (part of Mechanical Engineering), and, for EEE, Computing/Computer Science, despite string university reputation in communications technologies. Design/technology numbers also slower growing.

- Impact of tuition fees not yet fully known, though 4 year MSc degree (tied to industry experience but not funded or allowing 4th year student loans) seems to be attracting increasing applicant numbers in at least one university.

- Information is complex, signs encouraging, but individual discipline/sub-sector verification/review required, as other factors, e.g. Maths ability/A-Level choices may affect applicant numbers.
Prospective undergraduates now more focused on vocational courses and those leading to jobs rather than those of interest, but demand also driven by sector/products/services ‘glamour’.

Best ICT students often come from socio-eco disadvantaged backgrounds, but are less successful in jobs market.

Some courses closing where applicant numbers reducing, shifting demand to lower numbers of HEIs continuing to offer the subject, potentially creating over-subscription.

**Perceived ‘Value’ of Degrees**

- Clear CS definition, course content and skills/knowledge developed descriptions needed to enable consideration of sector(s)/course(s)/job opportunities, employer understanding of skills outcomes.
- Graduates/employees required to achieve professional status, over and above degree, by some employers, preferring chartered/incorporated engineers and skilled technicians.
- Masters degrees felt to be ‘nice’ rather than essential and to deliver less value for money for both employer and student. HEIs need to demonstrate value of degrees, e.g. transferability of technical/employability skills (e.g. teamworking, during programming capability projects) learned and how may be applied/needed in other sectors, widening breadth of labour market opportunity, e.g. health/social care, law and financial services sectors.
- Large spectrum of universities offer ICT/EEE but no data available (2013) by way of curve/histogram showing correlation between courses, outcomes and employment.

**Provider Reputation**

- Students prefer to aim for 1<sup>st</sup>/2<sup>nd</sup> tier universities, serving as employee sources for industry, offering graduates pick of jobs. Limitations do not appear to have been created by recession, though employers may accept lower level degrees from remaining pool to address shortages.

**Undergraduate Incentives**

- Universities offer incentives to encourage improved achievement in A level grades as precursor to degree course entry, e.g. laptop/tablet/cash.

**Impact of School Curriculum on Degree Course Access and Outcomes**

- Removal of government quotas opens up methods/criteria, enabling universities to achieve planned numbers, but creating pressure on standards maintenance, potentially resulting in good students accessing fewer universities, creation of employer concerns.
- Most universities seek quality over quantity in undergraduate selection pool, although many CS/EEE applicants have not achieved required standard as basis for successful outcomes. Relatively high setting of entry tariff ensures better quality outcomes. Recruitment of appropriately capable students, e.g. MEng = 3 As and BEng = 2 As plus B, is proving difficult.
The Knowledge Transfer Network – Written evidence (DSC0056)

- Limited understanding of degree course entry requirements by schools, and of achievement levels needed for successful completion. ICT curriculum focused heavily on user skills, lacked creativity skills development and did not necessarily support future jobs skills needs, requiring computing/physics/chemistry/maths skills, as employers not necessarily seek ICT/EEE graduates.
- ICT delivery is often by teachers lacking ‘professional’ background, rendering GCSE and A-level programmes bland and uninteresting, reinforcing need for technical teachers. (cf. Austria)
- Some data indicates high scores in Maths/Physics A-levels as good predictors of high grade degree achievement. Together A-level Physics/Maths provide better foundation, with Further Maths ideal, and some universities setting these as entry requirements in preference to Electronics. Good standard in Maths, plus analytical skills, required for all sector roles, with minimum GCSE (though currently not seen as ‘fit-for-purpose’) / A level C grades needed to support more advanced learning. Contextualising science and maths, embedding them in wider curriculum could improve achievement levels.
- Engineering Diploma, recently removed from curriculum prior to re-introduction, believed to contain required Maths content.
- Most degree courses include software study, needing programming skills, but content/standard of A-level Computing thought to be less than acceptable as undergraduate study foundation, making A-level Electronics a sounder option, though delivering lower completion numbers.
- Some electronics/electrical engineering students develop understanding of fundamentals early in their course. ‘Raspberry Pi’, etc. promotion/participation assists foundation learning.
- Engineering degree A-level access requirements may be lower, e.g. fewer A*s with more 2 Bs + C acceptable. Huge lower end peak for Electronics/Engineering degrees may be due to larger mature student cohort numbers and/or courses attracting lower achievers.
- Counter argument is that A-level results are not robust indicators of degree outcomes as 44% A-level students gain A/A* grades, yet the step up to graduate study remains too high.
- Some universities consider current A-level Maths only O-level standard equivalent, diluted by removal of complex numbers for A-level electrical engineering studies, leaving requirement of around half of fundamentals for degree work, limiting development of new knowledge ability. Need for 1st year top-up learning, supported by streaming of students, created, potentially shrinking the undergraduate pool.
- Some students appear proud of lack of Maths ability, potentially resulting in degree course ‘dumbing-down’ with Maths disappearance, specifically raising concerns in Research Councils.
- Other skills, i.e. professional/employability (e.g. leadership/project design) required for degree entry but achievement standards in schools variable, some students needing additional module study alongside degree programme.
- Applicants from independent schools likely to have achieved more A-levels, be tougher, more confident and possess more technical skills. State school applicants, even with respectable A-levels, often unable to learn independently. Those offering BTEC qualifications frequently lack independent thinking/Maths performance ability, leading to poorer degree outcomes, i.e. 2:2 and struggle to gain employment. Foundation
Year/additional ‘gap’ year studies, run alongside Year 1 programme for students failing to secure a specialist degree place, after little specialism experience in school
- Time required to assess impact of new Computing curriculum.
- New CS curriculum includes algorithms, data structures, etc., building on requirements for revised primary IT curriculum, which is encompassing algorithms, execution of devices, logical reasoning, retrieving data, and communicating online. Schools need devices for pupil use, requiring design and manufacture by developers, e.g. possibly Scratch software, Code U.
- Employer engagement not obligatory for schools, meaning some engage only with local authority/sponsors, increasing lack of employer engagement, diminishing interest in EEE/CS.

Post-Graduate and Doctoral Training
- Little data available on those students rejected for PhD programmes.
- System for creation of match between UK jobs/skills requirements and post-graduate numbers could inform basis for improvement.

Recruitment of non EU/UK Nationals
- PhD/Masters programmes are likely to attract mostly international students, e.g. 38 of 40.
- Some international students feel unwelcome on UK university degree courses. Engineering Science students mostly from Middle East, whilst Research Councils often encourage Chinese/Indian exchanges. Approximately 54% of engineering graduates are non-UK, with teaching staff frequently coming from abroad. Problem mirrored in US, now totally dependent on non-national researchers.

Development Programme Content

Current/Future Skills Requirements
- Employers seeking technical knowledge/skills development but in-university capacity limited. Some HEIs aiming match between course content and skills needs/local business types e.g. offering specialist modules in years 3/4), but content variable.
- Strategic, coherent thinking and agility on skills should serve (rapidly) changing industry and employment available. Industry/sectors need timely course content updating, aligned to pace of change, future skills requirements and changing job content. All are driven by consumer usage/needs, enabling new industries, products and services development to thrive, e.g. electrical power engineering and systems, supported by steady labour supply across all skill levels. HE offer enhancement, e.g. delivery model changes, introduction of new degrees to meet future skills needs, e.g. hybrid vehicles (relying on EE rather than ICT), could drive economic growth. ICT course content more likely to be outdated quickly, core learning needing to include application of technologies, project management and problem solving. ICT system design/manufacture, e.g. mobile technologies, more likely to move abroad as become consumer items, changing skills/education requirements, all likely to require significant investment.
• Design sector tends to seek post-graduate skills, potentially changing nature of university learning, creating need for introduction of different learning methods/media. Some courses may lack design skills, as focus on code writing/semantics, potentially diluting design skills, as programming metaphors change.

• University processes for content changes to meet changing skills requirements, i.e. validation/framework/accreditation, need time to work through, (indicative timeframe is 2 years), but interim actions to address some issues could begin meantime:
  o introduction of short modules, specifically as part of an MSc course, or MOOCs
  o day-release arrangements of employer-sponsored students, avoiding short-term fixes/deferments, e.g. sticking to ‘core’ learning, e.g. Electronics (how circuits work/logic gates, etc) and CS (science of computing/how computers work),
  o improved achievement at GCSE/A-level phase in preparation for higher level study.

• Course descriptions not always accurately reflecting course content nor linking to possible future job roles, e.g. micro-electronics and electronic systems, may deter potential students.

• Many university departments offer specific, specialist modules, leading to employers taking comfort in a ‘guarantee’, recruiting graduates with whom they have established relationships, reassured by knowledge of the courses and perceived standing of staff/courses/university, resulting in graduates of other HEIs, though having skills sought, not considered/recruited.

• New providers offering degree level provision, e.g. FECs and HE in FE/Higher Apprenticeships, are creating ability for new delivery models/development of different skill mixes, some being more flexible and closely aligned to industry needs. Fixed/formal, narrow training programmes may deliver less sought-after outcomes, as employers seek greater breadth of knowledge/skills.

• Some university departments with small-scale operations, specifically offering CS degrees, may be at risk, which may also be detrimental to degree course content.

• Few universities have well-developed SME (where many future jobs will occur) links. HEIs could make courses more attractive to prospective undergraduates by working with SMEs to create realistic expectations, looking at role-specific skills and environments, but not in isolation from employers of all shapes and sizes, enabling employers/graduates to make ‘wish-lists’ a reality.

Fundamentals

• All courses at all levels need to include the fundamentals requiring development. A ‘model’ ICT course could include: knowing hardware, understanding programming, ability to interrogate programmes/applications, meaning applicants need good maths, attention to detail, logic, realism, ability to develop practical/hands-on skills, passion, enterprise and entrepreneurial ability, knowledge of business and finance, horizon scanning and ability make links/connections.

• Degree course content is widely variable, from highly technical to librarianship and all points in between, e.g. no information management included with focus only on deep technical aspects, vs. focus on librarianship skills with little or no technical content.

• CS courses tend to be theoretical rather than develop technical/practical skills/problem solving. Content depth not always clearly understood, i.e. understanding of coding/solutions, not just programming (small part of design/development), testing of
invisible/inaccessible small parts. Provider improved understanding of detailed skills requirements may enhance teaching/learning

- Highly modular courses may enable students to gain ICT/EEE degrees by completion of significant proportion of non-IT modules, though skills developed, e.g. project management/business and finance, are sought by industry but question technical value to employers, with some now preferring to hire in only from relevant degree courses.
- Differing employer expectations of graduate skills/knowledge exist but some now working with HEIs on course content changes, e.g. programming languages. Courses need to meet business needs not contain technology for technology’s sake, by learning integration/embedding.
- Students need to learn how to build/design applications and develop transferable skills.
- Equally, some universities moving away from modules to mainstream approach, e.g. CS could reflect theory of computer workings, with IT including database/communications, adding to employer difficulty in assessing course value/worth.
- To attract undergraduates, some courses falling below required standards continue to be promoted as degree courses, leading to graduate/employer disappointment and dissatisfaction.
- Some ‘new’ universities appear to deliver more practical skills, though some lack focus on how applications work and solutions development may not be addressed.
- Professional skills/qualifications, e.g. BCS pathways may address shortfalls.

**Employability Skills**

- Well-developed entrepreneurial/enterprise skills needed for industrial roles, now appearing in courses from more pro-active universities, delivering employable graduates, equipped with relevant social skills, improving future employability and changing stereotypes.
- Graduates rejected for employment as over-qualified, may improve employment chances/confidence to start own business by developing entrepreneurial/enterprise skills, expanding ‘blue sky’ thinking on career aspirations/options, and creating new ambitions.
- Embedding of employability skills in degree courses could link employers to undergraduates, though 3-year period may limit relationship development, specifically for those with firm career plan. Entry into sector studied appears greater for Engineering/ICT than others, e.g. law.

**Placements, Internships, ‘Sandwich Courses’, Support and Sponsorship**

- HEIs with strong reputations for sector-related learning and development (some now placing 2X student numbers), tend to have well established placement schemes, enabling students to benefit from high quality experiences, enhanced by peer support and mentoring. Courses including placements (a few months in Year 1 and/or up to 1 year in Year 3) appear more attractive to employers recruiting graduates and may affect undergraduate degree choice. Whilst becoming a greater expectation, their availability has declined, so some practical skills development is delivered in projects/mentoring schemes, as end-game is securing employment.
- Some students reluctant to complete year-long placements, as defers graduation, moves them out of original peer group. Length of course, including placement, is cause
for concern to some, specifically those wishing to begin earning, resulting in some taking 3-year course without placements, becoming convinced of 2:2 outcome and that engineering is ‘not for them’. If job offers absent, some seek Masters programmes, simply to improve first degree grade rather become eligible for post-graduate programmes, raising questions on motivation for study.

- Some degree courses structured in ‘one long day’ in university and remaining 4 days in industry’, mirroring apprenticeship format, with some requiring students to complete a placement application process, mirroring job applications, providing taste of real world ICT/Engineering.

- Placements may be part of recruitment mechanisms, aiming to reduce risk/provide 2-way insurance for employer and graduate. Graduates completing placements more likely to find employment on graduation, but resourcing problems would arise should all students seek them.

- Lack of industry placement availability, including short ones improving sector knowledge for teachers, denies industry early talent spotting opportunities, and may reduce numbers of younger people entering ICT sector, e.g. of 400 conference delegates, only 5 were under 25.

- Internships, built into Years 2/3 of degree course and/or through summer employment, may offer recruitment options, assisting development of workplace experience/understanding, without requiring students to commit to the industry or employers to recruit.

- Undergraduate mentoring schemes, staffed by younger people, appear to work best, enabling quick build of rapport between mentor/mentee, though also possible fwith staff approaching retirement with well-developed design/implementation skills/experience, in the ‘wind-down’ phase, either as ambassadors into schools or engineer in residence (Institute of Physics).

- Sponsored students may be abandoned on graduation, whilst others continue benefitting from internal training, lectures and development, delivered in company staff development policy/strategy, e.g. in-house ‘university’, hosted and accredited by university partners, to grow and further develop graduate level employees. Even companies not taking on undergraduates, e.g. supplier chain, can contribute to graduate employability skills development. Student sponsorship may mean companies effectively pay for research.

**Career Pathways and Potential**

- Entry into the professions comes through many diverse routes/pathways. Students planning to enter the IT industry may not be studying ICT, so seek managerial jobs, due to perceived good salaries/opportunities. Equally, those studying ICT may not aspire to management, creating different skills gaps, including managerial lack of technical knowledge.

- Levels of professional grades seen as too closely set and whilst not all graduates join professional bodies, e.g. 1/3rd join professional body/1/3rd become chartered, this potentially adds to difficulties in candidate selection assessment by employers.

- Recognition of the need for a wide range of development models, routes and pathways to deliver the knowledge/skills required by industry, together with delivery of differentiated provision addressing individuals’ diverse learning styles and varying pace
of development to avoid ‘writing-off’ potential, not always apparent, potentially losing skills to industry.

- New development opportunities for young people, more mature workers and employers required, e.g. enabling geographical areas to benefit from ‘new’ companies moving in to set up ‘new’ industries, e.g. electric vehicles/power circuits. Creation of UTC partnerships could address skills requirements, generating labour market supply for new product delivery, e.g. fuel cells. Start-ups may be willing to fund skilled technician development, as post-graduates are often less dextrous/skilled at making things.

- Some major corporates involved in Foundation Degree development, aiming to create new learning opportunities to meet higher level technological skills needs. Use of Foundation Degree model perceived to deliver value more quickly than, say, Apprenticeships (10-12 years), sometimes creating lack of motivation in managers charged with scheme setting up, as they will have moved on prior to receiving recognition for its success.

- Engineering skills requirements often difficult to address as may need to straddle several levels, i.e. 3-7, making for difficulties in understanding requirements at corporate executive level or by HR function staff leading/involved in recruitment processes, especially when line managers most familiar with required skills needs are positioned lower in the company structure.

- Association of EngDs, established in the last 20 years (mirroring MBA Association model), still has relatively small number of graduates (50% MEngs, 25% Physicists, 25% Electrical Engineers), but could promote `doctoral training higher skills development aspirations.

**Alternative Development Routes**

Increased volumes of other provision models, e.g. units achieved in workplace matching degree requirements, could support sector skills requirements.

**Apprenticeships**

- SMEs mostly reluctant to recruit apprentices in recession, as unable to guarantee ‘employment’ for apprenticeship period. Higher level apprentices (Level 4) could contribute to skills needs.

**Knowledge Transfer Partnerships (KTPs)**

- Partnerships, enabling associates to develop business knowledge, may be created in/linked to university spin-out businesses, developing cutting-edge products/services for bringing to market, but may be less suited to SMEs seeking quick solutions and/or lacking ability to provide associate with envisaged amount of ‘meat’.

- Graduates with at least a Masters qualification/2:1 first degree including a placement, are preferred but option available to gain Masters qualification during period as KTP associate.

- Non-UK Associates may be recruited, possibly providing HEI access to wider R&D community.

- Intellectual property developed is owned by the company.

- KTPs also facilitate business community/education engagement, e.g. Herts/South Bank.
University Technical Centres (UTCs)

- Changes/enhancements in links between education provision and industry skills requirements being driven by creation of new providers, e.g. JCB UTC emerging from Academy, sponsored by JCB, serving as ‘blueprint’ for additional UTC development.
- UTCs selectively take in students for 14-19 phase, aiming to develop future business experts, embedding Key Skills in learning programmes with, say, engineering as main focus, though Year 9 not a familiar/popular transition point with schools.
- Schools currently not enjoying links with UTCs could benefit from their development, plus links with other universities/FECs to facilitate technical skills growth.
- UTCs regarded positively, fitting into Catapults ‘map’ forging education/industry links.
- UTCs offer new option for some learning phases/stages, specifically addressing practical skills needs, blurring boundaries between universities and former polytechnics.
- Image of ‘workshop’ activity may counteract transformations in sector image, but aims to attract more young people into engineering sector overall, though could perpetuate teachers’ view that engineering is for ‘dummies’, rather than engaging brightest students into sectors.

Doctoral Training Centres

- Training models changing, becoming focused primarily through doctoral training centres (DTCs), based on cohort approach with built-in taught elements.
- Centres seek good quality graduates capable of rising to senior industry posts, requiring skills in balancing priorities.
- Recruitment onto DTC programmes takes time and effort, requiring short-listing from large numbers of CVs, telephone/fac-to-face interviews with twice the candidate/places numbers to make the best selection. Best students often come through introduction not application.

Alternative Pathways

- Conversion courses offered at Masters level, providing opportunities for graduates from other disciplines, e.g. Humanities, to convert to an IT-related topic, in addition to specialists Masters e.g. IT 1st degree leads to Masters taking in 2 or 3 aspects to a deeper level, e.g. database codes.
- Greater flexibility is attractive to students, but may cause difficulties for employers struggling to understand the exact skills profile they may be hiring and its fit with skills needs, possibly placing greater emphasis on requirement for professional accreditation, i.e. 4 years experience, achievement of Chartered status and CPD confirming capability, rather than employment being secured on the basis of degree/vendor qualifications.
- Other disciplines, e.g. Psychology, possibly useful to ICT/EEE sectors, as developers need to understand consumer use of devices/applications, how individuals interact with them, creating need for engagement with various sectors, e.g. health devices, mobile applications, engineering developments such as smart-grid and use of power.
- Collaborative courses/approaches could create greater value with no single company being burdened with costs and responsibility, potential for co-ordination through DTCs, building in other skills such as enterprise/business with funding weighted towards
growth/enterprise companies, enabling UK universities to complete research with world-leading businesses.

Integration of Development Pathways

- Need for access to various development routes/options delivering mix of industry skills requirements, e.g. Apprenticeships, HNCs/Ds (pre-university entry), foundation and sandwich courses in addition to more traditional academic routes, offering options to switch between providers/qualifications/pathways.

Provider Skills, Sector Knowledge and Development

Factors affecting change

- Education system works on long-term cycles with industry focused on short-term development and skills needs, and education possibly regarded as stabilising feature, given that companies come and go. Opportunities exist for education sector to improve understanding of industry, its needs/timescales, and for business to work more effectively with educators.
- Higher levels of engagement and commitment potentially achievable with more incentives, e.g. by working with start-ups, education/development providers could be better placed to be pro-active by early understanding future skills requirements, potential relevant industrial changes, requiring curriculum updates, staff development and changes to resources and materials.
- Difficulties exist where teachers, brought in to newer ‘fast moving’ sector-related programmes, lack relevant industry experience/background, e.g. Physics, as although able to teach technical curriculum content, may lack skills/experience in ‘ideas/projects/qualifications’ implementation

Teacher/Tutor Development

- Teach First courses address shortfalls in teaching, offer curriculum-mapped resources, targeting embedded learning, but mostly aimed at 11+ age group with few used in primary schools.
- Few Physics teachers with subject degrees remain in teaching, and many Maths/Science departments closed. Involvement in sector issues may enable teachers to better engage with industry and increase understanding of skills requirements.
- University staff could benefit from additional learning about sector-related job roles, enabling more course content on product development processes, creation of technological products/services and knowledge/skills required by professionals.
- Some post-graduates return to academia, having spent time working in industry, though roles may be less interesting and lack opportunities for creativity, whilst offering better prospects.

2. CAREERS ADVICE and GUIDANCE


**Sector Requirements**

- No onus on schools to provide careers advice, only an obligation to provide minimum guidance with related funding not ‘ring-fenced’, resulting in variable information/advice quantity/quality.
- All young people, even if not interested in CS/EEE, need access to all careers information, to make informed career choices and decisions.
- Charitable foundation status schools appear most likely to deliver good careers advice/guidance.
- Students need visionary/helicopter-view careers advice, raising awareness of job opportunities/worthwhile nature of technology and engineering study, and potential future employment locations (an issue for some graduates, particularly those continuing to live at home during degree study, and no independent living experience).
- Careers advice needs to continue through higher education phase, embedded in programmes to ensure attention/engagement maintained, enhanced by outreach activity developing interpersonal/employability skills, e.g. internships, rewards for involvement in extra-curricular activities, though may be less easy to introduce into more regimented EEE courses.
- Messages should stress practical skills/Maths needed for all technology study offers
- New industries may address gender imbalances as girls traditionally struggle to see relevance of engineering to them/their lives, needing to increase understanding of its impact on everyday life, i.e. everything is engineered, potential of new devices/systems to address societal issues, e.g. devices helping the elderly live quality independent lives for longer.
- Advice for university entry/degree course selection needs to explore choices in 3/4 year courses:
  - Current most popular perception is that 4 year course including work placement is best.
  - Final degree classification is cause for concern by potential undergraduates, with those having chosen 3 year courses less committed to sector, especially if achieve lower grade. On completion of 1st degree may seek 1-year Masters to improve grade, enhancing prospects and eligibility to apply for jobs requiring 2:1s, but placing them in competition with subsequent intake, also raising questions about motives for postgraduate study.
- External careers advice providers have created a marketplace from which schools purchase services, but advice and interventions offered need to be stable/consistent, achieve general impact by delivering value through proven activities, focusing on engaging pupils as well as outcomes driven by league tables.
- Service providers need to achieve specified accreditation, which is adhered to, although the true impact of interventions can only be assessed by long-term evaluation.
- Employers often work with schools to increase knowledge of academia, gain insights into future research potential, and fulfil Corporate Social Responsibility.

**Issues**

1. Quality of careers advice/guidance is cited as main cause for concern and major issue amongst networks of leading employers. Lack of a national careers service, understanding of disciplines and sector careers means engineering is frequently promoted to least capable
students. Parents are often misinformed, many seeing it as a dying industry rather than large contributor to GDP.

2. Plethora of careers information websites available, e.g. 300 as reviewed by Engineering UK, is overwhelming, meaning no single recognised information point is available. A tiered approach to advice issues needed, with assurance of sustainability if/when initiatives are developed.

3. Earliest careers advice initiatives mostly aimed at Years 9/10, too late for making/revision of study choices/possibilities, needing career awareness to begin in the Primary phase.

4. Up-coming jobs and new opportunities, as well as current, require consideration. Skills demand being created by new industries, e.g. systems supply, require enthusiasm and passion in young people planning to enter current/emerging sectors, mirrored by advisors.

5. Teachers and tutors, followed by parents/guardians and advisors, have greatest influence on largest number of pupils, especially in independent schools, so need to be:
   - well-informed on current and future trends/developments in industry products/processes, as well as new future jobs,
   - energised, though raising awareness with them is frequently more difficult, due to school timetables limiting participation in initiatives

STEM curriculum areas are most likely to be staffed by those with industry experience, but many lack this. Experience in engineering sector specifically shows best advice as coming from family members working in sector roles, though this is not available to greater proportion of students.

6. Enhancing teacher industry experience and understanding of industry outputs/job possibilities could be improved by employer involvement (providing industrial competition is respected), with teachers/advisors also providing input into programme delivery, though co-ordination causes difficulties.

7. Engineering is rarely a school subject in its own right, but pursuing it as a subject at school/university allows students to keep career options/sector choices open, though the curriculum offer may prove restrictive. Poor A-level choices may exclude students from chosen/preferred degree course/success, whilst alternative pathways are often not known.

8. Failure to engage early enough/at the right time leads to increasing lack of awareness of industry/sectors and career possibilities.

9. Young people in schools tend to look at careers from an interesting rather than future employment potential perspective. They may be digitally aware and consumers of technology but are rarely creators, mostly lacking curiosity/confidence to explore how devices work. Young people need to be less passive, feel they have permission to explore and improve. Normalising this attitude and overcoming loss of curiosity (prevalent in 1980s when some programming required to get machines working) to dispel current accepting attitude of “it just does”, (as devices less able to be opened up and ‘played around with’ by hobbyists) needed.

10. ICT often not seen as part of engineering, although Engineering apprentices are most likely to have made specific career choice, with undergraduates less likely to, resulting in significant percentage seeking employment in other sectors, e.g. financial services.
11. Categorising jobs too tightly (blurred edges exist, e.g. opportunities for physicists/chemists in the ICT/EEE sectors) adds to problems making career choices.

12. Degree choices need to be based on possession of right attributes, to avoid inappropriate decisions and poor degree outcomes.

13. Placement providers have difficulty securing sufficient volumes for gap and industry year students, plus mentoring support for undergraduates, though this can pay for itself as companies potentially get employees of choice without need for recruitment/ associated costs.

14. Lack of university/student engagement with local industry loses them potential ‘seedcorn’, although the impact of tuition fees may improve this. Offer of scholarships can enhance education/industry links, e.g. summer project each year for the best local student. Employers can benefit from maintaining contact with less successful students, offering placements.

15. SME staff tend to participate in STEM activities/careers advice as individuals, not company reps

16. Pessimism exists amongst some new technology/engineering graduates, believing that vacancies not available or lack of work experience will affect employability. Some universities trying to address with vacancy alerts, recruiter presentations/fairs and alumni contacts. Graduates applying for jobs mid-final year may feel have missed the ‘autumn deadline’. Graduates and employers may not recognise value of transferable skills developed in part-time jobs and extra-curricular activities.

Barriers to Enthusing Young People and Sector Engagement

Sector Image

- Driven by misconceptions and lack of career opportunities awareness, ‘engineering’ (cf. Germany) projects images for some teachers/advisors/parents of work in a dirty environment, whilst IT, is widely believed to create mobile applications requiring programming downloads developed only in China/India.
- Parents view engineering as ‘car mechanic’ type of employment rather than graduate in cutting-edge industry delivering wealth creation, regarding it as vocational, specifically parents keen that their offspring ‘do better than them’. Positive role models needed to convert perceptions.
- Family dynasties exist in other professions, e.g. medicine, law, but are less likely in ICT/Engineering, possibly driven by remuneration levels but more probably by image.
- Few pupils have contact with sector employers to encourage aspirations, as engineering not fashionable, compounded by rarely being a discrete discipline in schools.
- Many young people believe engineering is difficult, that students/workers are ‘nerdy/geeky’ and bright, concluding it is not for them.
- Career and progression pathways need to demonstrate diversity of possibilities, e.g. could lead to robotics, design, projects, biomed, prosthetics, bugs and microbiology, R&D, all sector areas which offer pride in the work.
- ICT/EEE need to be ‘sold’ to parents/schools/students by IT professionals, e.g. through availability of Code Clubs (Year 5/6), pathways up to Code Academy, Young Rewired State, industry funded activity, such as bringing open data into schools, involving local
teachers in setting up initiatives, gaining buy-in and helping engagement with industry professionals. Involving all parties could ensure any use of social media aligns with DfE activity/strategies and secures parental support, without which even interested students likely to turn to other sectors.

- Job and course titles may appear insignificant but impact dramatically on levels of attraction, even revising the gender mix. Definitions of ICT and CS often confused/not fully understood. Information needs publication in ‘current’ widely-understood language, including differentiating between ICT and Computing/CS, enabling progress in primary education phase to be built upon. Awarding Bodies, AQA and OCR, both offer relevant qualifications, options for several computer languages to be used/developed.

**Capability**

- Lack of local sector initiatives prevents preparation of young people for hire at 18 by SMEs, with career prospects based on ‘home-grown talent’. Currently many employees working at ‘intermediate level’ recruited from outside EU e.g. Turkey/Russia, equipped with skills developed through work from entry level upwards outsourced there.
- Schools and teachers tend to steer low-achieving students to engineering, (often believing it easier to secure a degree course place with lower grades, (e.g. 24% Mechanical/Civil Engineering students achieve top-band UCAS scores compared to only 10% for ICT/CS), leaving universities the difficult task of bringing students up to required standard. Employers seek top-performing graduates from high-repute universities as apprentices and professional engineers, with few willing to take ‘all-rounders’.
- Conversely, pupils may be led to believe they are too good for engineering, considered a practical skills sector, appropriate for those with less academic capability.

**Gender issues**

- Girls need to be inspired/influenced from Years 5/6 onwards, as are likely to have self-identified by Year 7 (age 12) and have significant career aspirations. Transfer opportunities occur at age 14, e.g. UTCs, but barriers to progression also occur. *(Baker Dearing Report).*
- Introduction of careers awareness at an early age helps females build ‘sense of self’ and self-esteem, rather than follow peer/media pressure, also breeds critical awareness as future consumers and develops interest in how things work.
- Girls in single sex schools more likely to study Maths/sciences and take A-levels, with independent school pupils more likely to take Maths/Physics, those in state schools least likely to choose these options, with similarly influenced choices apparent in primary phase.
- Sector aims aspire to at least 10% females in any cohort, with girls perceived better students, driving a natural selection process. *(Current female recruitment levels to UK CS/EEE degrees are approx. 5%, with up to 40% of these being international students from China/Singapore).*
- Educators/careers advisors need to explore female students career expectations, learning how to expand recruitment campaigns for the wider design industry, targeting those sectors offering relevant opportunities, tailoring semantics/language to avoid meaningless conversations.
• Some universities actively involved in careers advice/guidance in schools, (Girls into STEM, Women in Science and Engineering (WISE) outreach), inspiring/enthusing girls at earliest age.
• WISE developed strategies to encourage females into ICT/EEE but not yet clear if seen as significant factor in UK economy.
• Careers in sector-related industries need to develop a ‘cool’ reputation to attract female employees specifically, more easily achieved by those seen to have ‘cool’ customers/suppliers.

5 September 2014
1. Executive Summary

1.1 This submission is based on learndirect’s experience helping hundreds of thousands of people improve their digital/IT skills – from getting the basic digital literacy skills to achieving professional IT qualifications.

1.2 Rapid advances in technology have changed the way we live and work. The recent report from UKCES320 highlights the workplace is increasingly being shaped by emerging technologies driving trends such as outsourcing, internationalisation and the need for greater flexibility. The digitalisation of products, increasing use of automated production processes and the way we process and use data and information, have already changed the nature of jobs in the labour market in the last 20 years and will continue to do so at an increasing pace.

1.3 The result has been, and still is, a massive ICT skills gap in the current and projected workforce. In the UK and across Europe the demand for ICT workers is outstripping supply. The European Commission321 reports more than 100,000 new ICT jobs were created in 2012 while overall employment dropped sharply. Whilst digital skills have traditionally been associated with IT jobs such as application developers and big data analysts, it is now widely acknowledged digital skills are in high demand across all industries and job roles. In recent years the proportion of 16-29 year olds entering the IT and Telecoms professions has declined from 32% in 2001 to 19% in 2011322.

1.4 Digital exclusion remains an issue in the UK. Whilst most young people now are entering the workforce with at least basic levels of digital skills, there are still 6.5 million people in the UK who have never been online, and an estimated 8.5 million who don’t have the skills to get any benefit from the online world323. The new ICT and computing curriculum in schools should ensure young people entering the workforce in the future have the full range of digital and computing skills, including technical skills and coding which are needed for the workplace, and not just ICT user skills such as word processing and internet skills. However, the government must also continue to provide support for those adults who currently don’t have the digital skills which are needed for the workplace now and in the future.

2. The changing technological landscape

2.1 We have identified a number of technological trends and innovations which will have an impact on jobs and the labour market in the future. Whilst all of these innovations have many advantages in terms of improving the quality of products and services, and reducing the cost of many processes in the workplace, the privacy of individuals and also integrity of data needs to be assured.

320 The Future of Work: Jobs and skills in 2030, UKCES (February 2014)
322 Technology Insights 2012, e-Skills UK
323 http://www.tinderfoundation.org/what-we-do/uk-online-centres#
Big data: the volume of data being generated through the use of technology in our everyday lives is growing at an exponential rate. Around 75% of this data remains unstructured creating challenges for the government and organisations about how this can be used and stored.

Disruptive technologies: the rapid advances in technology can be disruptive to traditional service providers. For example, technology can remove many barriers to entry for new providers in a market often destabilising traditional markets.

Cloud technology: as more and more data is stored in the cloud rather than on physical devices, employees no longer have to be tied to a physical location to do their job as they can access servers and information instantly from any location. This will continue to have a major impact on the workplace, for example we are starting to see the development of virtual call centres where operatives can be based at home and have the same access to systems as they have in the office. This can also potentially have huge cost savings for businesses.

Build for change: technology is driving the reduction in the lifespan of new products and services with many products and services reaching their peak in the market much more quickly before becoming obsolete. For example many new social networking sites, such as Gather, are growing much faster than some of the established sites such as Facebook.

Mobile to wearable: There is an increasing shift from mobile technology such as phones and tablets to wearable technology such as watches and wristbands. This will change both expectations and the way consumers access products, services and information.

Virtual reality and simulation technology: whilst still expensive virtual reality and simulation is increasingly being used by service providers. Simulation technology has already been introduced in the learning and skills sector to deliver vocational training as this technology can provide a virtual workplace for the learner.

3D printing: 3D printing has been transformational in the workplace and could wipe out many traditional skills as it can be faster and cheaper.

3. Impact on the workplace and jobs

3.1 In the last 20 years we have seen technology transform the way businesses operate in most, if not all, the activities they undertake. As a result of the trends outlined in 2.1 above, technology has become more portable, driving the mobility and flexibility of employees. As a result we are now seeing growing numbers of organisations with widely distributed workforces as technology makes it easier for people to communicate and collaborate. Virtual meetings, the use of mobile devices and enterprise wide information services are all on the increase and these technologies are used across many sectors, in many job roles, not just in the IT sector. For example only 43% of the IT and Telecoms professional workforce operate in the Information and Communications sector; 12% work in the financial insurance and other professional services sector; 10% work in manufacturing, 7% in construction and 7% in government.  

3.2 The structure of employment is also changing as those people with good ICT and digital skills are moving away from being employed by large corporates to self-employment where

324 E-Skills UK analysis of data from the ONS
they are empowered to drive their ideas forward. Self-employment therefore has the potential to lead to a massive increase in productivity and also individual wellbeing[^325].

4. Bridging the skills gap

4.1 From learndirect’s internal business insight, we know there is a significant skills gap at the technical level and we are now seeing a growing demand for IT technical and professional qualifications. It is reported 14% of IT and Telecoms recruiters have difficulties filling positions, and 15% experience IT and Telecoms related skills shortages[^326]. The government needs to work with employers to help them find the best way of articulating digital skills needs now and in the future. Schools, colleges and training providers will then be able to work with employers locally to ensure young people are leaving education or working towards jobs and careers with the appropriate digital skills for the jobs which are available.

4.2 Ensuring the ICT curriculum and qualifications remain current is challenging. Whilst there will always be the basic digital skills which are unlikely to change significantly from year to year, the content of technical and professional courses and qualifications will change rapidly. The curriculum and standards for these qualifications will need to be flexible in scope in order to incorporate new and emerging technologies. One way to address this issue would be for Awarding Bodies to set out the level at which learning is required with some mandatory units to cover the basic underpinning knowledge requirements. The optional units could include a range of standard units plus the option to build undefined credits into a programme which would be training provider specific tailored to meet the needs of the employer and the content approved by the Awarding Body. With regard to basic digital skills, there is scope for greater integration of ICT skills into employability programmes where this can be contextualised to the workplace and real life situations.

4.3 Vocational pathways in the IT sector should be recognised as an equal alternative to more traditional academic routes into these careers. At learndirect we are using our existing lower level IT user qualifications as a potential pipeline onto IT professional qualifications. We currently deliver around 70,000 ICT qualifications each year from Entry Level 3 to Level 2.

4.4 As a proactive training provider seeking to meet the demands of employers, we have developed strategic partnerships with companies such as Microsoft, CISCO, HP, Linus and Oracle to ensure our qualifications are fit for purpose now and in the future.

4.5 We have developed a Level 3 and Level 4 IT Professional Apprenticeship which is almost wholly delivered virtually. This allows the apprentice to do their learning anywhere they have access to the internet which can reduce the time spent away from the workplace. Our unique virtual offer uses a range of technologies designed to teach the learner; the technology also offers greater opportunities for collaboration and peer to peer support through our IT Professional Forum. For example pre-recorded sessions allow the learner to undertake bite-sized chunks of learning at a time which is convenient. Assessment and


[^326]: Technology Insights 2012, e-Skills UK
knowledge check is built into the programme which allows our trainers to keep a track on the individual progress of each apprentice.

5. Digital Exclusion

5.1 Digital exclusion remains a key issue in the UK for businesses as well as individuals. It is reported on average, 31% of organisations lack basic online skills\[http://www.go-on.co.uk/basic-online-skills\]\[^{327}\]. Our own research in 2012 also found 25% of jobseekers with qualifications below Level 2 said there wasn’t enough time spent on IT and computer skills at school.

5.2 Whilst changes to the ICT curriculum in schools from this autumn should have a positive impact on the digital skills of young people entering the workforce, the government must continue to invest in support to help the 8.5m people in the UK who still do not have the digital skills to benefit from the online world. Research commissioned by ICM in 2012 shows 72% of employers would not interview an entry level candidate who did not have computer and internet skills.

About learndirect

learndirect is the largest provider of skills, training and employment services in the UK and has supported more than 4.5 million individual customers and more than 75,000 employers.

In 2000 we challenged the norm and took a bold step to deliver learning online. We established ourselves as the leading UK provider of Adult Basic Skills delivering learning to thousands of people each year through a network of hundreds of centres. Ten years later we challenged it again by opening a state-of-the-art, unique support centre in Leicester, which has already worked with tens of thousands of learners.

We are the largest provider of Apprenticeships in England, a Prime provider and a sub-contractor to seven other Primes for the Work Programme, and hold major funding contracts with the Skills Funding Agency, Education Funding Agency, the Department for Work and Pensions, Skills Development Scotland, and the Welsh Government; as well as commercial contracts with clients including the Ministry of Defence, McDonald’s and The Co-operative Group. Our employer clients include tens of thousands of SMEs and large national organisations.

learndirect operates across England, Wales and Scotland using flexible delivery models via four main channels: online, work-

[^{327}]: \[http://www.go-on.co.uk/opportunity/\]

Who we are:

- Helped more than 4.5 million individuals get the skills for work and more than 75,000 businesses improve the skills of their workforce
- Supported more than 250,000 employability customers last year and provided training to c40,000
- On average one of our long-term unemployed customers gets a job every 20 minutes
- We find a work placement for one of our customers every 15 minutes
- Helped more than 6,500 customers get a work placement last year
- Delivered more than 20,000 Apprenticeships last year
- 95% customer satisfaction
based, local centres and network partners. By utilising our geographical scale, technological strengths and service portfolio, we provide holistic, end-to-end employment and skills solutions for individuals and employers, benefiting local communities and economies.

We are Ofsted grade 2 with a grade 1 for Leadership and Management. Our consistently high standards of delivery result in above-average achievement rates which exceed targets.

5 September 2014
London Borough of Camden – Written evidence (DSC0058)

The context for this submission is the Camden Digital Strategy which sets out how technology will support and enable the Borough to grow and develop in the years ahead and be a better Borough for it. The submission is confined to the three of the questions in the call for evidence.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

5.1 Camden has created a ‘ladder’ of opportunity to get Camden Children coding and to build their digital skills. All of our maintained schools subscribe to or otherwise use the services of the Camden City learning Centre (CLC) which provides opportunities for all Camden pupils to participate in day long technology rich projects led by a highly skilled team using the latest technology from programmable toys to robotics –modelled in this way schools can then build on these experiences e.g. Nursery children exploring the use of programmable and remote controlled toys borrowed from the CLC; an example of our youngest pupils beginning their technological journey. Activities at the CLC are always designed to develop creativity, to support the wider curriculum and to foster confidence and the ability to work both independently and as a successful team member.

5.2 Nurturing the interest and talent in technology beyond the school day will be key to increasing both the general skill levels and the supply of future technology specialists. To do this we need to harness support for our schools and teachers and to this end a collaboration with CODE CLUB has enabled staff from local businesses and Higher Education (UCL Department of Engineering) to support Camden’s intention to be the first Local Authority nationally to have a Code Club in every primary school –we are currently approaching 75% of schools either with an active club or seeking volunteer partners. All our secondary schools have after school computing opportunities for those who have a particular interest to explore further.

5.3 The council has enabled the procurement of ‘Coding Camden’, an innovative programme of sessions to promote coding and computing to students in Camden maintained secondary schools. Provided by a specialist provider, the pilot programme has developed activities which include programming a robot and the Engduino a computer on a board designed and produced at the UCL Department of Computer Science –a further example of the benefits of a partnership with HE. The student experience is complemented by information about careers as well as training to develop student Digital Leaders. The programme will be rolled out from Autumn 2014 and is anticipated to reach some 1000 students by the end 2016.

5.4 For Sixth form academic students there is a need to widen and enrich their experience so that they have a greater awareness of the opportunities of and substance of work and higher study. Over 50 Camden Masterclasses (including specific technology related opportunities) are brokered with a wide range of partners across the Capital (and with our link College in Cambridge). The format of a day with input from recognised experts at a venue offering practical ‘hands on’ activity has proven to be very successful. A thousand 17 and 18 year olds took part in these workshops during 2013-14.
5.5 The student ‘graduates’ from this ladder of opportunities need somewhere to explore, develop and share their interest so we are seeding a ‘Maker Community’ by hosting a group on Saturdays at the CLC to make computer controlled devices and write computer programs in general.

5.6 Links are being explored with an innovative local programme Camden Unlimited Academy - Coding the Web, while plans are being explored for a vocational path in a collaboration between Camden business, schools and other providers.

5.7 An underlying challenge is that of getting more girls and young women to join the Get Camden Coding ladder and develop their digital skills. We are taking action in this area too developing video resources to share the experience of women practitioners and examples of schemes of work with activities and girl friendly learning and teaching strategies. Projects and work with students with SEN and disabilities ensure that the strategies are inclusive and link to a sector that could provide substantial opportunities for lifetime careers.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

6.1 Working with primary ‘digital leaders of learning’, schemes of work and materials are being developed to support the implementation of the new National Curriculum for Computing. The use of common resources identified by and tested in our schools and the CLC better enables the sharing and development of practice between schools: one of a myriad examples is the adoption of online coding resources such as Espresso and most recently introduction to the innovative CodeKingdoms environment which provides for unlimited creativity by allowing children to design their own puzzles written in real code which they can work on beyond the school day.

6.2 Schools are making extensive use of CLC consultants to lead staff training working through exemplary activities to grow experience and confidence. It has been striking how great the challenge of preparing staff is proving to be with many having little grasp or experience of the enhanced emphasis on coding and the critical life skill of eSafety.

6.3 Because of this partnership between schools, the council and the CLC, all primary pupils in Camden have a broader more innovative technological experience that arguably starts earlier and goes deeper, than in any other London borough.

6.4 Innovative teaching requires great teachers so we are investing in Continuous Professional Development to support our teachers to deliver this ambitious programme. A special interest group has been established to share work from the undergraduate programmes at UCL with school teaching teams -in the next academic year group members will be supporting a computing club at the CLC. The partnership provides teachers with unique opportunities to learn about world leading developments in computing and leading thinking in pedagogy and curriculum – a summer school provided an opportunity for post 16 students to work with Dyson designers on programming projects.

7. How can the education system develop creativity and social skills more effectively?

7.1 Creative learning practices in schools help raise achievement and improve pupil’s personal development. It can place learning in a new context by turning new and
imaginative ideas into reality through literacy, maths and science. Creativity involves two processes: deeper thinking and practical learning.

7.2 See 8.1 below – by properly encouraging the whole gamut of high-quality technical and vocational courses available nationally – at 14 as well as at 16; and far better stressing the computer and other higher-order practical skills required for them, as well as the higher employability that will result. Inspiring ALL young people (who are almost all genuinely worried about finding a recognised place in the adult world), will make them more creative, and more socially effective. At the moment, it is no coincidence that such expression of creativity and social confidence is far easier to cultivate in the more academic post-16 educational institutions. These are full of young people who have been told they have ‘succeeded’. FE Colleges and Training Providers – generally - then begin with a deficit model, against which they achieve some startling results: but only for some.

8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

17. Nationally, the current post-16 system struggles to inspire sufficient numbers of students to attain the widest range of careers, now or in the future. Although it (increasingly) has the resources to train older students, many arrive even more dis-incentivised than ever; this is partly because of successive changes to the qualifications’ framework, which have reinforced the collective “5 A* to C at GCSE or bust” complex.

18. Students not achieving this benchmark often end up embarking on College courses, feeling they have failed already. Sixth forms tend not to admit such students, or do so on to courses which the system has already signposted as second-best. The courses that do take them often therefore lack sufficiently convincing reference to employability skills (they’ve been told too often A level is the only way to high-quality employability), and some lack coherence - Forensic Science for students who will never become pathologists, e.g. The courses and apprenticeships that DO lead to substantive skills’ acquisition under-recruit, or recruit only non-academic young people. Some apprenticeship training (and now national policy) has made GCSE English and Maths the effective gate-keeper anyway – logical and correct in itself but many young people will be unlikely to achieve this, yet demonstrate considerable practical/life skills. Such vocational provision usually lacks any significant coding or other relevant computing skills’ acquisition, even though almost all trades and professions require these as standard practice cf. CAC/CAD/CAM etc.

19. Against this sort of disincentivisation, in pre-16 education, schools continue to be ill-equipped with workplace/industrial/technical expertise, though many claim or actually run small-scale vocational courses. Many continue to gate keep, and/or lack resources to broker – let alone encourage – access to the pockets of high-quality pre-apprentice, apprentice, and vocational education that Colleges and training providers offer across the country. With a few exceptions, only the “third pathway” pupils are allowed (let alone encouraged) to embark on GCSE alternative courses, even the many that continue to be one –GCSE equivalent. Cost is often cited as a factor, though Pupil Premium and other schemes make this seem disingenuous. In some cases, the highest attaining pupils would benefit from a day a week of technical/vocational (i.e. non-academic) learning, but are almost always dissuaded, by the Year 9 Options’ timetable, mainly by teachers, and parents. Where exciting off-site provision is promoted at Options’ Evenings, pathway 1 and 2 pupils (those
on strong academic programmes) often express strong interest in this, only to be told it is not for them.

20. In Camden, the Local Authority aims to buck these trends, by continuing to broker and vet a systematic suite of high-quality, hands-on vocational/technical courses. These annually attract 50–60 pupils across our 10 mainstream Secondaries and ‘Pupil Referral Unit’. Our Camden 14-16 Courses increasingly require information skills or other computing expertise, and all cover the range of the major generic vocational areas: Engineering/Motor Vehicle, Construction, Silversmithing, Land studies, Hair/Beauty, and Catering (taught at Jamie Oliver’s old College, Westminster Kingsway). Yet our experience is mixed: some schools ignore the offer (except, for example, when they have a pupil in danger of exclusion…), some are genuinely wary of sending pupils off-site, or mistrust the provision; however, a rising number include the Camden package as part of their Year 9 Options’ choices.

21. A TEDX style careers conference with inspirational speakers and activities targeted Years 5&6 students is extending opportunities to experience what it would be like to work in a range of sectors including those reliant on technology. Established with major local businesses and cultural organisations it is targeted at vulnerable groups associated with persistent attainment gaps and at risk of becoming NEET between the ages of 16-25.

5 September 2014
Submitted as an interested individual representing my own views.

1. There is an increasing body of evidence which supports the use of digital technologies in classrooms, schools, and post-16 education as well as innovations such as MOOCs and wider aspects of informal learning or workplace training. For example, ITTE’s own peer-reviewed Journal of Technology, Pedagogy, and Education is a long established contributor to the continuous development of evidence-based research. More widely the evaluation and contextual application of research evidence is under constant review by many policy and strategy groups. Among the most notable perhaps are the recent report “Shut Down or Restart?” (2012) and “Digital Skills for Tomorrow’s World”. Both documents contain substantial bibliographies that reference important examples of the research base that underpins much current thinking.

2. However, much of this research evidences specific aspects of education for digital skills rather than the uation of a whole strategy to develop digital skills across the nation particularly in order to ensure a consistency of experience and outcome for all stakeholders. In its response ITTE aims to draw attention to some of the wider considerations that might be taken account of by the House of Lords Digital Skills Committee.

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

1.1 The rate of change in digital technology is a major challenge for education.

1.2 The technological future has a high degree of uncertainty. For example, whereas in the early phases of the ‘digital revolution’ (circa 1950-1980) the idea that digital technology could or would assume a core role in the everyday social life of people was still somewhat contentious, today we find that digital technology has moved well beyond the merely functional into deeply psychological aspects of human life. Digital technology increasingly assumes an active and contributory role in everyday life, so much so that some predict a tipping point when digital technology will become in some import ant sense more intelligent than people and will therefore become even more significant in social, economic and political decision making.

1.3 This implies the emergence, already apparent, of autonomous robotic devices that can in some sense take care of human affairs from devices that can provide palliative care to the infirm, or adaptive support for the disabled, through to advanced search and rescue operations and of course automated warfare. It implies the emergence, already apparent, of financial management systems that make their ‘own’ decisions about significant economic transactions, the development of automated newsgathering and dissemination up to an

328 Technology, Pedagogy and Education, Routledge
330 UK Digital Skills Taskforce: http://www.ukdigitalskills.com/
including the production of texts and videos without direct human intervention, and of course advanced, subtle and automated surveillance of vast swathes of human social life.

1.4 At the same time digital technology provides powerful tools that have the potential to improve human life. The diagnosis of disease and the molecular design of new drugs to combat disease or prolong life, the mapping and discovery of the planet’s remaining resources as well as the effective expansion of human activity to the Moon and Mars during the 21st Century are just three examples of the ways in which digital tools can have macro effects on human life. At the individual level too to the emergence of the ‘Internet of Things’ in which our everyday devices such as televisions, domestic heating, food storage and consumption, and even the domestic production of physical spare parts for broken devices or perhaps the ‘printing’ of entirely new devices are all now realistic possibilities and in some aspects are already available.

1.5 We also need to maintain awareness of the fact that ‘digital technology’ itself, as we understand it, may be supplanted. We may say with confidence that the ‘digital’ will give way to some other forms of computational technology and that this will begin to emerge during the next generation. Already, ‘silicon’ which was once the material that symbolically expressed the essence of the digital revolution is giving way to a whole new range of materials that offer faster, smaller, more complex physical embodiments of digital information and which thus can move the entire computational effort forward (e.g. molybdenum333 or carbon nanotubes334). Such investigations into the information handling properties of fundamental materials will perhaps leads us into a new type of computational technology based on the quantum properties of matter, possibilities that have been predicted at least since the 1980s335.

1.6 Such technological transformations are likely to happen during the lifetime of today’s infant school children, at least in part, and many of these changes will have a significant impact on their daily lives in economic and social settings. It is therefore important to ask ourselves how we can intellectually and practically ‘future-proof’ today’s children against a future that will be based on more sophisticated forms of computational logic (e.g. the qubit336) using new kinds of materials (e.g. nanotubes), and fully embedded in the social world (the “third age of computing”337 aka the ‘internet of things’).

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

2.1 Across the ‘body politic’ there is a continued and confusing view of the role of the state in stimulating economic growth. It is time to undertake a thorough review of the role of the state in generating and, to some extent, steering the direction of investment, innovation and education for a knowledge economy. We may date this period of confusion from the 1970s

333 Purdue University: http://www.purdue.edu/newsroom/releases/2014/Q2/silicon-alternatives-key-to-future-computers,-consumer-electronics.html
when doubts about the role of the state as an organised and controlling bureaucracy in managing social and economic affairs first emerged in serious debate; this followed a long period of reconstruction following the catastrophes of the second world war and subsequently during the 1980s the fading away of the cold war also fuelled these doubts about a complex, centralised state organisation.

2.2 Today, these doubts about the role of an organised state in the management and stimulation of the economy as well as the promotion of innovation and invention are much less secure. Indeed, it may be time to recognise that the state has a crucial role to play in organising and directing social and economic affairs notwithstanding prevailing ideologies to the contrary. For example, in education, health and public transport the positive role of the state is clear; its withdrawal from the direct management of these critical infrastructures is only apparent rather than real and public doubt is increasing about the efficacy of a decentralised, semi- or wholly privatised approach to such key infrastructural services. Without an honest recognition of the role of the state in supporting and promoting the future prosperity of the nation the United Kingdom is doomed to flounder as a mere shopkeeper for second-hand and hand-me-down goods and services. Such arguments are clearly and cogently put supported by such writers as Jones, 2014 and Mazzucato, 2013.

2.3 In short a knowledge economy cannot thrive without appreciating the truth that lies behind the role of the state in promoting innovation. We ignore the implications of state investment in research and innovation at our peril. Worse, we are already living under the deception that in fact the state has no part to play in such activities when, as Mazzucato argues, much, if not most, of the digital technology we currently enjoy has come about directly through state-funded research and development yet the myth is constantly reinforced that innovation is always the result of the dynamic inventiveness of the private sector.

2.4 Therefore, a key challenge for economic growth, and in particular the construction of a knowledge economy, is to review and reassert the pivotal role of the state as an agent of stimulus and change. It is impossible that the key developments we may envisage for the future (as hinted at in our response to Q1 above) can be fully realised and usefully exploited by the anarchic and self-interested motivation of a private sector economy alone.

2.5 However, there remain important issues in understanding the specific terms of this question, namely the idea of a “knowledge driven economy”. Much work remains to be done, even today, to understand what this concept means in practical terms for the everyday life of most school leavers. Certainly the idea of a ‘knowledge economy, has been with use for many years perhaps most famously in the formulations of post-industrialism by Daniel Bell as far back as 1973. More recently we have seen formulations such as ‘cognitive capitalism’ which explore the rise of ‘digital labor’ as a source of economic wealth.

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2.6 From the perspective of education a key point arising from these analyses of the emerging ‘knowledge economy’ is the extent to which education, and schools in particular, are equipping today’s students to be passive consumers and users of technology versus active and controlling agents of change and development. In short, to repeat an age old concern, to what extent is education merely ‘training’ students to acquire a set of skills that can be exploited by others to create economic wealth versus ‘educating’ students to take control of their digital environment and to empower their use of digital tools for person, communal, and economic ends.

2.7 This concern has not been fully resolved. A key aspiration underlying the new curriculum reforms in computing, now being implemented in schools in England, to turn students into active creators of digital content (in particular through the development of coding skills) is not matched by curriculum reforms that aim to build students’ understanding of how to implement an idea in practical business terms, in academic or research terms, or as a self-contained creative project. Thus the curriculum reforms are in danger of developing digital skills without comprehension of how these skills may be put to effective economic use.\(^{342}\)

5 September 2014

\(^{342}\) An interesting discussion of the detailed and multifaceted process of creating startups is to found in Gabriel Weinberg’s blog: http://www.gabrielweinberg.com/blog/. This is an example of the type of content that should be embodied in new curricula for the 21st Century.
Makers Academy – Written Evidence (DSC0119)

A brief summary

Makers Academy is the Europe's leading coding bootcamp. We help complete beginners to learn the basics of software development and find their first job as junior programmers in world-class companies. Launched in February 2013, we’ve graduated over 250 students who went to join leading software companies as junior developers earning an average £30,000 per annum starting salary. Companies hiring our graduates include Marks and Spencer, the Ministry of Justice, BSkyB, Compare The Market, Deloitte Digital, Just Giving and many many more leading tech companies.

The course is full-time, face-to-face, and highly intensive. Students undertake a 4-week, online, part-time pre-course on the basics of programming, followed by 12 weeks of project-based tuition at our teaching space in London’s Silicon Roundabout. We run a new course every 6 weeks, taking an average of 25 students in each intake.

The course costs £8,000 – less than a year at a university. Given that our graduates that want to get a job usually start on £30,000+ within two months after graduation, we believe that it represents great value for money.

Tech City Fellowship: a non-profit loan scheme

To make the course more accessible, we have recently launched the Tech City Fellowship in partnership with Centre for London’s Connecting Tech City initiative. The Fellowship is a VC-backed loan scheme intended to give East London residents under 25 access to Makers Academy (or similar courses) that they wouldn’t otherwise have had. In 2015, through a collaboration between the private and the public sector, we aim to grow this fund to over £1M, which will allow us to teach more than 100 students per year who would not be able to afford our course otherwise. The loans will be provided at a lower rate than that of the Student Loans Company which we don’t have access to.

Future plans

Long term, there are a number of initiatives to scale the company, reduce the cost of the course and improve access for people who do not have £8,000 in savings to cover their tuition. We are exploring a community-led learning model, reducing the need for us to invest in expert teachers, as well as testing online learning techniques that will allow students to learn to code and get a job without attending the course in person. Our vision of Makers Academy is a lower-cost, blended system of online and offline learning that would allow us to teach and place into junior programming jobs thousands of students per year both nationwide and worldwide.

Makers vs Higher Education

While we believe that Higher Education has a role in the future matrix of learning options for would-be tech engineers, we do not believe that institutions will ever be able to provide the sort of service we offer, due to inherent, systematic failures.
The tech industry is one of the fastest-moving of any industries. The specific technologies we taught just 18 months ago when we started the company are already becoming obsolete, and we have had to update the content of our course to reflect this. We change our course every six weeks to fit the needs of the market. Unlike universities, we are not accredited, which enables us to move at a superior speed to respond to the market.

In the three/four years it takes to complete a degree, the tech industry on your day of matriculation will bear little resemblance to the industry on the day of your graduation. Given the time it takes for higher education institutions to agree, create and begin to teach more up-to-date content, it will never be possible for students to learn the sorts of languages, techniques and best-practises that are current in the market.

Our world simply changes too quickly. This is where Makers Academy is able to deliver something that HE cannot, and it is the reason why we have such an impressive list of partners wishing to hire our graduates. We teach current, work-ready skills in a way that higher education institutions, with the constraint of needing to win formal accreditation and a lengthy curriculum revision process, cannot.

**Immigration / Post Study Visas**

While we do understand the position of the current government on immigration, we must note that the tightening of the immigration regime in recent years made it more difficult for educated and well-paid workers to stay. For example, the founder of Makers Academy Evgeny Shadchnev was able to stay in the country (and found Makers Academy in London as a result) only thanks to the post-study visa scheme that does not exist anymore. Had he graduated today, Makers Academy would probably have started in a different country.

Although some of our foreign students were lucky to secure working visas in time to stay after graduating from Makers Academy, many were not so successful and had to seek employment in other countries (Singapore, Australia, South Africa, etc), despite great demand for their skills in London. At the moment, Makers Academy has significantly more companies looking to hire our students that the number of graduates available for work.

We call for a range of measures to ensure that the most talented and in-demand graduates have a chance to stay in the county. Specifically, we would welcome a work permit that would be available to anyone, including junior talent, who have demonstrated exceptional promise in the field of technology and brilliant work prospects. The current Tier 1 visa is a great start but it does set the bar too high, only being available to established leaders in the tech field. Given high salaries (£30K+ starting pay) we would consider it appropriate to make such work permit conditional to earning above-average salary and having no access to public funds.

**How can the government do more to help?**

There are a number of ways that the government could support institutions like ours.

**Office Space and taxes**

Our annual rental for the space where we teach our students is £220,000 (and about £10,000 in stamp duty to acquire the space). If this could be fully or partially supported by
the government it would allow us to reduce the costs of the course and invest further in the quality of our education.

Unlike higher educational institutions that are VAT exempt, we have to charge VAT, making the course less accessible and creating fewer jobs as a result. It would really help us to get a VAT-exempt status because we’d be able to pass the savings to the consumers and teach more students as the result.

Tech City Fellowship

The government would do well to support initiatives like the Tech City Fellowship, which allows smart, dedicated students from lower socio-economic groups to access the level of education we provide. Support could include providing funding through The Department of Business for example, or supporting the initiative by sign-posting it to the right organisations and Councils.

Student Loans

In simple terms though, the easiest solution would be to scrap the Fellowship and offer a standard student loan that is repaid once our graduates get a job, so that anybody could take a loan to study at an institution like ours – ones that do not have and never plan to pursue any formal accreditation.

Right now, the only option for people who want to become coders is to get a loan and go to an approved university, which, as discussed above, simply doesn’t deliver in the way the market needs but leaves the student with a significant debt. The key issue for our potential students is that if they don’t have the money in the bank or parents’ support, exceptional educational courses like the one we provide at Makers Academy are out of reach.

Let’s take a specific example. If we compare the load to study at Makers Academy to a regular university loan, our students would only need to borrow up to £12,000 (£8,000 in tuition + £4,000 in living expenses) instead of up to £50,000.

Usually our graduates get jobs within 1-3 months of graduating, hence starting repaying their loan within 6 months of taking it, not 4.5 years.

Crucially, unlike university, we train people to get them job ready as software developers. Makers Academy lives solely on its reputation, so if we can’t deliver on our promise of getting our graduates into great jobs, new students won’t be joining the course.

Finally, it would be rather easy for the Student Loans Company to assess the repayments and hence success rates of our students to see if this makes sense.

Staff Costs

Another way the government can help would be to reduce or remove NI costs on coaching/teaching staff. Software developers are in high-demand. Their salaries top £500 per day, or £10,000 per month. If we could just remove the NI costs to our staff costs, this
would massively help us in increasing quality by hiring more staff members or decrease the cost of the course.

*5 December 2014*
1. Summary

1.1 This submission from the Management Consultancies Association (MCA) sets out the unique perspective of management consultants on Digital and Digital skills. It demonstrates the dual impact that Digital is having on our industry. First, clients are increasingly demanding advice on Digital matters. Recent MCA survey work showed that over 90% of business respondents considered Digital to be of great importance to them. However, their understanding of what Digital means varies considerably. MCA member firms are well placed to provide that advice, given their mix of technical specialisms and their ability to translate the complexities of Digital into a language business leaders can understand and use. Secondly, the process of management consulting is itself being transformed by Digital.

1.2 In helping others transform in response to Digital, and in transforming itself, the consulting industry is witnessing many changes in skills requirements, both for itself and clients. Our submission addresses some of the commonalities between these internal and external changes. It considers some of the more obvious issues, in particular that:

- Consulting and wider industry need more technically capable people
- The UK should build on and extend initiatives to make computing central to the school curriculum
- The UK should enlarge its STEM capabilities and remove barriers to increased take-up of these disciplines among female students

1.3 Our submission also addresses less obvious matters. While there is an understandable focus on the education of young people, Digital presents real challenges to those already in work. Forty-somethings whose education may scarcely have involved basic computing are often looking forward to nearly thirty more years in the workplace. They will need support, such as the reverse mentoring schemes MCA members deploy. Further, we highlight the degree to which the UK’s ability to take full advantage of the Digital opportunity will depend on factors beyond core technical skills. Digital will require new creative mindsets, capable of challenging existing ways of thinking, reinventing how businesses operate and how public policy problems are addressed.

1.4 We examine how consulting is responding to this emerging need to recruit people who think differently and consider areas where Digital’s potential poses indirect skills challenges. How Digital natives absorb information is starting to make significant changes to the construction of working environments. These changes will become the norm, necessitating training for older workers. Disciplines such as marketing benefit from new technologies, but are also impacted by Digital realities. To evolve, they will need to draw on different skills.

1.5 Our submission considers that as Digital destroys boundaries between workplace disciplines and even whole industrial sectors. Skills bases will need to become more flexible. Technical capabilities will need to be complemented by more rounded ones. We note the degree to which early specialisation in the UK education system undermines our ability to
produce the technicians who can create and the creatives who can code that our Digital future will require. Finally, we set out practical steps MCA members are taking to raise the Digital competence of consultants (who often go on to hold senior positions in other industries), as well as some of the initiatives they support to improve the UK’s Digital skills base, in partnerships with their clients and with educational establishments.

2. About the MCA

2.1 The Management Consultancies Association (MCA) is delighted to make its submission to the House of Lords Committee's review of the UK’s skills needs in the context of the rise of Digital.

2.2 The MCA is the representative body for the management consulting industry. Our 57 members work with most FTSE 100 companies and operate right across the public sector.

2.3 The MCA demands high standards of ethics and professional integrity from its members. It promotes the very best in consulting. MCA membership is a recognised hallmark of quality. Through our Consultancy Buyers Forum, we facilitate engagement between consultants and those who use them, to promote effective specification, purchase and management of consulting assignments. Our Young MCA is a network that captures the enthusiasm, talent and innovative thinking of our industry’s more junior members. The recently launched Managers Network provides the same service for middle-ranking consultants, and the work of both forums is closely linked to the Careers Group. We facilitate an SME Group to promote the interests of our small and medium-sized firms. We represent the interests of our members to Government, encouraging ministers and officials to continue to view the industry as a key growth sector and export. We also engage with a range of public sector bodies on procurement issues. Our Annual Awards celebrate the very best in consulting. Our Think Tank gathers our industry experts’ ideas and ensures they make a positive impact on debates on the economy, public policy and the business environment.

3. Why MCA members speak with authority on Digital matters

3.1 Management consultants are perhaps uniquely well placed to understand the implications of Digital for the economy as a whole.

3.2 This is not solely because of the relationship between Digital and technical capabilities. Certainly many MCA member firms have backgrounds in technical IT – IBM, CSC, Hitachi, Tata – or in sensitive information fields such as data security – BAE Systems Applied Intelligence. Our members work in cutting edge and technical projects, such as IBM's award-winning work with Jaguar on the "virtual" Land Rover, which allows consumers to customise their own vehicle remotely, or Deloitte's work to help transform John Lewis's online offerings.

3.3 More generally, however, our member firms' business strategy advisers work right across every industrial sector and in public services. In the course of this work, they are helping clients grasp the radical changes Digital is making to how the economy and society function. They are alive to the way in which the ability to access email, internet, telecoms, film, books, music, games and their workplace on one compact mobile device is driving new expectations about how goods should be bought, services accessed, and how people want to work and play. They understand how the common Digital coding of previously separate
services (phone calls, TV) is collapsing boundaries between industrial sectors. They work with businesses on the implications of the whole range of Digital disruptors. Firms seek our members’ help to meet their Big Data challenges – how they can understand their customers better, and also how they can deal with the "bi-directional" nature of Big Data, in which consumers now have more information about business than ever before. Firms such as Propaganda and Roth Observatory are helping firms re-imagine their communications and marketing functions in an age when social media provides opportunities for campaigns and promotion, but also places a sizeable portion of brand control in the hands of consumers.

3.4 In short, our members understand the radical implications of Digital at both a technical level and an organisational level. At a recent event, two thirds of them suggested that Digital was as big as the Industrial Revolution. But they also understand business. They know that business leaders, many of whom will have grown up before the omnipresence of computers, may be struggling to understand the implications of Digital. Indeed, our evidence bears this out. In a recent MCA survey of 100+ business leaders from all sectors of the economy, over 90% suggested that Digital was important to their business. Yet while a similar percentage suggested they understand the concept well, respondents’ attempts to define the phenomenon and how it should be managed were partial at best and ill-informed at worst.

3.5 Business leaders need Digital explained to them, but not in the radical language of a Digital zealot or the techno-speak of the classic CIO. Rather, they want to understand what they need to do about Digital, how they should organise and recruit to get the best of the Digital opportunity, how they can succeed in the Digital world and make money. Management consultants have the Digital knowhow. But they also speak the language of people, processes and the bottom line that businesses and other organisations understand.

3.6 Consequently, Digital consulting is on the up. In our most recent Annual Report, we recorded that in 2013, 25% of all MCA consulting was Digital, the largest single grouping. We expect that figure to rise, through growth within established consulting firms and through the continuing emergence of new Digital consulting ventures, such as Stream:20, who are experts in Digital marketing and Optimos, who specialise in Big Data. This trajectory reflects the centrality of Digital to the UK’s growth prospects. That industry leaders see as important Digital make sense given Britain’s Digital potential. That potential is a function of some sound fundamentals and experience. Britain already has a strong Digital reputation. It has a number of globally respected Digital hubs and concentrations of activity – Cambridge, Tech City – as well as emerging countercultural and insurgent centres. The challenge (and opportunity) for Britain will be to make these promising phenomena the basis of a sustainable industrial model. Indeed, Digital products, services and innovations hold out the best hope of significantly rebalancing and growing the economy.

3.7 Responding to this trend, in July this year we launched the MCA’s Year of Digital. This initiative is a series of events, research and thought-leadership intended to capture the breadth of our members’ involvement in Digital, their insights, and also to understand how Digital is changing consulting.

3.8 For the skills and organisational challenges of Digital are impacting consulting itself – even the 75% of consulting activity not currently characterised as Digital. Traditional
programme and project management is being changed by the availability of real-time Digital information, requiring agile responses from managers rather than dogged adherence to a plan. Strategists must advise clients in the context of relentless and fast-moving change and uncertain futures. They are moving away from providing detailed strategic plans and into acting as critical friends to clients. Strategy consultants validate clients' hunches, test their organisational resilience in the face of possible future disruptions, and support them in prototyping and getting new ideas to market quickly. They help clients succeed fast and, as importantly, fail fast (and cheaply). Consulting activities themselves may be disintermediated, with tasks previously carried out by analysts rendered into technologies and apps. And as the generations of Digital natives enter our profession, many of them active in our vibrant Young MCA network, they bring new cultural and behaviour assumptions which make their way into how consulting is done.

3.9 Consulting is changing, in its internal organisation and in the things it does for clients. The industry can thus speak of the implications of Digital and the associated skills challenges insofar as they affect the industry itself and as they impact the wider economy, pointing to commonalities where they occur.

3.10 Over the course of the Year of Digital, we will be harnessing our networks to conduct major research on the changing skills profile and needs of consulting. We will of course be happy to make this available to the Committee.

4. Digital and Digital Skills

4.1 Our recent survey of the British business leaders revealed concerns about the degree to which they were able to get the skills they needed to meet the Digital challenge. Only around a third of senior executives reported that their company had the right mix of skills within it to tackle the Digital future. Around a half agreed only slightly with this statement, suggesting that skills remain a key area of concern for businesses. And, while there is strong recognition that many of today’s school leavers and graduates are well-equipped for work in the Digital age, one out of every five executives in the survey rated them as average or below.

4.2 Consultants have similar concerns. At the most basic level, the problem is one of core Digital skills. Royston Seaward, Head of Deloitte Digital, now expects his consultants to be able to write code whether they will be required to do this on assignments or not. His argument is that it is essential to understand the nuts and bolts of Digital to be able to advise on even high-level matters such as Digital strategy. But Darren Gerry, Digital Director at IBM, argues that coding has been imperfectly taught in schools. He welcomes imminent improvements in the primary curriculum, with children starting coding in Reception. But he suggests that these initiatives now need to be matched urgently at secondary level, to equip those who will soon enter the workforce. Rachel Barton, Managing Director at Accenture Strategy, argues that STEM skills will be an immensely important part of the mix in years to come. Together with her colleague Emma McGuigan, Director of Accenture Technology, Rachel is also keen to see the technical aspects of the Digital skills base become more gender

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Rachel Barton’s most recent article on the subject may be read here: http://www.mca.org.uk/news/updates/skills-key-to-uk-exploiting-digital-opportunity/
inclusive, with technology shedding its image as a male preserve. This gender reorientation is plainly a component of wider initiatives across STEM subjects. It depends in part on the celebration of the increasing number of influential women in Digital, such as Tech Hub’s Elizabeth Varley. And as we shall see, it might also be beneficially impacted by demonstrating the relation between technical Digital disciplines and creativity.

4.3 STEM skills are particularly important in relation to the defensive aspects of coding and systems. Businesses, public bodies and citizens generate masses of Digital data, creating significant security challenges, including the risk of Cybercrime and hacking. Britain will need many mathematicians, coders and cryptographers to test the resilience of systems, with the protection and management of data likely to be major (and diversifying) source of business activity (as well as propositions and opportunities) in the coming years.

4.4 Rob Price, Head of Digital at Atos, believes that the skills of Digital natives and capable school-leavers need to be harnessed to address an urgent challenge: the lack of Digital awareness among those already in the workplace. Someone in their early forties may have the best part of thirty years left at work and may lack any Digital training at all. The Digital Native’s ability to create without fear or constraint may give them an advantage over those whose careers have led them to see potential pitfalls and reasons why something cannot be done. Digital’s ability to destroy business models and create new ones requires consultants with open minds who can embrace disruption, rather than find reasons to avoid it. For that reason, Atos engages in "reverse mentoring", with younger consultants helping more experienced colleagues come to terms with the possibilities of Digital. Other firms, such as PwC, have similar programmes.

4.5 Further, Carlo Gagliardi, Head of Digital at PwC, suggests that the generational issue manifests itself in contrasting modes of information consumption and thus of working. The non-Digital Natives absorb information in a linear fashion, through text and numerical data, using Word, Excel and Powerpoint. Digital Natives consume it on an array of devices in visual and interactive formats, often resembling videogames. They multitask, getting information from a variety of sources – Facebook, Twitter, YouTube, Instagram. This new orientation will gradually have to be reflected in the construction of workstations and the assumptions of its “suite” of tools and capabilities. Mastering the skills needed to manage the new work environments may prove especially challenging for those currently in the workplace, necessitating retraining.

4.6 Many MCA members believe that the technical aspect of Digital, though an important skills challenge, is not the sole one. Getting business leaders to understand the realities of Digital and its implications is a marketing task. They need to see what Digital will mean for them and play with it, especially since a Digital innovation’s immediate implications for consumers are likely to be visual and interactive. Carlo Gagliardi at PwC believes that this will drive the need in consulting for larger numbers of people with visual presentation and interactive user experience skills, who can use advanced Digital design and imaging into translate technical, organisational or customer-facing propositions into high quality and interactive graphics.

4.7 This phenomenon has implications beyond consulting. For example, it will impact marketing and communications professionals and place new demands on their skills base,
training and development. Further, Digital is not just supplying marketing departments with the possibility – and challenge – of producing better quality infographics, films and promotion materials, and ensuring that their chosen transmission channels match the usage patterns and interactive urges of emerging customers. As Lucinda Peniston-Baines at Roth Observatory International suggests, the marketing function is having to become more supple and reactive. Its challenges include not only the planned transmission of information but also real-time reaction to customers and events. If a product fails, or a bank's ATMs go down, after-the-event responses no longer suffice. Control of the issue has been wrested from the firm by the power of social media, with the problem potentially trending on Twitter. Further, Big Data now plays a huge role in marketing. Firms can adapt their campaigns not simply to the needs of customers who “present” themselves – by enquiring about or buying a product. They can also relate their messages to the lifestyle choices Big Data analytics reveal about both existing customers and potential ones. But Big Data is a two-way street, with customers having more information about businesses than ever. They are better equipped to make price-sensitive decisions or choices based on important personal criteria, such as ethical sourcing. The skills base of marketing professionals will accordingly need to become more rounded. Accomplished customer care, a good command of communications tactics, up-to-date knowledge of customers’ preferred channels and methods for information consumption, and the ability to interpret and respond to data analytics will be at least as important as the ability to develop and distribute quality materials.

4.8 The example of marketing touches on what many of our members see as critical here. Digital will require people with technical skills. But to fully harness its disruptive potential the UK will also need people who see the world differently and are willing to overturn traditional ways of thinking. For Alwin Magimay, Head of Digital at KPMG, the primary task will be to get more creative people into business and into consulting. The latter has an understandable preponderance of analysts. These are essential. But increasingly their approaches need to be leavened by original thinking. Organisations today need to overcome the “incompatible DNA” issue where creative and technical minds mix ineffectually, owing to the ingrained structures and disciplines in longstanding companies. Such cultures inhibit companies’ responses to a Digital world where flexibility, agility and speed are key.

4.9 Creativity is a preoccupation for Accenture. Les Bayne, who leads Accenture's work in Telecoms, Media and High Tech, is increasingly seeking what he terms "breakthrough" people, who think differently (and possibly look and dress differently) from the classic consultant. Andy Tinlin, who leads Accenture's Strategy practice, is interested in consultants who are able to cope with uncertainty and ambiguity, and can teach clients how to handle the unpredictability of the Digital economy. And Emma McGuigan strives to develop her technical people into "creative problem solvers". She wants the technically minded people in her team to grasp the business implications and disruptive potential of the technologies they produce.

4.10 This appetite for "people who think differently" has profound implications for the education system. It is also critical to ensuring that Britain makes the most of the Digital opportunity.
5. Digital, education and changes to business landscape

5.1 We specialise early in education in the UK. This has paradoxical effects. It fosters generalists and it creates rigidity. These problems take on more complex forms than even the arts/science divide articulated by CP Snow over fifty years ago.

5.2 Notably, our civil service contains many people whose educational background is in languages, classics or the arts who write policy briefs on the economy or the health service. It has mathematicians and physicists who articulate influential views on social policy. Similarly, creative people are frequently attracted to arts subjects and courses, and ultimately to creative careers. But since not all of them can become successful actors, musicians or film-makers, many may be drawn into administrative roles in the arts sector. Yet they may lack some of the useful corporate disciplines needed to run organisations. By contrast, while there are creative people in British business, larger firms undoubtedly possess a preponderance of dogged corporate survivors. Their MBA has equipped them with an understanding of balance sheets, the use of data, analytics and Excel. They speak the language of British business and master its politics. These are essential to corporate life. But they are not necessarily entrepreneurs, the innovative agents of change.

5.3 The cases above illustrate the UK’s tendency towards generalism and rigidity.

5.4 The tendency of creatives not to view business as a career option disables it. Aspects of arts administration could benefit from corporate capabilities. The public sector’s need for genuine specialists is well documented. What the problems seem to illustrate is that we close people off at a very young age from exposure to an array of options for life. In a baccalaureate system or university courses with majors and subsidiaries, a student with an early bent towards classics may also discover and develop, through late specialisation, abilities in economics or business administration. Our system of teenage specialisation by contrast disables our capabilities needlessly and in ways that runs counter to our increasing longevity.

5.5 Furthermore, early specialisation inhibits the development of valuable cross-currents. Emma McGuigan’s desire for the emergence of technically minded Digital types with creative capability plainly stems from current experience, in which these capabilities originate in different educational cultures and mindsets and are currently unlikely to converge in the same person. Yet there is no reason why in the baccalaureate or major/subsidiary models above, a mathematician with a programming bent could not, through exposure to courses on visual arts, enhance their ability to produce 3D images of mathematical models.

5.6 Digital should afford the opportunity to make British corporations and industries more creative and dynamic environments. As it expands the array of technical possibilities, it should expand our creative potential. Digital should be the means through which we visualise new ways in which existing goods can be purchased and enjoyed, new approaches marketing, and even wholly new product offerings.

5.7 In aiming to foster the technical capabilities needed for Digital advancement and the creative imaginations that characterise strong entrepreneurship, educators would be moving with the times. The new Digital entrepreneurs are insurgents, radicals. They are impatient.
with corporate life, its regulatory requirements and bureaucratic hurdles. Their mentality would be a very valuable addition to boards of British enterprises. As the worlds of coding, gaming and programme making converge, the potential for Digital to be a means for getting more creativity into business is there.

5.8 Furthermore, the degree to which Digital is collapsing boundaries between industries (as mentioned at the outset of this submission) needs to find a counterpart in less hard demarcation between certain technical and creative disciplines. Digitally facilitated ways of viewing business and even social problems are quite likely to have a cross-sectorial dimension. This should be reflected in how technically capable and creative people are encouraged to view Digital possibilities. For example, the health issue of obesity is one for which the solution will need to be multilateral, involving more than just health agencies. Digital technologies can be deployed to monitor individual calorie consumption and exercise regimes. But they also provide a means of viewing the problem in the round, marshalling an unprecedented array of data from across separate organisations, and interpreting it in ways which point towards innovative solutions. There are an array of business and policy issues in which the Smart technologies used to monitor activities such as consumption and usage can provide the analytical basis for recasting problems and the creative means for coming up with different sorts of solution.

5.9 To harness this opportunity, policy-makers and educationalists will need to move beyond slogans and into the realms of role models and career paths. The point made at the outset – that a Digital economy needs more people who can do Digital things – is obvious. And the implication – better training of technical specialisms across the whole lifetime of learning – is also obvious. We need technical specialists. They will be vital for the infrastructure and many of the inventions on which Digital will rest. But unless efforts to increase their numbers are linked to an awareness of the creative potential of Digital, then there is a risk of reinforcing and not challenging the rigidities of existing system, creating a belief among those who are technically minded that the future of business belongs solely to them, while creativity remains an "airy-fairy" add on of culture. While in practice effective Digital teams will have a mix of technical experts and creatives, the mutual exposure that a more rounded education system would give these types to each other’s worlds would allow the creation of more common understanding. It would allow creatives to engage in an informed way with technical possibilities and constraints, and technicians to see creative applications of technology. More importantly, as is already happening in the gaming, film and television, the fusion of pre-existing creative and technical capabilities can start to create new specialisms (as has happened radically in areas such as cartoon-making and CGI.) Those entrusted with careers advice in schools and colleges should celebrate the new career paths Digital affords in these areas. Businesses should make far more prominent their awareness of how these skills and their associated mindsets can help reinvent how things are bought and sold.

5.10 These steps would provide the conditions to make business more attractive to young people, harnessing their energies and encouraging them to acquire expertise in areas of life they find exciting. Coders who can create; creatives who can code: these should be the new Digital paradigms.
5.11 MCA members are extensively involved in practical steps to make these things into realities. As well as having a vibrant Young MCA and making efforts to attract high-calibre graduates, our members have developed partnerships with education institutions and government departments to develop apprenticeships in consulting generally. Furthermore, our members have started to investigate the nature of Digital apprenticeships. KPMG have made efforts to identify third sector partners to assist in developing these apprenticeships and linking them to credible career paths. And recently it has joined Barclays, Microsoft, Telefonica (O2), Mozilla, Salesforce.com, Silicon Valley Bank and University of Huddersfield to back a new scheme, iDEA, the inspiring Digital Enterprise Award. The Award aims to help more than one million 14-25 year-olds develop their digital skills and business ideas over the next five years.

6. Transforming Digital skills in consulting and beyond

6.1 Indeed, there are numerous examples across the MCA membership of direct to the Digital skills agenda, both within consulting and beyond.

6.2 Atos have been working with academic institutions, both in the UK and globally, to promote Digital thinking and mobile app development. This has taken the form of setting coursework (as in its UCL Industry programme), competitions (Atos runs a global IT Challenge) or through mentoring. In 2013, the Global IT Challenge was to deliver a mobile app for the Renault Connected Car. Universities entered across the globe, including a shortlisted team from UCL, which Rob Price (mentioned above) mentored during their four month final process. The winning app is sponsored by Renault and incorporated into their Connected Car. Atos has also been working with e-skills UK on the specification for Modern Computing Curriculum Learning Outcomes. This aims to create a "Digitally literate, digitally fluent and digitally productive society".

6.3 Within Atos, a Digital Ninja app has been launched. This applies gamification principles, with a competitive edge of "quests" and "challenges", to provide a personal guide to what it means to be Digital. The app is a source of knowledge to help consultants learn what they need to know, who to talk to, and how to score progress, dependent on their role in the organisation. Through the app they learn about the best sources of Digital Transformation, understanding Agile and open source technologies, social and mobile behaviours, Digital business language, networking communities.

6.4 KPMG recently launched the Business Analytics Institute with Imperial College London. This aims specifically to help British business use data to solve their most complex business issues. A core part of building Digital skills is building data skills and creating a world-class competency for advanced data analysis and insight. So the Analytics Institute also trains over 800 PhD students to become data scientists. KPMG also recently launched the C-Suite Programme to train a cohort of next generation leaders from the largest UK PLCs. A major part of the training is Digital awareness, in particular how to attract, retain and

344 For information on PwC’s apprenticeship work, see > http://www.pwc.co.uk/government-public-sector/issues/higher-apprenticeships-what-is-a-higher-apprenticeship.jhtml and https://www.gov.uk/government/news/23-million-to-open-londons-professional-services-to-more-apprentices
345 For further information see http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_15-7-2014-10-29-9
motivate a new generation of young people. The last cohort did a walking tour of Tech City, meeting the CEOs of these young businesses to learn from them.

6.5 PwC has overhauled its training curriculum to include a broad spectrum of Digital skills and training modules. Its “Foundation for the Future” programme for young graduates, for example, has materially increased the Digital component of basic consulting training substantially over the last two years. It runs periodic Digital Masterclasses aimed at PwC professionals of all levels of seniority. Its public micro-site, The World is in Beta (www.worldinbeta.com) captures - visually, dynamically and interactively - a number of Digital trends, disruptions and opportunities in the Digital Age. The microsite has had tens of thousands of hits and social media referrals.

6.6 PwC also runs "hackathons", internally and for clients. These are open competitions to create rapid interactive prototypes in days, even hours. PwC view these events as a catalyst and accelerator for the dissemination and consolidation of Digital skills, amongst PwC people and beyond.

7. Ongoing support

7.1 The MCA will be delighted to share findings from its work during the Year of Digital with the Committee's enquiry. We would also be very happy to meet with the Committee, bringing a delegation of experts from across the consulting sector, including people mentioned in this submission and from firms who are among the largest UK and global players in Digital. We would be in a position to bring experts of longstanding and, drawing on our Young MCA network, Digital Natives who speak with authority on how the education system did (and did not) equip them for the Digital challenge, and who will, of course, be the ones to shape our Digital future.

4 September 2014
Professor Alan Manning, Professor Phillip Brown and Professor Judy Wajcman – Oral evidence (QQ 15-25)

Professor Alan Manning, Professor Phillip Brown and Professor Judy Wajcman – Oral evidence (QQ 15-25)
Transcript to be found under Professor Phillip Brown
McAfee – Written evidence (DSC0022)

Introduction
1. McAfee is the world’s largest dedicated security technology company. Delivering proactive and proven solutions and services that help secure systems and networks around the world, McAfee protects consumers and organisations across the public and private sector from the latest malware and emerging threats online.

2. In the UK, McAfee operates out of sites in Slough, Aylesbury and Brighton. For the purpose of this inquiry, our Aylesbury site, home of our Technology Centre of Excellence, is of greatest interest. Our threat research hand gateway security development operations are based out of the site which boasts 230 employees drawn from sixteen nationalities and speaking 27 different languages. Many of McAfee’s global technologies are developed in Aylesbury.

3. Software engineering, backed up by strong skill sets in information technology and STEM, are critical to McAfee’s success in the UK and beyond. We are, therefore, very focused on the need to develop the next generation of inspired engineers who can work with us to develop the cyber-security technologies of the future.

4. Given cyber-security is our key business area, our response to the committee’s call for evidence concentrates on skills within the cyber-security industry, and the innovative ways in which McAfee is planning for the future.

The changing technological landscape
5. The technological landscape has changed immeasurably in recent years. Increasing numbers of devices are connected to the Internet, bringing with them new technical issues for engineers to grapple with and fresh opportunities for cyber-criminals to exploit technology vulnerabilities. And whilst the possibilities posed by the Big Data revolution are significant, the concomitant need to secure customer and citizen data should also not be underestimated.

6. At the same time, the Government Digital by Default strategy means that all government departments must comply with a set of standards, criteria and benchmarks for their online services to increase efficiency, meet user experience expectations and protect privacy. Increasing numbers of services are moving exclusively online, allowing departments to make significant savings whilst bringing other issues around security and digital inclusion into sharp relief.

7. McAfee’s own data, drawn from our Quarterly Global Threat Intelligence Reports, shows that the pace of cyber-attacks has more than matched broader technology development. The total malware count in the McAfee Labs “Zoo” broke the 200 million sample barrier in June this year, doubling in size in only two years. The increase in malware and cyber-attacks is exponential; addressing it requires dedicated skill and resource.

8. Indeed, cybercrime is a growth industry. The returns are great and the risks are low. McAfee has estimated that the likely annual cost to the global economy from cybercrime is...
more than $400 billion. A conservative estimate would be $375 billion in losses, while the maximum could be as much as $575 billion. Even the smallest of these figures is more than the national income of most countries and governments and companies underestimate how much risk they face from cybercrime and how quickly this risk can grow.

9. Tackling these threats in a timely and effective manner is critical to the future success of the economy and requires a dedicated and skilled technology workforce. However, the current education system in the UK (and beyond) is not providing and the number of ICT and cyber-security professionals globally has not increased in line with the growth of the internet and the corresponding growth in the cyber-threat.

**Future workforce**

10. The significance of the skills gap within the cyber-security sector has been highlighted by a number of different organisations in recent years:

- In 2013, the National Audit Office reported that the UK would take twenty years to close the cyber skills gap despite progress being made in tackling cyber-fraud with more police resources and prosecutions. The report linked the lack of promotion of science and technology subjects in schools to a low uptake by university subjects.

- A report by the Security and Defence Agenda (SDA) sponsored by McAfee last year reinforced these conclusions on a global scale. 56% of respondents from the public and private sectors to a high-level global survey on cyber capability highlighted the skills shortage as a core future concern.

- Cisco’s 2014 Annual Security Report estimated that industry will be short of over one million security professionals by the end of this year. This will have a negative impact on the ability of the defence and intelligence services to guard us against cyber-threats.

- Burning Glass Technologies have commented that the shortage of qualified IT workers is worst in the cyber-security field. But at the same time, there is increasing demand for qualified cyber-security engineers; cyber-security jobs already account for 10% of all ICT jobs and the sector has grown by 74% globally since 2007.

11. McAfee, in common with other security technology companies, is already reliant on a multinational workforce to provide the skills it needs. There is, therefore, a need for the immigration system to be sufficiently flexible to allow us to fill gaps quickly.

12. There is nevertheless an opportunity for the UK to develop and train the next generation of domestic cyber-security experts. The starting point really needs to be around inspiring young people to pursue careers in cyber-security from an early age, and ensuring that parents and teachers are similarly engaged and interested.

13. This is one area where governments and organisations like McAfee can make a real difference. McAfee undertakes considerable outreach work within the UK to promote cyber-security to children at school through our Online Safety for Kids programme. We harness the enthusiasm and excitement of our existing engineering team in schools and colleges, actively
encouraging them to present to parents at open evenings in schools and to school and college children during the teaching day.

14. McAfee is also contributing through its partnership with Bletchley Park. A five year collaborative effort to transform Bletchley Park by sponsoring an international cyber security exhibition and computer learning zone, this initiative will include workshops run at the Computer Learning Zone to engage, inspire and educate children and adults alike. This is the largest corporate initiative McAfee has ever undertaken in the UK.

15. Bletchley is a unique McAfee initiative. At the same time, there are a range of other initiatives being pursued by companies in tandem to develop the workforce of the future.

16. Government can play a role by co-ordinating and encouraging these initiatives in an appropriate fashion, drawing on what already exists rather than constantly trying to reinvent the wheel. Current government programmes in this regard are too often unfocused and uncoordinated. It is telling that up to fifteen government departments/agencies are involved in meeting the skills and education commitments set out in the Cyber Security Strategy.

17. Whilst a number of the initiatives launched are to be welcomed – such as the Academic Centre of Excellence in Cyber Security championed by BIS, the learning materials being developed by BIS for UK schools and the Open University introductory course recently announced by the Cabinet Office – initiatives are too often un-co-ordinated with what is already being delivered by industry or are not supported by appropriate metrics to measure their effectiveness. To revisit the examples outlined above:

- A number of ICT and defence companies are already sponsoring the development of practical academies and centres of excellence within universities and colleges, often with support from government. McAfee, for example, sponsors the Buckinghamshire University Technical College in Aylesbury and was actively involved in its formation.
- Companies have developed their own learning materials which are actively being taken into schools on a daily basis. Industry was also intimately involved in the development of the new ICT National Curriculum in partnership with the British Computer Society. McAfee has separately created and delivered its own “Principles of Programming” course.

18. It is critical that dedicated effort is made by government to understand what is out there at the moment and the extent to which the public sector can borrow and build on this. We welcome the creation of a new Digital Industries Minister in the last government reshuffle, combining relevant teams within DCMS and BIS with an interest in ICT, but still note that there are thirteen other government departments and agencies involved in cyber skill delivery.

19. Considerable money has also been spent on cross-cutting public awareness campaigns, many of which have been poorly targeted and conceived, and have not had the impact they should have had. Arguably, government should have relied more on industry to assist with delivery. McAfee alone, for example, has 2.25 million active commercial customers and 130,000 on trial, and reaches many, many more consumers through our relationships with hardware providers such as HP, Acer and Apple; almost all PCs now have McAfee products
preloaded. Through our partnerships with the main ISPs and one bank (BT, Sky, EE, 02, AOL, Geek Squad and Bank of America), McAfee reaches over 15 million people. In retail, McAfee reaches 60% of the market – over one million subscribers through Dixon’s alone. It would make sense for government to partner with McAfee and others given the PC, tablet and mobile using audience that could then be reached.

Conclusion

20. The cyber skills gap is real and is growing. The problem is not unique to the UK and is very much a global phenomenon. However, proportionately the UK is struggling, especially given the increased need generated by amongst other things, the huge growth in internet retail, the Government’s Digital by Default strategy, and moves to further develop e-health and smart grids.

21. There is currently some need to meet this gap through high skills immigration. But if sufficient attention is placed on developing talent early from schools, colleges and universities, it will be more than possible to develop strong pipeline of domestic talent.

- There are three key ingredients to this:
  - Making sure that the National Curriculum and university courses are fit for purpose;
  - Ensuring that young people, their teachers and their parents are aware of the possibility of pursuing a career in cyber-security and are enthused and inspired by it at an early age; and

22. Ensuring that industry and government are working closely together, building on what already exists rather than seeking to reinvent the wheel.

23. This all needs to be backed up by sufficient funding from government. It remains unclear where the funding to address the skills gap is coming from, and the extent to which it is drawn from the £650m cyber security pot.

24. In many areas, government is moving in the right direction and positive progress has been made in the three areas outlined above. However, more can be done to harness the commitment already being shown by industry.

29 August 2014
Microsoft, Google and UK Forum for Computing Education – Oral evidence (QQ 40-52)

Transcript to be found under Google
Microsoft shares the committee’s focus on the importance of digital skills. With this inquiry we have an important opportunity to think critically and ambitiously about how best to shape future skills policy and create the economic opportunities for young people – and people of all ages – to get on.

I touched on some of the trends that will shape future skills demands – including the shifts to natural computing interfaces, more contextualised computing experiences, and advances in machine learning that will increasingly allow computers to work on our behalf. Allied to these are the enablers – such as the spread of mobile connectivity, the potential for cloud computing, the application of big data analytics, and the way that new social technologies will create further impetus for technology adoption.

As we discussed, policy will need to approach new digital skills from two perspectives: enhancing skills for users of these new digital technologies, and building skills for the producers that will create and innovate.

I wanted to follow-up with more information on a number of areas.

First, we discussed ways to map demand for IT jobs, particularly in the context of the information, advice and guidance available to students, parents and teachers. As I mentioned, we work in partnership with IT Jobs Board, analysing around 100,000 job postings for tech-related jobs. Their website can be found at www.theitjobboard.co.uk. It is a great resource for anyone wishing to enter the sector or map demand for IT skills across a range of businesses.

Closing the gender gap must be at the heart of our efforts to meet future ICT skills demand. There can be no silver bullet and this will require leadership from government and industry alike. Microsoft is already taking steps in the way we market our apprenticeship programme, in doubling our number of female Apprenticeship Ambassadors, and in workshops for school leavers. We are keen to work closely with all our partners to get this right in the UK and internationally.

Second, we touched on the developer skills that are so heavily in demand by employers across sectors. Mike Warriner from Google kindly mentioned Microsoft’s Kodu Cup as an example of how the industry is finding innovative ways to inspire more developers. Kodu allows its users to create games on the PC and Xbox via a simple visual programming language. This is just one example of the many ways we are supporting coding. You can find out more at www.kodugamelab.com.

Finally, I wanted to update you on steps that we are taking to support the new computing curriculum. Microsoft has been working hard with the Computing at School Group, the Chartered Institute for IT and Department for Education and we believe the new lessons mark a significant step forward in the way they now encourage computational thinking, as well as how to use a computer.
Chris Mairs of UKForCE rightly identified the need to support teachers with these changes. Microsoft has developed the Switched ON Computing classroom resources as a first step in providing teachers with a creative means of meeting the curriculum objectives. This was sent free of charge to every primary school in England. I enclose a copy of the resource pack for your information. We are taking significant additional steps to support teachers to teach computer science in primary and secondary schools, which will be launched at BETT in the Spring.

29 July 2014
Naace, Miles Berry, George Spencer Academy and Kingsmead Primary School – Oral evidence (QQ 158-172)

Transcript to be found under Miles Berry
At the House of Lords select committee on digital skills on 21 October 2014, we discussed the current landscape for computing across English schools. Following our discussion, I thought it helpful to provide an overview of the activities which are supported by the Department for Education (DfE) and National College for Teaching and Leadership (NCTL) in computing across the school system.

As I outlined at my appearance before the select committee, NCTL remains committed to recruiting high quality trainee teachers and we have this year announced increased initial teacher training (ITT) bursaries of up to £25,000 tax-free for computing trainees starting their training in 2015/16. We are also continuing to fund a prestigious scholarship scheme in computing, delivered in partnership with BCS, worth £25,000 tax-free and offering a range of professional benefits. Additional funding is also available to schools offering School Direct (salaried) places in computing to boost starting salaries. We know that many STEM graduates are highly sought after which is why we are responding through the financial incentives on offer. Annex B maps computing ITT allocations across university-led, School Direct and school centred initial teacher training (SCITT) routes for 2015/16.

To encourage more teachers to enter the profession, we provide a School Experience Programme (SEP) portal for schools to offer school experience for a maximum of 10 days to potential applicants – both graduates and career changers - in computing. Schools also receive funding when placements in this priority subject have taken place. So far this academic year, in excess of 9000 one day computing school experience placements have been offered by 141 schools across England. Schools offering SEP placements in computing across the country are also mapped at Annex B.

Continuous professional development (CPD) of existing teachers is, of course, equally important. To enable the continued transition to a school-led system, we have supported a group of 45 teaching school alliances in a “test and learn” project to develop and deliver a range of post-ITT subject knowledge enhancement provision in shortage subjects, including computing. Those alliances involved in this project have identified the focus of their subject knowledge enhancement provision based on an audit of local need, and are building on existing capacity and expertise within the school system, such as Regional Science Learning Centres and Specialist Leaders of Education (SLEs). Following an evaluation of the project at the end of this academic year, we plan to disseminate best practice across the wider school system. Annex A maps the five project lead schools within the alliances currently delivering subject knowledge enhancement provision in computing as part of the ‘test and learn’ project. SLEs are outstanding middle and senior leaders who have the skills to support individuals or teams in similar positions in other schools. Teaching schools designate SLEs and broker their deployment into other schools. There are currently over 4,900 SLEs designated nationally with 224 designated with the ICT specialism.

As outlined before the select committee, the DfE has provided grant funding to BCS, through Computing At Schools (CAS), to establish the network of excellence for teachers in
computing. This network has forged links between schools, universities and employers, and BCS has harnessed support from organisations such as Microsoft and Google. BCS is now expanding the network so that it provides more comprehensive coverage nationally.

Additional funding provided by the DfE will build a network of master teachers in computing over the next two years, which schools can then commission to provide training for their teachers. CAS anticipates training a total of 600 master teachers to deliver not-for-profit CPD activities. In addition, the network will develop a comprehensive set of classroom-ready resources covering all key stages. There are currently 251 master teachers and 1293 registered network of excellence schools, of which 419 are lead schools. Annex A maps those schools currently involved in the BCS network of excellence as well as the universities who support network of excellence schools.
Annex A: Network of Teaching Excellence and Post ITT Subject Knowledge Enhancement Projects in Computing Science
Annex B: Allocations for Initial Teacher Training and School Experience Placements Offering Computing 2015/16

4 November 2014
Examination of Witnesses

David Hughes, Chief Executive, National Institute of Adult Continuing Education, and Professor Martin Weller, Professor of Educational Technology, The Open University

The Chairman: Thank you very much indeed for joining us this morning and helping us with our deliberations. You have in front of you, I hope, a list of interests that have been declared by members. These were declared by the Committee on 8 and 22 July. They can be found in the transcripts as well. This is a formal evidence-taking session of the Committee and a full note will be taken. It will be put on the public record in printed form and on the parliamentary website. You will be sent a copy of the transcript, and you are very welcome to revise any minor errors. The session is on the record. It is being webcast live and will be subsequently accessible on the parliamentary website. You are also welcome to submit any additional written evidence after this session. In fact, we welcome that if we feel there is
anything we need more information on. The acoustics are not bad in here, but it is always worth speaking up so that we can all hear each other properly. That is the housekeeping.

Would you like to introduce yourselves before we get going to the questions? If you want to make any brief opening remarks, please do so. If you do not want to, that is fine and we will go straight into the questions.

Professor Martin Weller: I am Martin Weller from the Open University. I am a professor in educational technology. My areas of interest are open access, open education MOOCs, open education resources, those sorts of things. That would be the line I guess I am pushing in this Committee.

David Hughes: I am David Hughes. I am the chief executive of NIACE, the National Institute of Adult Continuing Education with a national voice for lifelong learning, so there are lots of things to talk about. I am fascinated to hear the questions.

Q87 The Chairman: Thank you. I will kick off, if I may. Obviously we are talking about lifelong learning in particular with you today. We know that it needs to form an important part of the UK’s education system. It is necessary for the UK to adapt and compete in a knowledge-based economy. That is all quite glib, and we hear that all the time, but what we want to hear from you properly today is what you see the future of lifelong learning to be and what it means for lifelong learning to help us provide the skills that keep changing in a future digital economy.

David Hughes: That is a big topic. Lifelong learning is what we exist for, so I will try to keep it brief. There are a few problems with the current system. It is too focused on young people at the expense of the rest of the population. It is not that young people do not deserve a fantastic education, it is not that the transition from school into the workplace is not incredibly important—there are lots of things that need to be done in that arena—but the focus on that is at the expense of supporting people in the workforce and supporting people in later life. One statistic we use a lot is that about 13.5 million jobs need filling in next 10 years and yet there are only 7 million young people entering the labour market in that period. There is a 6.5 million gap. Those jobs need to be filled by people working longer, people working more hours and people who are not active getting back into the labour market. Most of those people will need some kind of lifelong learning support to be able to be effective in the workplace. Digital skills are an incredibly important part of that. There are estimates that about 90% of new jobs need at least basic digital skills, and we think that of those probably half need quite high-level skills as digital users and digital workers, yet the workforce does not have those skills, so we are too focused on young people and there is not enough support for people who are post-23 or 24. There is not enough investment in the workplace and in people, particularly those in low-paid work and low-paid jobs. There is too much focus on formal education at the expense of informal. We think that a lot of the digital skills that people will need to pick up can come from an informal leaning approach rather than a formal one. What I mean is that they do not need to get a qualification to be able to learn digital skills. Digital skills atrophy quite quickly. If you don’t use it, you lose it. You need constant refreshing and updating. Technology is changing, so you cannot say that anybody who is digitally literate now will be for the next five years, let alone 50. Therefore people will need constant support to be able to carry on learning. That needs people to be lifelong
learners, to learn the learning skills and the digital skills to be able to learn on their own and with others. There are lots of issues about it.

The other thing that is a problem for us is that there is too much focus on the state-funded part of the education system. Going forward, we have to have a system that looks at three different funders of learning: three investors. There are individuals themselves—we all need to be able to invest our time and resource in learning—and employers, who we think have reduced their funding. A lot of the UK Commission for Employment and Skills’ evidence suggests that employers are funding less learning in the workplace than they were before the recession and not very much of that is in the digital skills that we are talking about today. So employers need to invest more and government needs to start thinking of ways of enabling and encouraging individuals and employers to invest in learning. I will leave it there.

The Chairman: That is very helpful and instructive, thank you.

Professor Martin Weller: I agree with everything that David said. I see it as a rich ecosystem of different elements of learning mixing lots of things: formal and informal, as David said, people coming to take different sizes and types of learning, moving away from the kind of one-size big chunk of doing a degree to different types of accreditation. Some learning will be for accreditation and some will not. Some things may be accredited through the community through badges. That is a much more complex, nuanced way of learning. People will come in and out of different types of learning. They may come to do one part, which is vocational training, and then do some stuff for interest—that may be a MOOC, an open course—and then they may take some smaller bits of learning and build some of it into an evidence portfolio. That is a much richer picture of how people engage in learning throughout their lives.

The Chairman: Is there any sort of portal where there is a catalogue of all the different qualifications? One possible problem for employers is that there is chaos in qualifications and people do not really know what anything means, other than the qualifications that we all know about.

Professor Martin Weller: It depends what you are looking at. You have to know what you are looking for. If you are looking for MOOCs, there are catalogues you can go to for MOOCs; if you want to look at degrees, there are places you can go to for that; but if you want to look across different types of learning in a particular vocation or subject area, that is not there.

Q88 Lord Haskel: You have told us that there is too much concentration on young people, not enough expenditure on the rest, more jobs than people coming through and too much focus on the state and less on the individual and employers. Obviously that is what you think needs to be done to make it all more effective. I ask then, who is going to deliver this? At the moment, we have sector skills councils, professional organisations, trade unions, the BBC and the MOOCs. Can this be rationalised? Who will deliver all this?

David Hughes: That is a really good question. If I knew the answer I would be worth a lot of money, because people have been trying to tinker with the system for so long and it has changed so many times. Localism is really important. In England, that involves local enterprise partnerships; in Wales, Scotland and Northern Ireland, it involves different structures.
It seems to me that people want to understand what skills they may need and that will be useful for them in life and in work. Often, they need to see that locally. If they see employers getting engaged with public bodies locally, with community organisations, learning providers—universities, colleges, independent training providers, local authorities—and so on, that is a really important part of the answer. It is not the only answer—the OU is a really important part that is global, so there are other parts—but lots of people who we talk to do not understand the system or what learning they need.

It seems to me that it would not be adequate just to make a big list of qualifications. That would bewilder people. What works, we think, is when people can say, “There are employers who will be creating these jobs over the next five or 10 years. They are looking for these sorts of skills and people with these sorts of qualifications and putting them together”.

Then the providers of learning, the colleges and universities, have to follow and help to inform that pattern of delivery and give the flexibility needed. At the moment, as I said, it is so focused on the transition to work. Then people get into their first job and are left. That is bizarre, given that people will be working for 50 years or more. The local focus is critical. People can understand it, connect with local employers and understand the local labour market better. It is really important to get employers engaged in that process, in that social partnership with the other organisations that you mentioned—the unions, the BBC, the OU, the colleges and universities, and so on.

Q89 Baroness O’Cathain: I could not agree more with you that the local way is the way to go. In another Committee that we have in this House, we did a study into youth unemployment and it was suggested to us by Lord Heseltine that we should try to get down into the local area. Certainly, I do not think that people credit local enterprise partnerships, which I think are somewhat unstructured at the moment, with the information they have or with their ability to call in all the people you are mentioning—the local chamber of commerce, the unions and the employers. Could you tell us whether you think it is a good idea to invest in or encourage these local enterprise partnerships throughout the country to take on that responsibility and to channel some funding to them?

David Hughes: I do. They are very patchy. Their capacity is very different in different parts of the country. You cannot generalise. There are some fantastic examples of LEPs—local enterprise partnerships—with superb approaches to skills, and there are others that have less experience and less capacity. The capacity issue needs to be addressed. You address that partly by giving them more responsibility. My approach would be for the centre, which holds the purse strings, to do deals with local enterprise partnerships, so that locally social partnerships of organisations sign up to deliver outcomes that are related to skills, jobs and inclusion. The inclusion bit is critical. It is not just about getting young people into good jobs. That is really important, but we need inclusion, digital inclusion in particular, and literacy and numeracy for people to be able get into entry-level jobs and start moving in work. We need a compact with the Government saying “If you deliver this, we will give you this funding to be able to deliver through the partnership of organisations that is needed”. If you did that, locally people would start to build the capacity. They would have to.

Q90 Lord Lucas: If you are looking at changing to a digital skills-based job later in life and you do not have those skills, how do you find out which bit of the digital economy you might be suited for? Is there anything you can do to say, “Where would I fit into this world? Where
ought I to train?”. If you can identify a bit, how do you identify which sorts of training you can fit into your existing life that an employer will still value?

David Hughes: I think you know the answer. I do not think you can find that information very easily. The systems and the organisations that we have are not set up to provide it. The careers service does not provide that kind of information. It is not aimed at people in mid-career and mid-life. We carried out a pilot funded through the Department for Business, Innovation and Skills called the mid-life career review. We are really exited about it. We had 3,000 people aged around 45 to 55 who had a one-to-one or group work session aimed at giving them that sense of where you find out information, how you get some confidence about your own future and how you plan for the next 15 or 20 years of your working life as well as for your retirement, which might, of course, be semi-working. We are really excited about the opportunities around that. However, the reality is that the careers service is not funded to deliver to that group of people. It is not one of its priority groups, yet people who are 45 might have 25 years to work. There is a lot of technology change in that period. I do not think there is anywhere where you can find out that information in a systematic way. If you find out what skills you need and even which qualification might help, it is really difficult to find the funding and the access to be able to deliver it. Part-time, flexible HE, probably with the exception of the OU, has collapsed in the past three or four years. FE colleges are very focused on full-time learners rather than part-timers. There is not very much use of technology in learning to give that flexibility in a blended approach to learning. I am afraid I am quite pessimistic about that. I do not think you can.

Lord Macdonald of Tradeston: You do not have any suggestions at all about how that might be addressed. You obviously think it is a problem.

David Hughes: I think it is a major problem. The pilot we did on this with 3,000 in mid-life showed that a very simple and quite cheap intervention with individuals works. The evaluation we will be publishing within the next month shows that people can be empowered to start thinking about themselves as people who can change, people who can learn, people who can get new jobs.

The Chairman: Again, that would point to it being delivered locally.

Q91 Lord Macdonald of Tradeston: The problem with localism is that if you have apathy, incompetence or underfunding locally, you suffer as a citizen. Should there not be a benchmark offer from central government that we will make available the kind of counselling that you were implying mid-life people should be getting? Is that not an offer that political parties or government should be making?

David Hughes: Absolutely. We launched our manifesto in June and we said that we thought that mid-life career reviews should be an entitlement. Every citizen should be able to access some advice and support at some point in their mid-life and perhaps at other transition points, such as women returning to the labour market from looking after their children and people who have been made redundant and have an entitlement to some support to think about what jobs they might be able to get, what learning they might be able to do, what skills are available and what the labour market is doing. Some information and advice on where to go to find out that information is a very simple entitlement. The localism bit is a trade-off. You have to have a tension between what is important nationally and a loose framework negotiated locally to make it appropriate, because labour markets are very
different. The jobs that will be created in London will be completely different from those in Gateshead and Plymouth. You need a bit of both. That is why I am calling it a negotiation between the two and an agreement that that group of organisations locally will deliver outcomes, not just qualifications that are kind of important but actually the jobs, the skills and the chances they offer to people are much more important.

Professor Martin Weller: I am probably less pessimistic than David. The answers to many of these questions lie in approaching them from the side rather than head-on in terms of gaining employment skills. It is more about focusing on what people are interested in. There is then a bleed across, if you like, from digital skills. Let us take the example of local history. Digital Historians is really fascinating, and there are so many good things about it. That is how to approach it and it is how people want to engage with it. You can get the local photography club to create online profiles and so on. We have our open educational resource platform, OpenLearn, that helps local champions to run these clubs and get people to engage with the resources. Once people gain confidence in their digital skills, to the point that they do not even think of them as skills, they are much more confident about going on to do other things that might lead on to jobs and so on. You must attack this using the things that people are actually engaged with and interested in.

The Chairman: That sounds great, but who funds it and how is it scaled up to reach more people?

Professor Martin Weller: There are different elements that need funding. There is the release of open educational resources which at the Open University we have made into a more or less sustainable model. We release between 5% or 10% of the course material we produce openly, and we think that that works well enough as a marketing tool for student recruitment to pay for itself. That is how it works. Local support is often simply encouraging people to become their own champions. They might be people who have been active in our own forums. We encourage them and we have put guidelines in place on how to become a champion. Some of this is self-sustaining, but funding can be put in place for it. It requires bits of support, such as server space.

Q92 Lord Haskel: Do you not think that there is an economic imperative on employers to do a lot more? Surely there should be way of encouraging this. There was a time when employers would organise courses at the local FE college to train people for future work. Has that sort of co-operation disappeared entirely? You said that FE colleges concentrate too much on full-time courses, but that is because of the way they are funded. But, equally, there are ways that FE colleges can run courses for employers, and that goes on a lot. You seem to be writing off the need for employers to retrain people, although doing so is in their own interests.

David Hughes: I am not sure I am writing them off, but I am not sure that enough of it is happening, although it is critical. I used to work in Derby where Rolls-Royce used to have a learning centre in Derby that was open to the local community—Derby College. That does not happen any more, and in part it is because of the funding cuts that have been made. In particular the funding has become tighter and tighter over the past five or six years. There is also a need to focus resources on young people because there are a lot of them and they need a great deal of support. As I say, it is crucial and I do not think it is happening enough.
National Institute of Adult Continuing Education and The Open University – Oral evidence
(QQ 87-102)

A lot of the informal learning is also critical. We have funded dozens of local community peer
support projects in the digital space and they work really well. People like me then help and
give me advice on photography, Skype for getting in contact with my kids overseas, and
family tree projects. It is clear that these projects work and we have lots of evidence of how
important it is to bring people in and to give them the confidence to go on and learn. The
two problems are that the funding is short term in nature; it is not mainstream. Also, there
are no progression routes for people that are clear and consistent across the geography of
this country. In some ways this is an easy issue to tackle, which is why I suggest that the
localism approach is the right one. I cannot see this happening nationally. It has to happen
through people coming together and offering informal learning routes and informal ways to
access these resources, and then ensuring that the progression routes are there, with
information about the labour market and digital skills. Employers should offer support and
schools should offer family learning. There is enormous potential for schools to offer access
to technology, because this is a big issue of lots of people on low incomes. They and their
children need the digital skills to make a start on their digital journey. The digital divide by
class is horrible, and the digital divide by parental achievement and learning is dire. We have
to start in schools and to make the learning informal. Family learning is a very good
approach.

Professor Martin Weller: You have asked us about journeys into formal learning. It can be a
very dramatic step: you are not learning and then you are doing a three-year degree course.
It is a matter of trying to smooth out that curve, if you like. Perhaps it starts with someone
seeing a TV programme and wanting to learn a bit more about it. They try out some
educational resources and gain a bit of confidence. They may then go on to try an Open
course which lasts for seven weeks and they may get some accreditation for it. It helps to
smooth the transition. To go back to the role of employers, for professional societies I can
see Open courses being a productive way of bringing people into their profession, but the
funding works against them. They get their money from people paying to come on to their
courses. It might be good for wider society to have such courses open so that they generate
interest in, say, accountancy, but that is not the model. In some ways the system works
against them in terms of the longer-term benefits.

Lord Aberdare: What you seem to be describing is what I would think of as a careers service.
Is the careers service a completely lost cause as a result of the funding having gone to
schools, or is there something one could do in a relatively straightforward way that would
make a real improvement?

David Hughes: I do not think it is a lost cause; I would not want to suggest that. However, I
think that the targets are too tight and that the service focuses too closely on people aged
between 18 and 24. I think there are big issues in schools and that the issues for adults are
different. I know much more about the adult side than I do about the young people side,
although I am the father of three teenagers. On the adult side, there is not enough support
for people to get the skills so that they themselves learn what they need to do. I personally
do not believe in the concept of a careers adviser advising an individual about their future,
but I do believe in giving people some skills so that they can find out for themselves. That is
sustainable. Careers education is what people need and it is what schools should be
delivering as well. The careers service could be manoeuvred. The evaluation of our mid-life
career review pilot proved that there is a massive demand for it and that it works. It is also
incredibly good value for money. People need to be given confidence. We do a survey every
year of people in learning. It involves around 6,000 people, so it is statistically significant. The starkest finding for me is that if you were not successful in your education up to the age of 16, 17 or 18, it is incredibly unlikely that you are going to get back into learning. It is very skewed, whereas if you are successful and if you carry on learning to degree level, the number of people still in learning and talking about themselves as learners throughout their lives is incredibly high. The family and intergenerational aspects of this are also quite scary. We have to break into that and give people confidence that they can be successful learners, that it is worth doing and can pay for itself because it will lead to a better job and a better life. That needs some nudge.

Q93 Baroness Garden of Frognal: You have both been referring to things that require motivation. There is a move towards self-teaching as a means of upskilling both in schools and for the workforce, but learning online without a teacher or a set pattern of study requires a certain degree of discipline as well as motivation. Both of your organisations have expertise in that. Can you delve a bit further into how you can increase the motivation for people who are not natural learners?

Professor Martin Weller: You are absolutely right to label that as an issue. The completion rates on these MOOCs, the big open courses, are very low at around 10%. The people who complete are usually those who have studied before, often at post-grad level. You are not getting to the people that you want to get at with this idea of democratising learning. It is not so much about motivation as more about having a set of learning skills. Those people who have been through a degree or post-grad know how to learn: discipline and structure in learning and knowing how to set aside time. Being an independent learner is difficult, so it needs lots of support. It is manageable; you can do the online element, but it is difficult without human support.

We ran a project in the United States funded by the Bill & Melinda Gates Foundation, in which there were people who had consistently failed maths, could not get employment and were trying to get on to an employment programme. We gave them an open course on an introduction to maths with really targeted support and got something like 80% pass rates on that. If you intervene at the right point, you can get success.

The Chairman: What was the intervention there? In a sense, that is the key, is it not? You are saying that you need certain skills, and it is not motivation but confidence.

Professor Martin Weller: It was very local but also they could study at their own pace. They could come back to drop-in centres when they needed it and the material was structured very differently from conventional high school maths in the States—it was new material that had been adapted. What we often find at the Open University, to go back to David’s point about people who have failed in education once, that they get into the mindset that “Education and learning are not for me”. It takes a bit of work to get around that. If you get some early success, then you can find, “Maybe it is for me”. It is important to get that across. It is a worry that MOOCs, while they are fantastic in a way, may reinforce that sense of failure. If you are thinking, “I will try it this week”, and have dropped out after week two, perhaps it compounds the message that it is not for you.

Baroness Garden of Frognal: Perhaps a solution is reinforcing the relevance to something within their own lives. Very often school learning can seem remote. Maths might seem
remote, but if you can see that it will help you to run your household accounts, that might help.

**Q94 Lord Janvrin:** Following up on this and digging deeper, if we are going to get change, are there champions or local centres of excellence that should be publicised more? Is there a national campaign? How does one try to intervene, as you say, in some of these areas? Are there things that we ought to be recommending, suggesting or pushing? We can all see the problem.

**David Hughes:** There are lots of things. One of the problems with this type of debate is to know at what level we are talking about the issue because there are so many different dimensions to it. For me, there are four issues around MOOCs. Motivation and relevance to people’s lives is one. Access to technology is one. If you do not have access to technology, you do not access a MOOC; it is as simple as that. That is true of a lot of people. Study skills, which Martin mentioned, but also digital skills are relevant. Some of the support you can access is through virtual networks, and you have to be quite highly digitally skilled to be able to access and use those and be confident about them. That is in itself multidimensional.

The other issue is about people’s desire or motivation for social interaction. Learning is not something that you do in isolation. There is a great study of people coming into this country doing the citizenship test, with two simple groups: you can do it in groups or on your own online. The learners who achieved the citizenship test and became citizens were followed up. The people who learnt together were more likely to be employed and engaged with their children’s learning, and were more likely to volunteer. They were more likely to say that they felt British and felt proud to be British. That is because of the social interaction and the other benefits of being together with people. You can replicate some of that through a MOOC, but you are relying on people’s pre-existing social networks for that. It is pretty complex.

**The Chairman:** To come back to Professor Weller, I do not want to put words into your mouth, but are you saying that the traditional OU route of distance learning but with a level of interaction is more important for people who have not necessarily had a tradition of study skills, and that MOOCs work fine if you already have a higher level of study skills?

**Professor Martin Weller:** Yes, that seems to be the picture. We may just be seeing early adopters, and as people become more familiar with the stuff maybe we will see a greater completion rate. It comes down to investment as well. If you have not paid anything to sign up for a course and can do so on a whim, it is easy to drop out. To go back to David’s point, we also see a much higher retention rate among students who make a social connection with a cohort because they have a commitment, an investment, with their friends. That can be online, it does not have to be face to face, but having a social connection does help. Certainly for the sorts of learners we try to target at the OU, we still feel that that human support, something we invest a lot of money in, is significant.

**Q95 Lord Lucas:** You talk about lack of learning skills, study skills and digital skills as being a problem. Is there any evidence or research on that? My life suggests that those are not problems. Whenever I have been dealing with prisoners or the unemployed in south London, the problem has always been motivation. You supply them with motivation and the study skills appear. Certainly, that is the experience of most computer games companies: they can pose extremely difficult questions to their users and their users will learn, whatever their background.
David Hughes: Ability and skills represent an interesting debate in themselves. Lots of people have the ability to learn. There is lots of evidence of poor literacy and digital skills getting in the way of people’s ability to learn. The literacy statistics are quite shocking. There are quite a lot of statistics from the national skills survey that people in socioeconomic groups C, D and E have much lower digital skills than people in higher economic groups. A survey by the Prince’s Trust looked at young people who are not in education, employment or training and the evidence from that was that their confidence in their digital skills was much lower than that of their peer group who were in education.

Lord Lucas: Is there any evidence that teaching digital skills improves things, as opposed to supplying the motivation for them to learn it themselves?

David Hughes: That is a more difficult one to prove, is it not? I am not sure that there is any direct evidence.

Professor Martin Weller: Our approach at the Open University is to embed those skills rather than make them explicit. You come in because you want to learn history, not digital skills. If you ask people whether they need digital skills, they say, “Oh no, I don’t need that”, but actually they do.

Lord Lucas: So in practice you go for the motivation.

Professor Martin Weller: You are absolutely right. We can talk about digital skills, but there has been a big upsurge in the elderly population on Facebook because the motivation is for them to keep in touch with their family and all sorts of things. When motivation is there, one can often overcome these things.

The Chairman: This carries on to Lord Janvrin’s next question. Have we covered that? Fine.

David Hughes: Quickly, the CBI did a survey recently that suggested that employers believe that a lot of their workforce has poor digital skills and that that is holding back their businesses. Again, I appreciate that this is not quite answering your question, but there is a lot of concern that people are not able to function in the way that employers want in order to be effective in the workplace.

Q96 Baroness O’Cathain: I have a simple question. Do you have any information at all about how many people are in that block of the ages of 16 to 24 who have very poor, if any, digital skills? Mainly, I want to know what proportion of that block has access to getting digital skills. It seems that the younger you get them, the more interested they are. These youngsters are all going around now with smartphones and things, but not in deprived areas. The work that you mentioned that the Prince’s Trust is doing on that is quite significant. You seem to be saying, “We will get them digital skills”, but they do not even know how to open a computer.

David Hughes: Again, the Prince’s Trust study is worth looking at. There is a lot of evidence from that about what young people who are not in education, employment or training are doing or not doing. There are some worrying statistics: 25% of males are not looking for jobs online. It is very difficult to find most jobs now without going online. It is very difficult to get a job without applying online. It is very difficult to get a job online without having a digital presence.

Baroness O’Cathain: But how do they get online? The number one step is not readily available to them.
David Hughes: As I said, access to the technology itself is really important. Libraries are becoming less and less accessible. A lot of them are closing down, opening hours are getting shorter, and it is difficult to book time on computers in a library, so there are massive barriers to individuals who do not have access at home.

Q97 Lord Holmes of Richmond: I think we have covered much of what I wanted to ask around the localism agenda and local delivery models so I shall ask you to be quite specific on stuff that is happening now at a local level which you think is impactful and effective and about specific things that are not happening at a local level which you think would make a difference, not least local delivery leading to reductions in local inequality.

David Hughes: There are probably four groups of people who we need to think about in this. It is quite important to think about them separately as well as collectively. There are some big issues about people with disabilities and their access to technology, learning and work. There is evidence that unemployed people claiming jobseeker’s allowance have lower digital skills than their counterparts. Low-wage, low-skilled workers in mid-life are probably at higher risk of redundancy and are not getting support. Older people need to be digital citizens because digital by default means that they are going to have to access more and more services digitally and they are missing out on retail opportunities and so on and so forth. We need to think about the issue in different ways. For me, they are the four big priorities.

I am really keen to look at family learning as one of the solutions. There is lots of evidence that parents are more interested in digital skills than non-parents because their kids are using it and are expected to use it at school. There is lots of evidence that peer-to-peer support is really important. We talked a bit about that and about getting people who live next to you to start talking about digital skills and helping to supply them. There is a need for employers to take the upskilling of people in the workforce more seriously and to help to support them informally.

Older people are a particular target we need to think about carefully. There is an irony in that lots of isolation can be overcome by people having digital access, yet older people tend to have much lower access and skills, so we need to think about ways of doing that. Helen, who I have just seen walk in, will talk about the Tinder Foundation’s work locally, which is fantastic.

The final bit of the jigsaw for me would be to get that planning of progression routes. It is all very well enticing people into understanding why they need better digital skills, and it is fantastic to use different ways to motivate them. A lot of people want to move on. That flexible offer, informal as well as formal, does not exist. It has to be a ladder or a climbing frame up to the very high-level digital skills that the economy needs around digital makers, but there are not the rungs on those ladders or climbing frames to get there.

Lord Janvrin: On the employers’ side, how does one get much greater understanding of their role in this? It is obviously in their long-term interest. Are there suggestions you could make in that area?

David Hughes: There are exemplars. East Midlands Housing Group has an approach to every member of its staff and a digital charter that says that it wants every member of its staff to improve their skills, that every member of staff needs a basic set of digital skills to work in that organisation, in a positive way, not as a barrier, and that different people in specialisms...
need higher-level skills. It is taking that approach. We can look at those exemplars and get some evaluation of their impact in the workplace and of their productivity and effectiveness. We need to start shouting about that more. Organisations such as the CBI and the Federation of Small Businesses need to be able to promote that more.

Lord Holmes of Richmond: I want to explore the family learning point further. There is something in that. I am interested in your hypothesis. Going back to traditional learning and reading for families where it has been problematic in the past, is there any evidence that the fact of children going to school and having to learn to read necessarily fed back to encourage the parents of those children to improve their literacy skills? If that was not the case then, do you think it would be different and that technology and digital skills are fundamentally different from traditional literacy and numeracy skills?

David Hughes: On the latter point, basic digital skills need to be part of that package. If there was one recommendation I would like you to propose, it is that we start to see digital skills as the third plank of the basic skills that every citizen needs: literacy and language, numeracy, and digital skills. They are essential, and they are not funded and supported in the same way at the moment. There is evidence from family learning that if schools work with families, the children do better at key stages 1, 2 and 3. At 4, it is more difficult to evidence. The parents will go on and carry on learning. Anecdotally, there are lots of examples of schools. We gave an award to a school in Nottingham this year for its family learning. It targeted the most disadvantaged children and their families, children who were truanting and who were not at school the most. It invited the parents in very gently. The improvement in attendance and motivation was startling. That was around learning generally. My point is that most of those families will also have very poor or low access to technology and the school is an important and useful place they can go to access the technology and support the learning of their children. This is an easy recommendation because the pupil premium is targeted at those families. I suggest that some emphasis on family learning and digital skills would be a fantastic proposition.

Q98 Lord Macdonald of Tradeston: It is clear that in recent years there has been growing enthusiasm for vocational training across politics and across government, including, in particular, apprenticeships. Baroness O’Cathain mentioned the 16 to 24 age group. Do you think that the Government could give more effective leadership and support in digital skills in things such as industry partnerships and post-16 specialisms and, perhaps most importantly, their funding priorities?

Professor Martin Weller: To push my line again, there is a role for open education. We have seen that a lot of our open projects allow us a light form of collaboration. People can take things and do things and adapt them very quickly without having to go through complex memorandums of understanding and so on. For instance, when we produced our open education resources people took them and said they were going to translate everything into Chinese for the community over here. They did not have to ask our permission to do that. They could just go and do that. We are seeing teachers taking stuff, combining it with other elements and putting things together. The type of specialisms you might want to see would be quite cross-disciplinary, combining things in unexpected ways that you could probably not predict. It is only when you allow stuff to be openly licensed and adaptable that you get those unpredictable outcomes. That is what employers want to see. There is a new skill coming over here that we had not thought of before. A few years ago, we did not talk of
data journalists, for instance. That brings together two disciplines into one role. Those people need different skills and resources from different areas. It is difficult to put a programme in place for the jobs of the future because we do not know what those jobs of the future are yet. If you have an open ecosystem, you can create those things as they come along.

David Hughes: There are lots of things that need to happen in this arena. I do not think that digital skills are embedded enough in the curriculum generally post-16. In some sectors they are, and are very specific, but most self-employed people will need quite high levels of digital skills. They will need a website, online banking and an online payment system. They will need to be able to present themselves to the world digitally. I think that they are part of the curriculum for lots of trades and lots of potential self-employed people. We need employers to start engaging with providers of education post-16 to learn both ways about the digital skills we will need in the future. We talked about the need for people in the workplace to keep learning informally. That happens when colleges and universities work closely with employers and start to offer that suite of skills and learning that needs to be available. That then taps into people’s motivation. People will very often be turned on by learning that is endorsed by a local employer in a way that they will not be if it is just a qualification they have never heard of. I use the Rolls-Royce example because I worked in Derby for many years. If you had Rolls-Royce involved in any of the learning offer, people took it seriously. If you put some bizarre NVQ level 2 or level 1 title on something, they were strangely not interested.

The Chairman: How can we reinvigorate that with employers? All the evidence is that, post the recession, they are not doing that at the same level. They say, “If we train people, they may move”. How can we reinvigorate a commitment to the development of the workforce?

David Hughes: At the risk of repeating myself, there has to be a local focus on outcomes and the Government need to fund colleges, universities and other providers to focus on those outcomes. If they do that, they free up the innovation and creativity to start to engage with employers to ask: “What outcomes do we want in this area? How do we engage people who will be vital to the workforce in future? What skills do they need before they enter the workforce? What skills do they need when they are in the workforce? What part does the employer play in paying for that? What subsidy do the Government provide?”.

The Chairman: That is pretty crucial, because otherwise it is the Government doing it for business, is it not?

David Hughes: Not for one minute am I suggesting that the Government can fund all this; employers need to pay for lots of the provision required, but the flexibility is not there because the focus is too much on full qualifications all the time. Qualifications are really important, do not get me wrong, but they are not the only part of the system that is needed.

Q99 Lord Macdonald of Tradeston: Is there a direction from the Government—because our report is to advise the Government—that you would like that would help to stimulate industry partnerships and that kind of localism?

David Hughes: Definitely. An emphasis on local partnerships—in England, that is LEPs and in other parts of the UK it is different mechanisms—local deals based on outcomes, the funding system focused not on qualifications but on the skills that people need to get on and the progression that they want to achieve, would be fantastic.
Professor Martin Weller: We could help employers by having a convenient package for them so that when they are doing a review of an employee they can say, “Here are some learning options”. Some of those can be informal, some of them may be formal. Employers are busy people and they are not aware of the range of stuff out there. Part of the onus is on those of us in education to come up with a neat package to provide to different employers in different circumstances.

The Chairman: Pushing you further, because that goes back to my earlier point about information, who provides that? Where is that provided? Is it local or national?

Professor Martin Weller: It could be by sector, it could be local. A local college could provide that to local employers, but there might also be online offerings, so that, if you are studying engineering, you are told, “Here is a bunch of things that might be interesting for you to study”, so that when the employer is doing a mid-career review, it is more about your learning opportunities. Some of those will be formal, some will be informal, and they will be of different sizes, but at least it is a convenient package for them to take to sit down with in the meeting.

The Chairman: I understand that, but who has the responsibility for putting that information together, for making the links?

Professor Martin Weller: If you tell the universities, they should provide that structure.

David Hughes: That is a crucial point. I do not think that universities and colleges think it is their job to deliver that type of learning to employers and employees. That is wrong. We must reinject some sense of localism into colleges and universities beyond the publicly funded full qualifications. That is hard because it is risky and difficult. They do not necessarily have the right skills or employees to deliver it, but if they do not, there is no one else to step in, so it has to be through those institutions.

Lord Lucas: Can you point out any examples of good practice, of people doing it because they believe it is right in advance of funding?

David Hughes: There a conference going on at the moment in Warwick, which Martin is going back to, which is full of people who are doing fantastic work on the use of technology in learning and embedding technology in learning in different areas of the curriculum. There are lots of what I would say are small pockets of fantastic practice. We need to promote that much more widely. Enormous investment is needed in the workforce. Lots of people who are expected to teach digital skills and use digital learning do not have the skills themselves to have the confidence to do that, so we need a big investment in the workforce—teachers, lecturers, trainers and so on.

Baroness O’Cathain: That is a very valid point. Most people directing large organisations have not done any of that themselves, and they do not like being shown up by the youngsters who can do all those things. There is a psychological problem there, but there are some terrific examples. You have twice mentioned Rolls-Royce. Rolls-Royce created a huge factory on the South Downs. Nobody had ever built a car down there or knew anything about them—well, obviously, some of the local mechanics did. They trained every person. That is one of the most important new developments of the past 10 or 20 years in Sussex. It is an incredible example, but not many people know about it.

When the Blair Government first came in, I was very impressed by their campaign saying, “The most important person in my life was my teacher. I remember Mr or Miss so and so”. I
thought, “Gosh, what a good thing to do”, and that must have had a lot of positive effects on teaching people. Similarly, there seems to be huge need for an information campaign. If people could see what Rolls-Royce did down in Sussex, the result could be amazing.

**David Hughes:** We can provide some written examples, if that would be helpful, of family learning, community work and peer-to-peer support network working. I am sure that later Helen will give you some examples as well.

**Lord Lucas:** If employers are not doing enough, they need to understand how it can be done.

**The Chairman:** There needs to be some push on them as well.

**Q100 Lord Kirkwood of Kirkhope:** Can I take you back? You scoped out some of the client groups that we are concerned about, but I am nervous of complacency. We are talking about peer-to-peer and family learning, but there is dislocation. Think of the work of Louise Casey. We have families facing nine socioeconomic barriers to getting anywhere in life that keeps them out of jail, but we are talking gently among our middle-class selves. I emphasise that to make a point, but what do we do? All the evidence that I am hearing in this inquiry, which is fascinating and absorbing—it is an important policy area for the country—suggests that inequality is going to get worse. No one is suggesting that we stop technological development because it will make equality more severe, but I get no sense that people are thinking about the number of people who are going to be dislocated from the labour market who are already in work. We are talking about getting them interested in mid-term career reviews by joining photography sessions.

What do the Government really need to do to grab hold of this before we start getting public unrest in the streets of our major cities? Things can change dramatically and quickly in this area, as you know better than we do. What should we be recommending to the Government in the next Parliament that needs to get done and funded to make sure that we do not lose not just 15% but perhaps 25% of our population who feel completely left behind, because that has political as well as economic implications?

**David Hughes:** I am pessimistic, and I am sorry about that because we have been talking about literacy and numeracy for 100 years but we still have not cracked it. This is a new challenge that comes on top of that. Of course, it is a compound issue. People with literacy and numeracy problems often have poor health understanding and poor financial skills, and they nearly always have poor digital skills as well. I completely understand the challenge: it is getting bigger and it is getting worse. We have to invest more money at the local level in tackling the challenges which people are facing as adults. Again, family learning is important.

**Lord Kirkwood of Kirkhope:** That is a very important point. Can you point us towards any sort of cost-benefit analysis that has been made of doing exactly the kind of thing you are talking about? I am sorry, I interrupted you when you were trying to explain the position. I apologise for that.

**David Hughes:** Interestingly, we are just seeking some money to do some research on family learning because we believe that it can tackle problems for the most disadvantaged people.

**The Chairman:** There is certainly some evidence on literacy levels.

**David Hughes:** There is indeed, and we are doing some family numeracy work at the moment that again will produce evidence. Family learning is not just a nice, fluffy thing. I have kids and I do family learning all the time. I am not talking about the state supporting
me, I am talking about the kids who grow up in households without books, PCs, laptops and iPads. We need to target them. The Robin Hood Primary School in Nottingham is doing that now and is achieving some fantastic results. This work is being done with families whose kids may possibly end up going off the rails. It is being targeted at that group, which is important. However, there is not enough funding going into it. The PISA and PIAAC studies done recently by the OECD suggest that we have long-standing literacy, numeracy and technology problems, and that is partly about funding.

Lord Kirkwood of Kirkhope: We know that universal credit, which is coming in eventually, has a local support service framework so that advisers can help people through the Digital by Default service. Is there not something there that will allow us to grab hold of these families and say to them, “Come this way. Here is an avenue you can take to introduce you to the idea of technological training.”?

David Hughes: Both of us have said that there are things that work, but most of the funding is very short term. We have had projects funded through BIS and the Skills Funding Agency for 12 months. The results were fantastic, but the funding finishes and the project finishes. I hate to keep going back to funding, but there has to be a stronger focus on it as being a part of what works.

The Chairman: As you say, it is what works.

David Hughes: Absolutely. I go back to the role of universities, colleges and other public institutions. They should be given the responsibility to do something about this as part of all the other things they do. In too many instances institutions have lost sight of responsibility to the local community. They are much more focused on universities being global in nature. Colleges are going to India. Let us focus on the local community because that is really critical.

Professor Martin Weller: Context is important in this as well. I did some work with a group of people in Jamaica. They put lovely laptops into the libraries but no one wanted to go in and use them because it was not “their place”. This guy bought some metal containers that you see dumped everywhere and fitted them out with Macs. He then put them into the middle of villages.

Lord Kirkwood of Kirkhope: A metal container.

Professor Martin Weller: I am not suggesting that we supply metal containers, but the context is important. Even if we did open up all our libraries again, the people we want to get at might not feel that the library is “their place”. It needs to be done somewhere where they might go, such as the pub or the shop. Again, context is important.

Q101 Earl of Courtown: I think we have already covered part of my question, which concerns the sort of chicken-and-egg situation with regard to online learning and digital skills: if you do not have digital skills you cannot engage in online learning. We have also been talking about motivation, and of course we come back to the literacy problem. Once you get the literacy problem sorted out, you can get the motivation going, along with more social interaction. I am thinking particularly of older groups and the level of confidence people need to get back into retraining. You were saying that we should concentrate more on the older groups, people in their 40s, 50s and 60s, and you said that they have much to contribute. One would imagine that those individuals will seek out additional learning if they can be shown that they will actually gain from it. However, there are those who do not actually seek out additional learning. We have been through this subject, but is there one
more point you could make about motivating those who are not actively seeking out additional learning?

David Hughes: One of the particular issues about digital skills is that people need ongoing support, not just initial learning. That is critical, particularly for older people. My mum, who is very digitally literate, still sometimes needs me or my son to help her sort out her problems. It is not enough to provide one burst of input. The confidence thing comes from knowing who to ask and where to go when you are stuck. This is an important part of it.

Baroness O’Cathain: Before I go into my final question, I have two brief queries. What about teacher training colleges? Do they feature significantly or are they still in the groove of the classical subjects?

David Hughes: There is not enough going on.

Baroness O’Cathain: So there could be a recommendation in that area.

Professor Martin Weller: It can become a kind of check-box exercise: can you add up a formula in Excel? We need to work towards higher-level skills and on fostering digital curiosity so that people are creative online. The tick-box skills are not enough.

The Chairman: Such as teaching children how to do a spreadsheet but not teaching them how to think.

Baroness O’Cathain: My second point is whether there is any way we can stop the computer industry from putting a towel over its head every month and trying to change everything that we have all got used to. It is absolutely ludicrous.

The Chairman: We have just started migrating from Microsoft Office 365.

Baroness O’Cathain: I have been told that Windows 7 has just about reached its sell-by date. Why is that? People are not going to be given any support by Microsoft, Dell or anyone else because they have made their money on that particular product. They then make it more and more inconvenient for the normal user, who has to relearn everything. I actually think it is criminal; I will go as far as saying that. These people are making more money than any other sector and they are taking us all for a ride. Is there any way that Governments throughout the world or the EU could do something? You may laugh, but it is true. However, I am exaggerating to make the point.

The Chairman: Maybe we need to get them back so that we can have a go at them.

Q102 Baroness O’Cathain: I think we should because it is very bad. Anyway. I turn now to my final question. I know the answer from Mr Hughes, but I do not know what Professor Weller has to say. What is your one key suggestion for a change that this Committee could recommend to improve UK competitiveness in respect of digital skills? How would you make that fundamental change happen and how much would it cost?

Professor Martin Weller: My answer would be that we need to create a context within which innovation and experimentation can flourish. We are talking about digital skills almost separately, as if we could simply enhance them, but actually lots of things work against them. So off the top of my head I will refer to, for example, student fees. At the moment they work against someone coming in and trying out a bit of learning, and perhaps then going away and coming back. They also make both students and universities quite risk averse. I would refer to the Research Excellence Framework as well, which tends to make
academics think that they must publish in the traditional journals and should not do any of the other things. You need to look at the whole context within which digital skills develop. You want to allow for experimentation and innovation, but lots of things serve to constrain them.

**Baroness O'Cathain:** Mr Hughes, I take it that your answer is that all the emphasis should be put on digital skills, literacy and numeracy. Is that so?

**The Chairman:** And the local hub.

**David Hughes:** The third one would be to use the European Social Fund locally and engage employers to be funders for delivering skills to the workforce as well as to the community. I think that a specific focus for the ESF could be on that aspect.

**Baroness O'Cathain:** There is to be a specific focus on youth unemployment and we could actually piggyback on that.

**The Chairman:** Thank you very much indeed. You have both been very helpful.
National Institute of Adult Continuing Education – Written evidence (DSC0088)

NIACE, the national voice for lifelong learning, is delighted to contribute written evidence to this important inquiry, following on from the verbal evidence presented to the Committee by our Chief Executive, David Hughes, on 2 September 2014.

NIACE is a large, internationally respected development organisation and think-tank, working on issues central to the economic renewal of the UK, particularly in the political economy, education and learning, public policy and regeneration fields. We campaign for the personal, social and economic benefits derived from lifelong learning; we work to improve peoples’ experience of the adult learning and skills system, and fight for all adults to have opportunities throughout their lives to participate in and benefit from learning.

Summary of Evidence

- Lifelong learning is the key to the UK’s digital growth, giving everyone, regardless of gender, race, age or background, the opportunity to participate in our digital society, as digital citizens, workers and makers.346
- No one has the digital skills now which they will need in the future. National support, local co-ordination and delivery are needed to establish a culture of lifelong digital skills.
- The digital economy cannot depend solely on young people, yet our current skills system is focused on them at the expense of the rest of the population.
- A mixture of formal, non-formal and informal learning can develop and update digital skills as technology progresses and needs change.
- The third sector, employers, universities, colleges, adult education providers and schools all have a role in developing digital skills. No one organisation or sector can deliver all of the digital skills required for life and for work.
- Community based, family and intergenerational programmes successfully develop basic digital skills for niche groups, but further skills development is dependent on opportunities for progression.
- A digital skills strategy should have a particular focus on those most at risk of exclusion including: those in low-paid and low skilled jobs, older people, disabled people, young people not in education, employment or training, people with no or little prior learning, unemployed people and adults in mid – career.
- Employers, individuals and government should all contribute to the development of digital skills.
- Locally-focussed social partnerships should identify the digital skills which people need and describe the learning which they can access.

Recommendations from NIACE

Government should:

- Acknowledge digital skills as the third basic skill

346 Skills for Prosperity: Building Sustainable Recovery for All. June 2014. Leicester. NIACE
• Prioritise lifelong digital skills through national directive implemented at local level
• Facilitate partnership between the Department of Business Innovation and Skills (BIS) and the department for Education (DfE) to improve family and intergenerational provision for digital skills
• Ensure the National Careers Service offers improved guidance on digital careers and skills for work, for people at all stages of their working lives. To support this, the National Careers Service should fund Mid Life Career Reviews so people in mid life are aware of the digital skills needed for them to gain and sustain employment
• Develop outcome based agreements with Local Enterprise Partnerships (LEPs) to establish locally focussed social partnerships between public institutions, employers and the third sector. These will offer opportunities for to develop different levels of digital skills and identify progression routes between levels

Local Enterprise Partnerships should:
• Use ESF funding to drive the development of locally focussed digital skill provision which meets the specific needs of their local economies, in line with the European Union’s inclusion agenda
• Engage with their local authorities to ensure that marginalised groups such as care leavers and carers are supported and encouraged to develop digital skills

Learning providers should:
• Embed digital skills across all curricular areas
• Develop, trial and adopt inclusive approaches to online learning
• Work in partnership with each other, employers, LEPs and the third sector to share effective practice and identify progression routes between different levels of digital skills

Schools should:
• Use funding such as the pupil premium to ensure disadvantaged children and their families benefit from the revised computing curriculum and improve their digital skills
• Work with family learning providers and with the technology third sector to increase the awareness of disadvantaged families in the importance of digital skills for work

Employers (including SMEs) should:
• Offer regular training to develop and/ or refresh the digital skills of their workforce
• Engage with their local enterprise partnership to identify how to benefit from the digital skills agenda

Detailed Written Evidence from NIACE
1) Digital skills for life
We live in an increasingly digital society in which everyone needs at least basic digital skills. Although these are variously defined, the UK Digital Inclusion Charter defines basic digital skills

347 Cabinet Office (2014) UK Digital Inclusion Charter
skills as those skills that allow us to communicate, find things and share personal information. Those with basic digital skills should have the ability to:

- Send and receive emails,
- Identify and delete spam,
- Use a search engine,
- Browse the internet,
- Evaluate which websites to trust,
- Fill out an online application,
- Make a booking or purchase,
- Access government services,
- Register on a social website and set privacy settings.

These are the minimum skills required to participate in today’s society. Additional digital skills will be required at different life stages and should be regularly updated.

A significant proportion of the UK population do not have even basic online skills. The exact statistics for digital exclusion differs according to source and definition; however it is clear from both ONS 348 and BBC reports 349, that although the number of Internet users in the UK has increased in recent years, the demographics of digital exclusion remain roughly the same, compounding the effects of social exclusion. Adults without basic digital skills are more likely to be older, disabled, and/or from socioeconomic groups C2DE.

Those least likely to have basic digital skills are also those who may need them the most. The UK government’s “Digital by Default” agenda 350 includes a DWP target for 80% of Universal Credit claims to be made online by 2017 351 which has huge implications for the relatively high proportion of disabled people who have never accessed the internet and JSA claimants with low/no digital skills. Older people will also claim pensions and carers allowance online. Despite the Assisted Digital Programme, the move to online services is already problematic for many.

People without basic digital skills do not have access to the vast range of information, public and commercial services on the internet; they have fewer opportunities for social interaction, civic participation and the democratic process. 352 Access to the internet can also enable older people to live independently for longer by facilitating access to telehealth technologies to manage long-term conditions and chronic illness and by supporting mental well being, financial and social inclusion 353

351 Work and Pensions Committee (2012) Universal Credit implementation: meeting the needs of vulnerable claimants.
Community and family learning is particularly successful in engaging hard-to-reach learners, by making digital skills relevant and useful to their real-life needs. It also shows that digital champions are especially effective in engaging, recruiting and supporting digitally excluded adults. The combination of community-based learning and peer support empowers people to take responsibility for their own learning and develop the skills they need for the future.  

2) Digital skills for work

By 2015, 90% of jobs in the EU will need at least basic computer skills, but around half of adults in the UK do not currently have these skills, with 62% of employers concerned about the level of IT skills in their current workforce. The 2011 Skills for Life Survey found that 46% of adults claiming JSA were at Entry Level 2 or below in using email and 61% were at this level with word processing, compared to 31% and 43% of all adults respectively.

There is also a strong correlation between levels of education and internet use: 95% of those with a university education use the internet, compared to 54% of those with a basic or secondary school education. A 2012 survey showed that 72% of employers would be unlikely to interview a candidate that does not possess basic online skills.

Our economy will have 13.5 million job vacancies in the next decade, but only 7 million young people will enter the labour force during that period. There is a 6.5 million gap which will need to be filled by people working longer, people working more hours and people returning to the labour market. Additionally, the UK will need 750,000 more skilled digital workers by 2017 to compete in the global market while the digital sector alone will require 300,000 recruits with the high-end skills to invent and apply new technologies. Almost 20% of these vacancies are already difficult to fill due to skills shortages. Some of these jobs could be filled by young people entering the workforce, but this is not enough to solve the digital skills gap. Only 9% (57,500) of pupils who entered GCSEs in the 2012/13 academic year took IT as a GCSE, and only 7% (41,800) achieved an A*-C grade in this subject.

2a) Digital skills for young people

It is widely believed that all young people as “digital natives” have the skills needed to be digital citizens and digital workers. However, recent research found that only 48% of young people, not in education, employment or training (NEET), rated themselves as ‘very good’ with a computer, compared to 71% of young people in education.

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359 The internet and informal learning: A report by UK online centres and ICM July 2012
10% of NEET young people cannot send a CV online
More than 35% of NEET young people “rarely” or “never” look for jobs online
25% of NEET young people dread filling in online job applications
11% of NEET young people admit they avoid using computers
10% of NEET young people feel “out of their depth” using a computer
Only 48% of NEET young people rate themselves as “very good” at using a computer compared with 71% of those in education
16% of young people do not feel confident creating a spreadsheet on the computer, with this increasing to 24% among NEET youngsters

NEET young people are more likely to believe that their computer skills are holding them back when it comes to applying for jobs:

• Almost 1 in 5 NEETs do not think their computer skills are good enough to use in the job they want
• 1 in 10 young people are not confident in completing online job application forms and creating and updating their CVs on a computer and NEETs are generally less confident than their peers.
• More than 1 in 6 NEETs believe they would be in work today if they had better computer skills
• More than 1 in 6 NEETs would not apply for jobs that require basic computer skills
• 11% of NEETs believe that their IT skills are holding them back in their career
• 10% of NEETs claim their computer skills have let them down more than their Maths or English when applying for jobs
• 10% of NEETs are embarrassed by their lack of computer skills.
• 1 in 6 NEETs don’t know where to find job vacancies

These statistics are disturbing, given that, by 2015, over half the UK workforce will require greater skills than those needed for digital citizenship, yet many of the UK’s most disenfranchised young people do not even have the minimum digital skills needed to find and gain employment.

2b) Mid-life digital skills
A UK digital skills strategy should address the needs of the whole workforce. This applies to those in work, so they can sustain employment, those seeking employment (perhaps as a result of changing employment needs) and to those wishing to change career mid-life, or to become self employed.

The Government’s extending working lives agenda means that people will have to work longer before they can access their pension. State Pension Age will increase to 66 for both men and women by 2020, and to 67 by between 2026 and 2028. However, older adults are less likely to have digital skills so it is essential that adults at this stage in their lives develop

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Extending working life: Behaviour change interventions: Weyman A. Wainwright D. O’Hara R, Jones P and Buckingham A.
new skills and regularly refresh existing skills so they can continue to work until their State Pension Age.

The UK will require 750,000 more skilled digital workers by 2017 to compete in the global market\textsuperscript{368} while the digital sector alone will require 300,000 recruits with the high-end skills to invent and apply new technologies. Almost 20\% of these vacancies are already difficult to fill due to skills shortages\textsuperscript{369}. NIACE’s Mid-life Career Review\textsuperscript{370} includes a proposal for a mid-life learning health check for people age 40-50, including a review of their digital skills, with recommendations for digital up skill, reskill or update.

\textbf{2c) People in work}

“If we want to make sure that people can remain in the workforce for longer, they will increasingly need to improve their digital skills at all levels. We need to make sure that the support we offer to lifelong learning is fit for purpose for our digital future.”\textsuperscript{371}

Standard computing / ICT skills are not enough to fit the UK workforce for the future. The OECD Survey of Adult Skills (PIAAC)\textsuperscript{372} states that: “In addition to mastering occupation-specific skills, workers in the 21st century must also have a stock of information-processing skills and various “generic” skills, including interpersonal communication, self-management, and the ability to learn, to help them weather the uncertainties of a rapidly changing labour market.”

The survey also found that England/Northern Ireland had the second highest proportion of adults who scored below Level 1 in the problem solving in technology-rich environments proficiency test. For those in work, employers have a responsibility to re-skill their workforce for the digital economy. Digital technology evolves quickly and to keep abreast of change, the whole workforce needs to develop and regularly refresh their digital skills.

\textbf{2d) People out of work}

People out of work would be more employable if they had higher level digital skills. The UK forum on Computing Education recently analysed the 361 standard occupation codes used by the government to categorize the occupations of the UK workforce\textsuperscript{373} and found that 37\% of UK jobs required employees to be Digital Citizens; 46\% of jobs required employees to be Digital Workers; and 10\% of jobs required employees to be Digital Makers. \textbf{Only 7\% of jobs in the current UK workforce did not require any digital skills.}

Go-On UK\textsuperscript{374} identifies basic digital skills needed by businesses as the ability to:

- Use customer relationship management tools,
- Ensure email accounts are secure,

\textsuperscript{369} European Commission (2014) Digital Agenda: ICT for jobs
\textsuperscript{370} NIACE mid life career review http://shop.niace.org.uk/media/catalog/product/m/i/midlife_career_review_-_final.pdf
\textsuperscript{372} OECD (2013) OECD Skills Outlook 2013: First Results from the Survey of Adult Skills. OECD Publishing
\textsuperscript{373} Submission from the UK forum for Computing Education (UKForCE)
\textsuperscript{374} Go On UK (2014) The ‘Basic Online Skills’ that every person, small business and charity need.
• Ensure website and social media accounts are secure,
• Build, maintain and promote a website,
• Comply with accessibility guidelines,
• Optimise site for different devices,
• Make and take payments online and
• Provide a secure transacting environment.

Having these skills would increase the employability of those out of work people.

FE colleges currently deliver courses which have been specifically set up for referrals from Job Centre Plus under the Skills Conditionality mandate scheme. Courses include ICT Adult Programmes where individuals are assessed on their ICT ability and the relevant start point will typically be identified from: Introduction to word, Further Internet skills / Universal Job match, Introduction to Internet and E-safety, ITQ Entry level 3, ITQ level 1, ECDL level 1.

Work courses can include other options (e.g. web design, IT qualifications), but access for unemployed adults depends on local funding priorities. Further digital skills (e.g. specific IT qualifications) are available to unemployed people only if local funding is available.

Learning opportunities can be difficult to identify and to access. Local coordination would map existing learning opportunities, identify and fund gaps in provision, resulting in a cohesive digital skills map which would meet the needs of learners and employers.

3) The state of digital skills learning

“In a technology rich world, no amount of memorizing information will make a student competitive in the global labour market. We need an education and training system that supports students from all walks of life in becoming inquisitive, resourceful thinkers who use technology to: pursue knowledge, collaborate across geographic boundaries, acquire new skills and solve complex problems.” 375

Community, family and intergenerational learning, Further, Higher and school education, third sector, private, charitable and publicly funded organisations all have a role to play in developing digital skills, but:

Provision is not “joined up” so there is limited progression from basic to higher level digital skills;

Some programmes are not sustainable, due to resource and funding limitations, so there are gaps in long term digital skills provision;

Further and Higher Education has not embedded digital skills across in most subject areas, so formal education does not currently prepare learners for the digital future.

375 Technology-Enabled Education Innovation Partnership Act USA H.R. 3325 October 2013
Recent reports\textsuperscript{376} show that adult learning providers and teachers have a variable and often limited knowledge of how to use technology and of higher level digital skills, so education will not necessarily support, inspire or guide learners to digital careers.

4) Learning technology

Technology could hold the key to lifelong learning, transforming access to learning and how that learning takes place.

Technology is a strong motivator for disengaged adults to engage with learning\textsuperscript{377} and to widen participation. Using technology, learners can overcome barriers of geography, physical condition and finance.

Technology, however, could present barriers to those who could benefit most from learning. The 2014 NIACE Adult Participation in Learning Survey found that the main reasons for learning online are: convenience, ability to learn at their own pace, low cost and increased choice. However, social classifications C2 and DE had noticeably lower percentage participation in online learning; with 21% stating that lack of digital skills presented the greatest barrier to learning online, in contrast with 12% from classifications AB and C1.

Vulnerable groups are unlikely to engage and stay in learning unless they can see from the outset the benefit of doing so\textsuperscript{378}. Research\textsuperscript{379} also shows that online learning hinders progression for low-income and underprepared students due to: technical difficulties, lack of social or emotional connections and / or lack of support.

Although online learning theoretically widens access to learning for adults it has no impact on enrolments among low-income populations. For this group, providers should:

- Build regular self- and peer-assessment into online learning\textsuperscript{380}.
- Reduce the cost of online learning by offering low-cost computers and high-speed Internet.
- Assess learners’ ability to succeed and recommend online courses only to learners who are prepared to succeed in those courses\textsuperscript{381}.
- Teach online learning skills in advance of participation\textsuperscript{382}.
- Provide dedicated mentors and / or offline support centres\textsuperscript{383}.


\textsuperscript{377} Ministry of Education and Research (2014) The Estonian Lifelong Learning Strategy 2020


\textsuperscript{380} NIACE (2014) Reaching and Engaging Disadvantaged Groups In and Through Community Learning. Leicester: NIACE.


National Library of Wales – Written evidence (DSC0117)

Introduction
The National Library of Wales is very pleased to contribute to the inquiry into digital skills in the UK. The NLW is located in Aberystwyth and plays a central role in culture and heritage as one of Wales’s major national institutions. It is one of the great libraries of the world, with major collections spanning many formats, from books and other print publications in all formats to archives and manuscripts, literary and political papers, sound and moving images, newspapers, maps, artworks and photographs. It serves as a long-term memory for Wales and is also an important knowledge institution as one of the UK’s six legal deposit libraries.

NLW’s key objective by 2017 is to place the NLW at the core of the national information infrastructure of Wales. It will do this by increasing access to its collections, promoting skills, forming partnerships and collaborating with others, acting sustainably and responding to the rapidly-changing landscapes of information need and developing the technologies that support delivery and access requirements.

1 The changing technological landscape
Over the last decade, the amount of digital content, both born-digital and digitised, has increased substantially. The reasons for this include:

- the extension of the Legal Deposit Libraries Act, 2003, to cover electronic material which has enabled the NLW to collect, preserve and provide limited access to UK electronic publications, including websites.
- an active programme of digitisation by NLW which includes projects such as Welsh Newspaper Online which provides access to over 2.5 million searchable articles and to the Wills Project, providing access to 190,000 wills (800,000 pages), and 200,000 pages of digital archive relating to the Welsh experience of the First World War. The Library has also digitised its extensive photographic and art collections.
- growth in the number of collections which have been created in digital format, or have elements of digital and physical content, so called hybrid collections

Challenges to economic growth include the inability to locate and retrieve trustworthy and relevant information, the “digital black hole’ which prevents access to digital information due to factors such as technological obsolescence, data corruption, lack of permission to use the data, inability to re-use data due to lack of standards and interoperability.

The ability to connect digital resources provides the potential for the virtual connectivity of disparate resources. In order to take advantage of this, and to enable compatibility, the NLW is working with other partners in Wales to develop a co-ordinated digital strategy. The strategy will place an emphasis on providing sustained access to culture and heritage through a unified and co-ordinated approach. The objectives are to support economic development through sharing, innovation, re-use, collaboration; to facilitate participation and learning through the development and transfer of skills and knowledge and to enhance social inclusion through the development of platforms to reach new audiences and data enrichment.
National Library of Wales – Written evidence (DSC0117)

The NLW’s location in Aberystwyth means that increasingly, our primary means of engagement with the public is digital. While over 80,000 physical visitors come to the building in Aberystwyth each year, there are also over 2,000,000 digital visitors. This means that the NLW is able to deliver education, research, and community support digitally, and has had to adapt our methods of serving the public to engage with a disparate, international audience with differing levels of IT skills. The NLW has adapted many aspects of service delivery to suit digital users.

The NLW’s content is freely accessible as part of a strategy of open access to the documentary heritage of Wales. This is different to the policies adopted by other archives in the UK, and reflects the WG’s priorities on open access to heritage. The policy enabled the Library to make submission to the Hargreaves report emphasizing the value of freely accessible digital content for use, and future re-use, including data mining and analysis (“Big data”).

2 The Future Workforce
The NLW is home to a range of highly developed and scarce skills within a bi-lingual institution. These skills are essential to support sustainable access to its collections and to support use and re-use

- Conservation and preservation skills enable content to be digitised
- Cataloguing skills enable access to relevant information
- Information knowledge and organisation skills guide users to trustworthy and valuable information
- Digital preservation skills ensure that the digital data remains useable, trustworthy and reliable in the future, despite changes in hardware and software
- IT skills ensure that digital information is delivered on different platforms
- The creation of catalogue information, or metadata, is essential for retrieval of relevant data
- Information retrieval and organisational skills support users to evaluate the value and reliability of information
- Creation of a pool of data for analysis and analytics to measure uses, impact and value
- IPR awareness and implementation
- Open data for sharing data as widely as possible, enabling cross sector and community and international collaboration in innovative ways.

The NLW will provide trustworthy data, which is retrievable and delivered upon suitable platforms to support future workers. It will develop its own skills in digital curation by embedding them into the NLW, as well as assisting training others in the skills of retrieval, preservation and curation.

The NLW has been creating, managing and delivering digital content to a wide user community for approximately 20 years. This has led to the development of a great deal of in-house expertise in all aspects of the digital life-cycle. This is seen as an opportunity for upskilling staff and building capacity in-house: as we shift to ever-more digital modes of dissemination of our heritage, staff must acquire new expertise to keep up with
technological changes. This ability to adapt to the need for new skills was reflected in our strategy “the agile Library”.

3 Short and medium term support to the digital sector

The Digital Heritage Strategy will support education and learning through the establishing standards to enable the discovery of information and resources and through the development of new and transferable information and resources, including skills in information curation, storage and retrieval and adopting standards to enable digital resources to be embedded in educational resources. It will enhance social inclusion by facilitating the discovery of meaningful information and enabling the collections to be used in ways which reflect the depth and diversity of Wales’s culture and heritage.

Given the reliance digital delivery of heritage content, the Library is well-placed to advice other sectors (eg, the education and business communities) on all aspects of data management. Frequently, advances in data curation and management are seen in the Library sector long before they have an impact on other sectors.

The Library has a large number of digital users, and statistics about their usage of digital content are available. They are used in-house for designing and delivering services, but could also be used as part of a wider analysis about digital information literacy and use by the wider public.

4 Industry

The NLW’s Digido project was established in 2013 to develop new products and services based on the Library’s digital collections to strengthen businesses to local and global competitiveness. The businesses benefit from the NLW’s expertise and specialist knowledge on a range of issues from copyright and licensing, through to digital capture, digital storage and preservation to searing digital resources. During the life of the project, it is envisaged that 100 businesses will be assisted, leading to 10 new services and 6 new jobs.

5 Infrastructure

The NLW has its own preservation infrastructure for the sustainability of its own content. It has been in consultation with other partners in Wales to consider the establishment of a trusted digital repository for external content. The TDR guarantees to actively manage content held within the repository, accept responsibility for the long-term maintenance of digital resources on behalf of stakeholders and for the benefit of current and future users and has a system which supports the long-term sustainability of the repository and the resources held within it.

Comments

Digital literacy is a prime area of interest for the Library. A recent project, Wales at War (walesatwar.org), funded by the Heritage Lottery Foundation, the Department of Education and Skills, and the Armed Forces Covenant Fund, is developing a project for school children to use digital heritage content to develop biographies of names on their local war memorials. These projects will develop digital literacy skills and enable the construction of historical narratives using digital content. Its outputs will be carefully evaluated and passed to policy makers.
The Library has a Research programme in digital Collections, which works with academics and representatives of other organisations around the world to develop a better understanding of the use of NLW content for research, teaching, and public engagement; to enhance and enrich existing digital content to increase its impact; and to develop new strategic digital initiatives.

Nonetheless, capacity at NLW is an issue. Due to budget cuts, the NLW has been trying to ‘do more with less’ to face the challenges of digital skills development, and supporting the delivery of digital content. Despite this, we continue to play a leadership role in the information architecture of Wales, providing support for all aspects of the creation, curation, use, and long-term preservation of digital content.

28 November 2014
Evidence Session No. 1  Heard in Public  Questions 1 - 14

TUESDAY 8 JULY 2014

Members present
Baroness Morgan of Huyton (Chairman)
Lord Aberdare
Earl of Courtown
Baroness Garden of Frognal
Lord Giddens
Lord Haskel
Lord Holmes of Richmond
Lord Janvrin
Lord Kirkwood of Kirkhope
Baroness O’Cathain

Examination of Witnesses

Martin Wolf, Chief Economics Commentator, Financial Times, Oliver Quinlan, Programme Manager, Digital Education, Nesta, and Jessica Bland, Senior Researcher in Technology Futures, Nesta

The Chairman: Welcome. Thank you very much indeed for agreeing to join us today and give evidence. This is our first public meeting of this new Committee, so we are grateful that you could join us. This is obviously a formal evidence session of the Committee and a full shorthand note will be taken. This will be put on the public record in printed form and on the parliamentary website. You have a list of interests of the Committee, which is there in front of you, but because this is the first meeting each of us who has things listed will say that because we have to have it on the public record. You will be sent a copy of the transcript and you will be able to revise it in terms of any minor errors that have been made. This session is on the record. It is being audio broadcast live—not webcast on this occasion, which is a bit sad, but it will be subsequently accessible on the parliamentary website. Witnesses and Members are asked to speak up clearly partly because there is some noise outside but also
just to make sure we get an accurate record. I think that is all in terms of the housekeeping. First of all, would you like to make some brief opening remarks before we get into the question session? Professor Wolf?

**Martin Wolf**: I had not really intended to and I must say I would rather get into questions.

**The Chairman**: Go into questions, fine.

**Martin Wolf**: I am very good at making hour-long speeches but I do not think you will want to listen to it.

**The Chairman**: That is absolutely fine. That is a very good start.

**Jessica Bland**: I would agree with that. I have come with answers to questions in mind.

**The Chairman**: That is fine. That is very helpful.

**Oliver Quinlan**: Yes.

**The Chairman**: I should also say that obviously you do not all need to answer every question, particularly the two colleagues from Nesta. It may well be that you will alternate because otherwise we will get a lot of Nesta and not as much of Mr Wolf.

**Jessica Bland**: That is why we are both here.

**Q1 The Chairman**: Thank you very much. I will start with the first question. I will just put my interests on the record—I will whip through them—which may be relevant: non-executive director of Carphone Warehouse, Infinis plc and on the advisory committee of Virgin Group Holdings. I am Chair of Ofsted, Chair of Future Leaders, which is a head teachers’ charity, Teaching Leaders board member. I am on King’s College Council and I am adviser to ARK, which run schools in the UK. That is just to put that on the record.

Can we start by a big overarching question to try to get the big landscape view, which is what we are particularly interested to hear from you today? Can you describe for us what you see as the future big technology innovations and the trends and how, in a broad sense, they will impact on the UK’s economic future? If you can help us by painting that sort of big picture at the start of the Committee, that would be very helpful. Mr Wolf?

**Martin Wolf**: I think I will make three points. First, I think it is very helpful, incredibly important, if we are thinking about the future, about which we know rather little, to think about the past and what we have already gone through, because we have had 200 years at least—we can go further back, but 200 years at least—of quite rapid technological progress in which our lives collectively have been utterly and completely transformed. I am a Luddite in these matters—sorry, I should not use that word; “antediluvian” perhaps—and I think we are in a period of relatively slow technological change. Everybody thinks, except people who I think really understand economic history, that we are living in a period of unbelievably rapid technological change, but if we think about the process of the last few centuries and particularly the period since about 1860 and 1940, and we look at the range of changes that occurred in the economy over that period in the western world—electricity, the internal combustion engine, aircraft, the chemical industry, motor vehicles, radio, telephone; I could go on—and everything that electricity brought with it, I think the consequent transformation of our economy, ways of work, social patterns and so forth was more profound than what we are going through. We can discuss this in more detail, but I think it is very important not to think that we are experiencing something in any way utterly
Nesta and Martin Wolf – Oral evidence (QQ 1-14)

unprecedented. It is different. It is always different but these are not utterly unprecedented sorts of challenges, and people previously were also very worried about the consequences of all this.

The second point is that we clearly are in the process of a revolutionary transformation in the interaction of computing and communications. That is the area of most obvious transformation at the moment. I am not going to go into biotechnology at all unless you want to discuss it. I do not consider myself at all knowledgeable there, but obviously the potential there is also very profound. I think it is clear that the integration of computing and telecommunications is a revolution that has been going on now for about 40 years. It is not a new one, but it is continuing and it is rapid. There is a dispute over this but some people argue that we are on the verge of genuine artificial intelligence, which is clearly a transforming moment if true. But even as it is, it is important to remember that computers have already done incredibly big things to our labour-market services. I was discussing this before I came in. To take one example, they got rid of all the clerks we used to have. It was a huge number of jobs. So that is the second thing.

The third thing is that by its nature the future is unknowable. There are very different aspects of the transformation but if you are particularly interested in labour-market effects of all this, the really important aspect of that to my mind is uneven impacts. If you could imagine a technological revolution that made all of us more productive to exactly the same degree, it would create relatively small challenges. We would all just be much better off. But it is the extent to which that is not the case that seems to me to create enormous challenges for pattern of jobs and the pattern of incomes. In this case there are profound possible effects.

The Chairman: Thank you. Any Nesta comments?

Jessica Bland: I do not want to be drawn into an argument about whether it is slow or fast innovation at the moment compared to the past, but I think the point about the computing and communication revolution is well made. Certainly from our recent research, I would point to almost three stages we are seeing of particular digital revolutions that are happening one after the other to some extent. Many people talk about the need for coding skills among our current secondary school students and Oliver can speak much more to the Year of Code and to those kinds of digital-making skills, and in some ways that is backfilling for what we see as a shortage of skills in programming at the moment.

There are two things in my research at Nesta and my colleagues’ research that we are seeing the beginnings of that are probably worth mentioning at the beginning of today. The first is around data analysts. These are people who have—to use a technical term—machine-learning skills or large-data-set analysis skills and they are partnering those with statistical skills. These are in a piece of work that is coming out tomorrow called Model Workers from Nesta. It is something that we see great demand for, not just in what might be called big data companies but across several sectors, from pharmaceuticals to the creative industries. It is quite a specific set of skills they are looking for. What was interesting in the interviews behind that research was that it was that this was about not just the ability to bring together those disciplines but also the ability to have understanding of the domain you are working in—not just to be the data analyst in the ivory tower in the corner of a business but to bring those skills out into business strategy that those particular companies feel that they are
missing at the moment. There was almost a repetition of some of the arguments we had around programming perhaps 10 years ago that we are now seeing around data analysts.

Finally from my own particular area of interest, I think where we are seeing the diffusion of low-powered computing—the internet of things or the smart home or whatever comes to your mind—that implies again another generation of particular kinds of digital skills: those people who can manage data exchange over whole urban structures. I think particularly of one small initiative in London called OpenSensors.io where they are producing new kinds of engines for sharing data between multiple devices. So it is a kind of many-to-many data-sharing problem rather than a one to one, and we see very few people with those skills. OpenSensors.io is a team of I think about three at the moment and the demand for them is much, much greater. So there does feel to be a generational thing going on here and you can see somewhere into the future where that might go.

Q2 The Chairman: To what extent should we as a Committee be nervous about the changes that are coming, be positive about the changes that are coming or be both?

Jessica Bland: Perhaps Oliver can talk about the present but I feel the thing that frustrates me about the changes that are coming is that if we have seen a similar pattern of undersupply of particular skills in the past, why are we not creating the systems that can be aware of what is coming up rather than constantly backfilling for what we see is coming along? We will come on later to specific recommendations but I am not so nervous of it. It is more that if we can at least see the green shoots of these things we should have a more adaptive system to deal with them.

The Chairman: Do you want to add anything?

Oliver Quinlan: I would add that perhaps my own angle is very much from education. My background is as a primary school teacher and a teacher educator in this area. We have a lot of discourse about specific skills, such as programming skills, computer science and perhaps some of these more emerging skills that Jessica has just alluded to, but I have a nervousness about the general population’s understanding of the underlying mechanics of technologies and where those things might be going. I think some of that is very technical and relies on technical understanding; some of it is more societal in terms of seeing how people entrust their data to large corporations and what the longer-term implications of all of us opting into something, often out of ignorance, may be. So those would be my areas.

Martin Wolf: I am inclined to think that nervousness is pointless. It is almost like getting nervous about the weather. We are seeing some very important areas of innovation. In the economists’ jargon these are general purpose technologies, if any are. They are going to affect everything. They are or are going to be part of everything and they are going to be introduced in every possible way. We are going to go on riding this wave one would imagine for quite a long time, so it is a question of taking advantage of it and managing those problems that arise, so one has to take a pretty forward-looking view of it.

The second point I would make, and we can have this debate, is that I am not sure how far we are going to be able—I am generally sceptical about this—to identify needed labour-market skills over the time horizon of the education system at least. We have a problem that it takes a very long time to create an adult human being and one is an adult human being for a very long time, in relationship to these changes. So the whole period from beginning to educate the child to retirement—and that is perhaps 70 or 80 years for all we know—and
trying to guess now what will be needed over 70 or 80 years as a result of these changes seems to me to be basically hopeless.

There are necessary skills that we clearly need if people are going to have any capacity to cope with the sort of world that is coming up, but some of these are quite complicated because—and this is my third point—I think it is very important to make the following distinctions. There are implications for us as producers of these services and technologies, broadly defined. My own guess is the number of people who are producers in this area is going to be a relatively small part of our labour force—a very important part but a relatively small part. Then there are an immense number of users. Some of them will be relatively well-informed users and some possibly very highly paid users who have no idea of how it works and do not really have to. I suspect the capacity to use them is going to be more important than to be producers. I am not denying that.

The final thing—incredibly important—is that there are all the sectors that are likely to grow as incomes rise as a by-product of the productivity generation in this sector. I think this is incredibly important to understand. My own view that is it is pretty clear—it is almost inconceivable it will not be true—that almost everybody 20 years from now essentially will be in a service activity. We are almost there anyway. A lot of these service activities will have nothing to do with IT and digital, per se. They will be the things we can afford as we get richer: caring for one another, entertaining one another and all the rest of it. So when you are thinking about the labour-market effects of productivity-enhancing change, you have to think of the sectors into which labour will be released. Historically, it is the low-productivity-growth sectors that are highly demanded as we get richer and that have generated all the employment. By definition, those are the sectors furthest away from the area of technological change, not closest to it.

If you start thinking about the areas where we have not seen massive reductions in the numbers of people working—school teachers, for example, or people in the health system—it is because these are the least easy things to display. It can be complemented by these—and they must be, that is very important—but if you are thinking about the ultimate implications for the labour market, and I know this is on digital skills, they are: do not just look at the spotlight that you are looking at because I believe the activity will be much more likely to be somewhere else.

The Chairman: That is helpful.

Q3 Baroness O’Cathain: Very briefly, following the scenario painted by Jessica Bland, where you have these new green shoots that are incredible and mind-blowing, very few people are going to be involved in them or at least are involved in them at the moment. Obviously that will grow. But the greater the development of this technology, the greater the growth in people not being able to cope with it—and talking about the demographics of this country, the digital divide will widen and widen. I know this question is about the labour market, but I know this is on digital skills, they are: do not just look at the spotlight that you are looking at because I believe the activity will be much more likely to be somewhere else.

Jessica Bland: Is there an answer from today’s curriculum at all, about people who will be users?
Baroness O’Cathain: Who will be left out?

Oliver Quinlan: Yes, there are. I totally agree with the point that most people will be users of this kind of technology and not need to understand it in the same way someone many years ago may have needed to understand the ins and outs of how their car worked to be able to fix it. I do not think that is a comparable situation. But I think a broad understanding of the underlying concepts behind things is important. In this case the computer science elements of the new national curriculum are very welcome in that area, because they are focused on the fundamental concepts of computation rather than a specific technology. The various parties who were involved in putting that together were very right to leave that in that type of form, because many of these underlying concepts have developed but not fundamentally shifted since the early days of computing; they have continued to develop. So I think that intellectual approach and looking at young people understanding the discipline of computer science and the broad—

The Chairman: So only in the brain in a sense.

Oliver Quinlan: Yes. A lot of people in education are talking about the concept of computational thinking at the moment being at the core of this. I think that is far more important and has a much longer life than talking about young people learning to write Python code.

The Chairman: Yes. We need to keep it tight so we can get through the questions.

Martin Wolf: An argument that technologists would make is that the essence of what has happened is that as the machines get smarter using them becomes easier. In some obvious sense that is true. I am old enough to have used pretty well the first PC ever, the Apple G2. It was really, really hard and it is now really, really easy. So if we believe in the artificial intelligence model or anything like that, we are going to have computers that will talk to you. You will talk to them. You will use natural language. They will clean your house, or whatever you want them to do, and the digital divide will simply melt away. It will be just like dealing with another human being.

I do not believe that model, but that is what one is being told and clearly it is already true. If you think of a smartphone, it is a pretty simple machine and I do not believe—I would have to say that, would I not—that just because one is getting on a little bit that one cannot understand how to work them.

Q4 Lord Haskel: I would add that when I started we had an Acorn computer and on the screen you had an “A” with a little accent but then you were on your own. What you have been describing to us, whether we are nervous about it or not, is going to happen is what most people call a knowledge-driven economy. Can you tell us what are the main challenges for economic growth in a knowledge-driven economy? How do we need to adapt to it so that we can make our living in such a world and be competitive?

Jessica Bland: That is a very big question. But one thing I did want to talk about in talking about this divide—or not—was the effect on not just the creative industries but the creative economy as a whole, including people who are designers in engineering companies, who have the creative jobs in a classically not-creative sector. Nesta did some work on that last year and estimated that about 2.5 million people are working in that area. It has been growing at four times the rate of the other bits of the workforce in recent years. A lot of those people are creatively using technology. I think there is a nice parallel with computing
languages here. You might say that they are using extremely high-level languages, so they are not using C, which is the basic one, but they might be using R or Python and in fact some of the visualisation languages that sit on top of that. So there are new nexuses that I think complicate this landscape that we are talking about. Concentrating on some of those occupations and those jobs, where we are already seeing growth, would be my emphasis.

Martin Wolf: This is sort of a frightening question because it amounts to: what is the economic future? I personally—again this probably shows my prejudice—do not find the knowledge-driven-economy notion terribly helpful because the economy is knowledge-driven, period. There is nothing else ultimately. Even before the Industrial Revolution, farming required a lot of knowledge—in fact, an immense amount of knowledge, most of which, of course, we have now lost. The same has been true with each development. So it seems to me that understanding what is going on and how to use it remains the principal challenge. I think what changes is what you have to know about and how to use particular technology.

Obviously what is important about this—and this is the sense in which I can understand this idea—is that the core technological revolution of our time is itself about the application, development and distribution of knowledge and that is the core activity. In that sense I can understand it. But it has always been embodied in other things and will continue predominantly to be embodied in other things. To take an example, the motorcar industry is going to be and is being transformed by these processes. It is still the motorcar industry. So I am not sure we should get hung up on this.

The second point is that this is part of a broader question. If you think about the world we live in at the moment, there are several very large trends coming together. This is one of them, namely, a technological revolution, which changes the economy. The other pretty obviously is globalisation. They are interacting. It is difficult to think about just one of them without thinking about the collection of things.

The third point I would make—and this is the last, because there are so many issues here—is that right at the moment it is pretty clear that we have a problem in generating rising living standards in this country. We have had an exceptionally long period of what appears to be productivity stagnation—really exceptionally long and it is still something of a puzzle. But this suggests that something is not working terribly well. My own view on this is that we have to think about what our particular areas of comparative advantage are likely to be and what sort of skills we are going to need to support those. I think in our case they are going to be overwhelmingly in the use of these technologies. We are not going to go back into mass manufacturing as a fundamental source of income generation or employment—that is not where we are going to go. It is going to be services and the sort of skills we are talking about is part of that. As I said, a lot of the things that are likely to develop and be important for our economic future could well be precisely the things that are least affected by these technologies. We cannot be at all confident about it. But the main point I would make is that I feel that beyond the relatively short horizon, perhaps five to 10 years, if we are thinking about the planning of education and skills, what the world economy is going to look like, in terms of where people are going to be employed and what jobs will grow, is becoming very difficult to predict.
Lord Haskel: But meanwhile in this globalised economy we have to earn our living. So how can we support the inventiveness, the adaptation and the diffusion of all this new technology to generate growth and help us earn our living in the modern world?

Martin Wolf: This amounts to answering the question: what is your growth strategy for the country? How many hours do you have?

The Chairman: You have two minutes, Martin.

Martin Wolf: I think the broader answers are reasonably clear. You need an economy that—because this is trial and error stuff—has a lot of entrepreneurial flexibility and adaptation; you need to produce a labour force that is sufficiently broadly skilled and educated to be extremely flexible and be able to work in many different ways. I think the core of that is fundamental numeracy and literacy and a lot of specialised skills. You need to create really productive interfaces between the parts of our system that generate knowledge and information, particularly but not exclusively universities and the productive system. We happen to have an extraordinarily successful higher education and research system by the standards of most comparable countries and we are going to have to live on that to a very significant degree. We also have an incredibly successful creative industry, which again is something one might be able to support. But if you are asking me to produce an economic plan for Britain for the next 20 or 30 years I am afraid, with great respect, I would have to decline.

The Chairman: Lord Janvrin, do you want to pick up on that?

Q5 Lord Janvrin: Perhaps I could come in on that last point, which is about innovation and creativity, particularly talking about digital skills. As a panel do you have any advice on how we should continue to nurture creativity innovation, particularly in this area? Are there things that we should be thinking about that we are not doing in the financial sector, in education and so on, in encouraging innovation and creativity? That seems to lie at the core of what you were saying, Martin.

Martin Wolf: Why do you not go on with this first?

Oliver Quinlan: Okay. From an education perspective I think what we have been talking about in terms of being agile is important. If we are looking at that particularly in a digital area, one of the areas that I think is a potential concern within schools is how digital skills are linked in with different subjects across the curriculum. I think there is a lot of discussion to be had moving on from the computer science in the curriculum, where we have had a lot of change recently and teachers need to be getting to grips with that—there is a lot of work to be done in upskilling. But there is another section about digital skills within different subjects and, as Jessica said, particularly in areas like science there is a huge influence of not just using the kinds of skills that were previously taught in the ICT curriculum but actually computational skills, visualisation and those kinds of areas. That is just one subject that is an example. I think an area to look at is the opportunities for young people to see those links across different subjects, the opportunities for teachers to be able to be up to date themselves with how those developments affect their subjects as well.

Jessica Bland: Yes. To give one example, not from the secondary sector but from the higher education sector, if you look at some of the art and design schools in the UK they are now increasingly teaching digital skills in some of these ways. They have bespoke courses for people who have not done maths for, well, in some cases six or seven years. They are
thinking quite carefully about how to make those courses bespoke to those people, to not lose them along the way. Even if people have not had this experience at school level there are opportunities further on in the education system to bring those things back together, often with a stronger hook. If you are someone moving into that as an occupation you want to be at the cutting edge when you graduate.

**Martin Wolf:** I would say that to me this is just unbelievably difficult. What people need to know to be creative and how you produce people who are creative is scary—just scary. I think having an environment that encourages it and in which it is believed to be valuable is very important and I believe, as I said, that having a good all-round basic education is very important. I was thinking when you were saying this—I was just reminding myself—that to my knowledge Paul McCartney never learnt how to read or write music. It did not seem to do him too much harm. It suggests that defining what it is to be creative and what skills you need is quite important.

I am a bit concerned about the digital skills concept. My colleagues might be able to explain this, but to me most of the skills we are talking about are quite generic and they are not digital. Digital obviously refers to the way information is encoded within the system as developed by the great computer geniuses from the past, von Neumann and Turing. You do not have to understand that stuff. Even at a philosophical level you do not, I think. You do not even need to understand how the internet works to use it, and I think the number of people who really understand how the internet works is incredibly small, but that does not matter because they do. As I said before, the number of people who are going to end up doing that sort of engineering will be very small. So I tend to think that in the end almost a characteristic of a general purpose technology—and I think it is the most general purpose technology imaginable, because it affects human skills—is that it changes everything. These are tools and the question is how the tools are going to be used. They are not necessarily going to be used by people who know how the tools work, so it is building on what we already have but even more so.

**Q6 Earl of Courtown:** In filling in some of the details of technology landscape, one has to look at the regional differences throughout the United Kingdom. You hear about the M4 corridor or Tech Valley. Are there other areas that are particularly lacking? Are there other areas that are particularly concentrating on these issues? Also is it really important where it is in the UK?

**Martin Wolf:** Do you want to talk about the geographical distribution?

**Jessica Bland:** Not particularly, but I am happy to—

**The Chairman:** If you want to go away and think about any of these questions, we are very happy to receive further evidence from you in writing afterwards.

**Jessica Bland:** I did not want to talk about particular regions, but there is some evidence of localised effects. I am thinking particularly of the *Model Workers* report, which comes out tomorrow, so unfortunately I cannot bring it with me today—I will send it through. You see particularly good spillover when you have data. For example, with companies that are very good at data analytics you see positive spillovers locally. This is not necessarily about clustering but certainly there is a sense of creating a critical mass in particular areas. There may be a role for the local enterprise partnerships in this area but I am not exactly clear what that role would be.
Martin Wolf: It is clear that producers in these broad areas cluster dramatically. This is so obvious. It is quite interesting. I regard it as almost a joke that if you think of the two industries that are most changed by this they are the IT sector itself and the finance sector. Therefore if you believe that the essence of almost infinite bandwidth communications is that it does not matter where you are, the surprise is that it clearly matters dramatically, because they all on top of one another, even if they have to live in congested circumstances. The famous points made by Paul Krugman and Tony Venables about the economics of clustering seem to overwhelm the industry that in theory is working against them. That is very, very interesting. Being on top of one another is clearly crucial; being close to universities seems to be crucial. I stressed that before. Essentially you have the Boston cluster and you have the San Francisco cluster and that is because of the universities. I have long believed that in the long term we are going to find that our universities are the most important regional development institutions in our country. Now, that is problematic too, because of the nature of the people whom they are likely to promote, but if you are thinking about the sector itself and what it is producing, then that is very important.

If you think about the creative industries more broadly, people cluster there too because they like to be close to people who have the complementary skills and who they want to talk to. Amenities are very important to encourage people to go and live in places. I think we are in a world where clustering happens and since the primary raw material is infinite in potential supply—it is not like you have to be near a gold seam if you are going to do gold mining or near a port if you are going to ship lots of steel—that does not matter here. So the clusters become incredibly powerfully self-reinforcing and it is pretty obvious in the UK where they are.

Q7 The Chairman: Can I just ask a supplementary on that? Is there any way that that could be spread proactively? You said that a successful university is almost a starting point. So how can that be taken to more disadvantaged areas of the UK?

Martin Wolf: Well, you cannot just move the whole thing because the way it affects the local economy is very complicated—second and third effects, more tax revenue, more income, more spending, which might generate completely different jobs—but I think you have to build on institutions that exist and consciously support them. So if the British Government were to say, “We are going to make a rather big effort to ensure that relevant scientific and technological research activities and their interface with business do not all end up in the Oxbridge-London triangle”, that would be a perfectly reasonable thing for them to think about. In fact, I know they do think about it. Fortunately, we have absolutely first-rate universities across the country so we can build upon that. I am not just focusing on that—it is just something I know about—but I think that would be the sort of way to think about it.

Our attempt to start real development from scratch by just plonking down a factory somewhere, I do not think that works.

Q8 Lord Holmes of Richmond: From the regional I would like to take us to the global perspective and get your thoughts on how you think the UK shapes up compared with other economies, and what some of the other nations who are ahead of us are doing that we might consider doing in this area.

The Chairman: Who wants to kick off with that?
Jessica Bland: From a schools perspective, there is a league table aspect that might be worth mentioning.

The Chairman: Do not worry, if you do not have anything go away and think about it and you can always send us some stuff—that is fine.

Martin Wolf: This is very difficult because I am really not an expert here. Again, we are talking about production, innovation and use, a lot of it quite remote so if the musical industry or the design industry or the publishing industry uses these technologies they might be anywhere. I would have thought that in terms of production in these sectors we are reasonably well positioned against the other large European countries. Clearly in aggregate—it is inevitable—we are way behind the US, probably on a per capita basis too. The most successful countries in my view in the production of IT services and technology interestingly are a range of quite small countries—basically the Scandinavian countries and Israel. There has been a remarkable amount of ongoing continuing innovation in this sector and those are the countries and the parts of the US that I look to. They are the only places it seems to me obvious that on a per head basis are doing better. What are they doing in northern California and Boston? Well, education again is crucial and links with business, including big businesses. Think of the role of Ericsson, for example, and earlier Nokia in Finland. In Israel of course the defence establishment plays a very big role in training people. My wife, who is interested in these areas, wrote once that the most important training institution for high-tech skills in this country is the Ministry of Defence. These are quite surprising places. We could think more actively about what the lessons from these remarkably successful small economies have been and whether there is something we can acquire. I would not have thought France, even Germany—although it has incredible strengths elsewhere that we cannot now replicate—and certainly not Italy; those are not the countries I would look at. I would go to these other places. I could talk about it a bit more but I would not regard myself as sufficient of an expert to contribute much. Get some experts from Sweden or Finland, or Israel.

The Chairman: Thank you, that is very helpful. Lord Giddens.

Q9 Lord Giddens: First of all, I have to declare an interest. I am the patron of Keeping in Touch, which is an organisation that brings information technology to people with dementia in care homes using simplified IT technology.

We have worked through a lot of the questions that are set out here as they are set out so I wonder if I could just make a couple of comments about what Martin said at the very beginning. I think the case for the opposite can be argued forcefully, as someone who has spent quite a lot of my life looking at the history of technologies—there has probably never been a period in human history where the pace of change has been so fast, so global. If you look at the advent of the internet, it is only about 20 years old and it is a truly global phenomenon. Then to me you have another line of other technologies stacked up where, as you say, we do not know the impact. You could make a case for saying some of them look pretty fundamental and pretty revolutionary.

I wonder if Nesta could comment on one aspect of that because you have produced this interesting study of robotics. Are you able to comment on that study? I am particularly interested in what you called the “Cambrian explosion” of second-generation robots that will not look at all like current robots. Robots are doing many, many things already—on the
moon and under the sea and so on—but you say that second generation robotics will be bio-
robotics, wearable robotics, all sorts of things that we do not normally think of as robotics.
You seem to be arguing in the book that this is going to be very transformational so I
wondered if I could give you a chance just to elaborate on that.

Jessica Bland: The phrase that you quoted, or at least some version of that, is from Alan
Winfield, who is from the Bristol Robotics Lab, and his chapter in our book on the future of
the robot economy. His argument is for a second generation or a second wave of robotics
that does not look like the humanoid visions of robots that we had or we have had in science
fiction for many decades now. It is of a much more pervasive system of intelligence. You will
not perhaps have smart systems that interact with you like humans but you have ones that
form support infrastructures. So to take the idea of dementia support in the home, there is
some great work at Newcastle University looking particularly at helping people around a
kitchen, prompting them on how to make a cup of tea, so that when they fill a cup with
water they are reminded to go and put the milk in the top and then to put the milk back in
the fridge. So we are seeing robotic intelligence that does not appear to us as the vision of
robots that we may have originally thought of but a more, as I said, pervasive form of
intelligence. That idea is quite interesting. It leads to maybe a different set of demands on
what we are expecting people to be good at in the future, so people who are very good at
defining user interfaces rather than people who are good at nuts and bolts engineering may
become incredibly important in that wave of robotics compared to what our original vision
was.

Lord Giddens: There was a bit about bio-robotics.

Jessica Bland: I am not an expert on bio-robotics but there is some material on wearables
and second-skin robotics in the book.

Q10 Lord Giddens: I am going to ask Martin to comment on that. Could you comment also,
Martin, on the productivity issue, because you raise that in your interesting article? Some
people argue that, as Jeremy Rifkin thought, we are now moving to what he calls a zero-
margin economy where many of the traditional measures and values simply do not apply
because digital production is going to be quite different—costless mostly—compared with
traditional schemas of value.

Martin Wolf: I would make two points, because we have limited time. On the first one, I
think it is arguable—I certainly would not disagree with it because it would be pointless—
that in terms of communication technology and the associated information processing, what
has happened in the last 20 years is faster and more comprehensive than comparable
revolutions in the past. So if you think about the move from the cable to the telephone, it
took longer, much longer. You can argue—I would disagree with it by the way; I think it is
wrong—that this is a bigger effect than that. I think it is almost impossible to exaggerate the
effect the cable had but that is not incredibly important. The really important point is all the
areas where there are not technological revolutions. I like pointing out that if you look at our
transport, technology and energy systems, they are essentially the same as they were 60
years ago—well, 50 years ago. Let us think what happened in the second half of the 19th
century and the first half of the 20th: it is just incomparable.

Although this is an incredibly profound thing, I like to think about all the things that are not
changing. That fits in with the second point. We are essentially saying that GDP is becoming
quite difficult to measure. That is true. By the way, GDP has always been very difficult to measure and it has never been clear what GDP measures, either, but it certainly does not measure welfare. The question here is: has it in some deep sense become more difficult to measure? On that, I think even if you take the Rifkin point that there are a lot of things whose marginal cost is now zero, so they drop out of GDP, that is clearly true. That affects welfare. The question is: is that a much bigger effect than ever before? It is not clear. It might be, but I think we have to have an open mind on the possibility that as a measure of economic success GDP is now just so hopelessly flawed that we have to forget it. I have always felt that any measure that excludes household production is useless anyway. To that extent, of course, productivity really is very difficult to measure. But maybe the more important point is not that productivity is very difficult to measure; maybe the point is that productivity does not mean anything.

I have been thinking about this quite hard because we can still compare it across countries and you can see that some countries, whatever they are measuring, seem to be doing better than we do: the US, for example, recently. Does that matter? I think at the moment I am very agnostic but certainly in terms of GDP, to the extent that we still think it measures anything, we do seem to have a problem. There is a philosophical issue, which I think is a very big one about whether that is something that should concern us.

The Chairman: Thank you very much. We are going to have to move on, I am sorry. Lady O’Cathain and Lord Aberdare, can you ask what you still want to ask on the skills education agenda? We have covered quite a lot of it, I think, in the earlier questions.

Q11 Baroness O’Cathain: I think most of the stuff I was going to ask has been answered already by Mr Wolf. The only thing is the bit in italics: “Employers report a large proportion of young people do not have work-ready skills such as aptitude and attitude of self-management”. Can digital skills help that, I ask: aptitude and attitude of self-management?

The Chairman: It is the social and organisational skills, in a sense, is it not?

Baroness O’Cathain: Indeed, yes, its.

Oliver Quinlan: I would say there are great possibilities there.

Baroness O’Cathain: But there is nothing yet in the curriculum that would help things like that.

Oliver Quinlan: I would say from my teaching experience that that is more about how curriculum is delivered rather than curriculum itself. A curriculum could be constructed around those kinds of skills. The way our curriculum has been constructed is more around the core knowledge of certain disciplines, so therefore those kinds of things, I would say, come down to how something is delivered. There is quite a lot of appetite from the teaching profession for developing those kinds of skills and good case studies could be found, but it would be in delivery rather than in the actual curriculum content.

The Chairman: If you could send us any good case studies, that would be very welcome.

Q12 Lord Aberdare: I should declare my interest as an e-skills UK digital industries ambassador. The one area on skills that seems to me we have not really looked at is the delivery process. How are we going to deliver these skills? We have said it is very hard to identify specific skills that we will need. I think there are two dimensions. First of all, what
about the producer skills versus the user skills: do we need to look at those separately? Secondly, are we right to be looking at schools and formal education as the way to deliver these or how can we use the informal system and the fact that most of our grandchildren know how to do things that we certainly cannot? Is that something we can build into the process of developing the kinds of skills and attitudes that we will need for the future, given that we cannot predict what those specifically might be?

Jessica Bland: I think in terms of lifelong learning, of course we can. Particular initiatives like Tech Mums, which allows women who are working part-time or require flexible working, who have their own businesses—I hate the word “digitise”, but there is an aspect of that—to learn to build their own e-commerce solution to what may have been a market stall for a decade. I should declare an interest in that Nesta partly funded Tech Mums through our own accelerator programme but I think there are little things like that—I would not say they are widespread—where you can see those systems coming into play.

Lord Aberdare: I was hoping we were going to hear something from the learning technologist of the year about this as well.

Oliver Quinlan: There is lots of incredible work being done through informal learning with adults and lifelong learning—I would totally agree with that point—but also with younger people through initiatives again that we have funded with Nesta, such as Code Club and organisations that do things outside of school. The work that Mozilla is doing to allow access to skills is very interesting. From the point of view of a teacher, what I find interesting there is: what are the benefits of these informal learning networks that are allowing some teenagers to make large sums of money with breakthrough apps on the app store? Possibly, the benefit of it is a personalisation and a personalised pathway through something to get to great expertise quite quickly, driven by a strong interest. That is one of the things that traditionally formal education does not necessarily do very well until you get a lot further through the system to the higher education level. So as somebody who would be looking at what are the opportunities for young people, I think that the personalisation aspect that informal learning brings is a very powerful one. It is one that is enabled by technology in very many respects because of the access to a depth of information that technology can allow.

Q13 Lord Kirkwood of Kirkhope: Can I take you back to Martin Wolf’s third point about unequal impacts and ask a brief question about inclusion? The early evidence is that there is a genuine concern out there, both in the respect that there are quite stark differences in the participation in the learning part of going into ICT industries and in education between women and men, girls and boys at school. Is that something that we as a Committee, in our recommendations, should be concerned about? Perhaps more generally, on the protective characteristics of age, disability and all of these kind of things, are there obvious things that you can see that we should be thinking about in terms of recommendations to deal with these very important aspects of some of the future changes that we are facing?

Oliver Quinlan: I would agree that divides, particularly the gender divide, are really important areas to look at. I do not think they are necessarily areas with easy answers. Sometimes we see people trying to engage young girls with producing technology by focusing on different ways of manufacturing high-tech jewellery. There is a lot of danger of being incredibly patronising to young women with initiatives like that. It is very important to look at some of the underlying reasons why they might not be deciding or being encouraged to have interests. I think role models are very important. There is a great history in fact of
female role models in technology who are not necessarily celebrated through the contemporary representation of what it is to be a producer of technology. I find it difficult to come up with specific recommendations, but I think as an area to explore and try to find the underlying reasons for—and things we can do to remedy it—it is very important.

Q14 The Chairman: We are not going to let you escape without one final question, which we are going to ask all our witnesses, which is: if you could help us come up with one key recommendation within this report, what would it be? Who would like to go first? We could have a joint Nesta one if you wish.

Jessica Bland: We have parts A and B.

The Chairman: Go on, yes, that is good. We like that. There are two of you, so that is all right.

Oliver Quinlan: So from an education angle my recommendation would be to explore how we take forward the three areas of use of digital technology in schools in terms of teacher skills, because I think that is the area that is lacking. Number one, we have a gap with teacher skills in terms of those who are delivering the new computing curriculum. That is something that there has been some funding to address, but there is much less funding than for a subject such as maths, which it could be argued is not a completely new subject in the curriculum. Teachers have largely never even studied it before in many cases, particularly at primary. The other area of the CPD is the subject-specific use of digital technology. The example I gave was of science and how that has been impacted on. If someone has been a teacher for a number of years they may not have experienced how technology is specifically impacting on that subject. That is really important. The other area is how teachers professionally use technology for the best delivery of learning, which is a different and distinct area, in my opinion. The delivery of learning through technology is separate from those other two areas. So my recommendation would be exploring ways that teacher skills in those three areas can be supported, both in terms of the gap that I believe we have at the moment and the continuing engagement with things as they develop in a very fast-moving field.

Martin Wolf: I suppose probably this is going to make your life more difficult. I am going to say something rather different, which is that I think you have to be very careful about emphasising digital skills per se and emphasise—if you think about this in the right context—that it is about fundamental skills and their ability to be used. If you produce people from the educational system who are enthusiastic, flexible, numerate and literate, they are going to do quite well in this world that is going to be very unpredictable. My big worry, which we have not really raised at all, is that these changes will, along with other changes in the economy, reinforce the trends towards massive inequality in our society, which goes way beyond the inclusion points you made. While those are not easy to fix—there are many issues raised there that are way beyond them—part of this clearly is about the sort of educational and continuing education processes we have. That is why I emphasise the point that human capital is an 80-year machine in a way, if you can think about it as that, and you cannot stop the education at the age of 18.

The Chairman: Thank you. That is a really good place to stop. Thank you very much indeed to all of you. That has been really useful. Thank you.
1. Introduction
Further to oral evidence given on 8th July 2014 this note includes additional information and supportive material for inclusion in the evidence volume and referable in the Committee’s report.

2. Supporting links
Presented below are a number of reference links in support of the evidence that was given during the oral session:

a. Model Workers report- This report looks at the data skills that leading companies look for, and the implications for policy and management.

b. Creative Economy Manifesto- This manifesto sets out our 10-point plan to bolster the creative industries, one of the UK’s fastest growing sectors
http://www.nesta.org.uk/publications/manifesto-creative-economy

c. Robot Economy book- This book looks at the phenomenon of new robot technologies, asks what impact they might have on the economy, and considers how governments, businesses and individuals should respond to them.

d. Techmums

e. Opensensors
http://blog.opensensors.io/

3. Additional Information
a. In response to oral question 10: “What is your one key suggestion for a change this Committee could recommend to improve UK competitiveness in respect of digital skills?”

Nesta has an additional recommendation:

Taking into account Universities UK’s recent warnings about holding doctoral training hostage to industry match-funding, there does need to be a substantive relationship between businesses and those training to be employed there. However, careful work needs to be done in making this long-term rather than concentrating on short-term business priorities.

Strengthening links between the Sector Skills Council for Digital (e-Skills UK) and the Connected Digital Economy Catapult would encourage better information flow between the
Nesta – Supplementary written evidence (DSC0003)

Catapult, who should have a view on the skills demand to further the digital economy, and the SSC who have the levers to challenge skills delivery. Perhaps CDE Catapult should be on the Board of the SSC or vice versa. The National Centre for Universities and Business programme on Skills Demand could be given a specific remit around digital skills for sectors outside those covered by e-Skills UK.

b. Evidence on subjects discussed during oral evidence but not addressed by Nesta at the time.

Report on Highly Innovative Small Nations (Nesta)

Project to connect young people with STEM ambitions through industry links and support (StateofAmbition)
http://www.stateofambition.org/summerofstem

c. Biorobots and interdisciplinary skills needed in the future.

Presented below are a number of cutting edge areas which generate interesting questions about interdisciplinary skills we'll need in the future:

(i) Soft robotics: Self-assembling, flexible, intelligent machines which require understanding of material science and the development of new forms of adaptive Artificial Intelligence (AI). Jamie Paik at the École polytechnique fédérale de Lausanne is working within this field. Associated links from the École polytechnique fédérale de Lausanne:
  - http://www.youtube.com/watch?v=ASvE1RcOko8  (Jamie Paik talk)
(ii) Biomimicry: mimetic have been used for a long time in defence technology and are now becoming more widely used for more mainstream applications:
(iii) Implantable technology: Kareem Ayoub is working within this field. He trained as a doctor, specifically as a specialist neurosurgeon but took time out to develop is a decision-support tool for clinicians managing the post neurosurgery recovery process and is now working in Oxford concentrating on creating new artificial intelligence systems for managing the recovery of stroke victims who have neural implants. The tool analyses data from the (out)patients' brains, modifying their treatment programme appropriately.

This kind of super-skilled, and constantly reskilling, hybrid academic and practitioner is not only possible but already here.

16 July 2014
1. Introduction

a) “Digital” is not an industry sector. All aspects of the modern economy are under-pinned by smart and connected Embedded Electronic Systems, so well embedded and integrated that, whilst they are critical, they are completely hidden from view and often un-appreciated. Embedded Systems’ primary role is not computation, but the control of a physical system, through sensing and feedback, often in real-time; traditionally a programmable electronic system having dedicated purpose or specific functionality. All our smart devices have such an embedded system; “Digital” is not stand-alone - it is integrated everywhere.

b) Electronics has become the foremost driver of social and economic progress worldwide, underpinning nearly every industrial sector directly or indirectly. Globally, the digital economy was estimated in 2010 at $50Billion p.a. (approx £28Billion) and estimated to grow at 11% p.a.\(^{384}\) Of the 10 Billion microprocessors produced globally p.a., 98% are destined for Embedded Systems products, for which embedded software engineering accounts for over 50% of the product costs.\(^1\) Those products have, on average, grown from 350,000 Lines of Code 5 years ago\(^{385}\) to >1 Million Lines of Code today, and continue to require 7% year-on-year growth in the software engineering skills market to be sustainable.\(^1\)

1.1 UK Embedded Systems Sector

a) The UK sector employs about 850,000 people in 2.5 million companies with 2.9% of the UK workforce\(^386\) and is acknowledged as the European leader in independent electronics system design, making up some 40% of the market.

b) UK companies lead embedded system design in multiple niche market application areas, such as communications, video, graphics, audio, as well as inside wireless, IT and Internet-connected equipments. The sector has transformed over the last decade as global economies have evolved, with the changes presenting both market opportunities and structural challenges for the UK industry. These embedded system products globally improve our economy, reduce our energy burden, help assure our identity and safety, adapt our security to ever-changing threats and define the competitive value that secures the market for the product in which they reside.

c) Globally, more than 65% of embedded systems product developments are entirely new, whilst another 28% leverage previous product designs. The crucial protection of that intellectual property drives more than 60% of products to have no (software rather than electronic) components out-sourced.\(^387\)

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\(^{385}\) VDC Research “Embedded Opportunity: Dynamics of Medical Device Evolution driving need for Static Analysis” Jul 2009

\(^{386}\) ESCO Report – Electronic Systems Challenges and Opportunities http://www.esco.org.uk

\(^{387}\) VDC Research “Select Findings: Embedded Engineering Survey” Aug 2011
1.2 Capacity and Capability of Engineers
a) Despite the UK’s position in the market, the industry is finding it difficult to source engineers domestically with the requisite skills and experience. There are particular concerns in the supply of graduate engineers, the low take-up of careers in the sector, the industrial acceptability of graduates and the limited availability of appropriate technical apprenticeships. There is, and will continue to be, a shortage of skills against this projected growth, not just in the UK, but across the world. UK learning institutions and UK industry need to create and retain the best candidates to capitalise on their market position in this diverse, substantial and growing market place.

1.3 Sustaining the Sector
a) The decline in numbers of Embedded Systems apprentices, graduates and post-graduates needs to be addressed if the UK industry is to maintain and grow its leadership position. The industry’s skills challenge has never been more critical to ensure that the UK continues to be competitive globally, provide high-value jobs and support the wider economy.

2. Digital Skill Creation
a) In most of our education programmes from Primary, Secondary through Bachelors degree, Masters degree and even taught components of Doctoral training, for software engineering, computer science and embedded systems, the focus is on solving today’s problems with today’s (and in some cases yesterday’s) tools and technologies.

b) Using the techniques and tools afforded by today’s computing and information technology is not itself a solution to the education demand of our current information dependent, connected society. We need to do much more than get caught up in the technology of today; of necessity we must understand its capabilities, its strengths and weaknesses, but we must pursue, aggressively, the skills and methods necessary to produce architects and designers for the future complex information systems that our society will require.

2.1 Economic Importance of Embedded Systems
a) Embedded Software and Embedded Electronics are everywhere. The fact that these systems remain ‘invisible’ (the major part of the definition of ‘embedded systems’) to a large part of the population is testament to the clever design of these systems... but because they are not ‘apparent’, or are often diminutive, they should not be dismissed as trivial.

b) Many of the products we employ today rely on embedded software to deliver market advantage for the business that manufactures them. In turn this usually means that system (and its controlling software) conveys some advantage to the user in performance, efficiency, aesthetics, connectivity, cost saving or time saving. In most cases, the embedded software is the enabler of those advantages from premium product to toy!

2.2 Embedded Systems Knowledge
a) In order to control the physical world the Embedded Engineer must have a wide understanding of physics as it applies to sensing systems and mechanics of actuation systems, and use his knowledge of computation to deliver relevant, ordered and safely choreographed outputs from inherently imprecise, noisy and vulnerable inputs to achieve
his purpose. These engineers are the dominant ‘problem solvers’ of our modern era, applying science in engineering steps that rival the achievements of Faraday, Wheatstone, Bell, Swan, Baird, Flowers and Berners-Lee on whose shoulders they stand.

2.3 Embedded Systems and Software Engineering – Are we working against the system?

a) According to the Higher Education Statistics Agency (HESA) data\(^{388}\), UK Computer Science degrees appear to be seen as a ‘soft option’ for student populations and the statistics of graduate entrant qualifications suggest it is frequently a ‘clearing house’ for low achievers. As a result the output from some academic institutions is little more than candidates filled with jargon, with little understanding of its meaning or use, especially regards industrial application, as can be seen by the poor uptake of these candidates into the UK embedded systems industry (and even the IT industry).

b) It is difficult for industry to identify establishments that continue to set the entrance bar high, select appropriate candidates, give them the appropriate abstract learning coupled with sufficient examples of practical application, that enable them to ‘hit the ground running’ in industrial employment, let alone challenge and extend the thinking of those businesses for improved capability and productivity.

c) Academics find it increasingly difficult to create courses that attract students, without appearing so onerous as to discourage them, yet a significant part of their funding (and business economic) is driven by student numbers, which puts further tension between ‘attractiveness’ and perceptions of ‘workload’ and ‘achievability’.

d) Equally it is difficult for those academics to keep abreast of the fast-moving technology, have access to the industry’s leaders, get examples of the latest application of technology, techniques and capabilities, and be able to distil the essence of what should be learned without burying the students in detailed domain-specific engineering and complexity. This requires more effort from industry to invest directly in education, carefully facilitated by the trained educators. Working through the Electronic Systems Council, we have submitted a Trailblazer Application evidencing industry’s intention to take-up this challenge.

e) The fact that industry-leading technology in embedded systems is generally a product of private research rather than through research partnership with academic institutions adds further testament to this education disconnect.

2.4 Science, Technology, Engineering and Mathematics (STEM) students

a) Few things create a ‘draw’ to the young student population than the animated antics of robotics, of interactive experimentation, the interactive experience of digital technologies whether through the unexpected nature of game theory, or the immersion of senses in virtual realities... none of which could be delivered without ‘game-changing’ steps in computational power, processing techniques and understanding of systems engineering techniques to engage with human physiology and even psychology!

\(^{388}\) Higher Education Statistics Agency (HESA) – Free online statistics http://www.hesa.ac.uk/content/view/1897/239/
b) In order to generate the appropriate clamour for such demanding courses we must first enthuse sufficient youngsters into wanting a career in these topics. The fact that, in general, engineering jobs (especially within electronics and embedded systems) will in the future be widely available (continued growth that outstrips supply) and will potentially pay a premium (because of scarcity of skills) soon after graduation should be added incentives.

c) To enthuse future generations of youngsters we need to sow seeds that inspire them at primary school, with exposure to role models and technologies; we need to nurture them through secondary school with exciting ‘applications’ of knowledge that generate a thirst for greater understanding outside the academic curriculum; we need to encourage selections of STEM-based topics for study to support the breadth of career potential and that implies a need to augment the academic teaching in primary and secondary schools if we are to raise the proportion, and standard, of students pursuing STEM topics in Further Education.

d) Even at Further Education the consolidation of learning is best achieved through the practical application in a familiar context. Giving our children a vision of how industry uses embedded engineering to support our world today and the vast opportunity of the future may help their personal aspirations, their attitude to work by being enthusiastic and better engaged, their aptitude by helping them select a career path early than can be supported by more focussed educational needs and qualifications... and better career advice from those active in industry.

e) It becomes an industrial responsibility to deliver these practical applications with engaging demonstrations, not with heavily prepared pieces, but by quickly creating (‘hacking’ in modern parlance) prototypes from identifiable components, to new purposes. The drive to ‘learn’ enough about something in an effort to overcome a ‘problem’ encountered (i.e. engineer a solution) is what stimulates the appropriate learning characteristics.

f) Experience shows that for women to be attracted to engineering it is often best supported by demonstrations for health, well-being or social-care ideas rather than more masculine-engendered robotics or cyber-physical systems.

2.5 Higher Education

a) Engineering doctoral and post-doctoral research must challenge our world, extending our boundaries significantly, rather than ‘playing-safe’ by evolving the existing work in some esoteric form. We look to these larger intellects to make step-changes, be more ‘scientific’ by experimenting in the unknown, but with a purpose of identifying systems that deliver innovative mechanisms that engineering can solidify in methods, processes and automata.

b) Computer Science is a key part of the Embedded Systems industry’s needs, yet the HESA statistics show that Computer Science has one of the poorest conversion rates from Masters to PhD enrolments (some 19% in 2009/10 growing to 28% in 2011/12, compared with 91% falling to 87% for Maths and 35% rising to 46% for Electrical and Electronic Engineering in the same period). This is significantly driven by the high-proportion of overseas (non-EU) students (>50% in 09/10) that traditionally swell the graduate numbers and whose numbers (significantly Indian subcontinent) have had dramatic falls in that same period (overall engineering 25% reduction, and nearing 50% in Computer Science), so any apparent ratio improvement in doctoral enrolment may be as a result of the changing proportion of UK
Masters enrolments; the absolute number of postgraduate enrolments is falling fast (down 22% from 09/10 to 11/12).

2.6 The Engineering Industry values Practical Experience as well as Education
a) In the general engineering population, those who opted to study part-time (generally whilst including relevant occupational employment) attract a premium salary (some 40% from first quartile through 3rd quartile, including mean salary and still some 30% premium at the median salary) over their full-time study counterparts. This suggests that for engineering, practical experience, or application, is a significant factor.

b) An Embedded Systems education is largely only offered at Masters level, because of the breadth of learning required (the combination of both Computer Science and Electronics Engineering skills). Low conversion rates at first degree and the challenging course content make it a risky selection for students looking for attainment.

c) Of first year graduates entering employment, only 40% are ultimately employed in an industry that uses their Computer Science degree in an engineering context, most being lured into financial sectors who value ‘numerate’ engineers, but reward better than engineering.

d) The educational journey for embedded systems, must consider opportunities for technical apprenticeships, for those who can be taught practical skills and application389.

3. Future Capability
a) That a new or expanded embedded systems capability is required is not in doubt. The world has created consumer demand, and with it, a burgeoning need, that is exponentially increasing. This is fundamentally fuelled by the capability, capacity, performance and complexity that is increasingly delivered by embedded systems technology.

b) Large companies have created their own training infrastructure for engineering topics, but very few for embedded systems even though it may consume a significant part of their engineering effort. These initiatives are not visible, disparate, not nationally recognised and often localised, although the potential content has significant commonality, portability and value across multiple industrial domains and UK companies and could be delivered more economically, consistently and with reduced fear of loss of investment, if delivered as a national standard. This presents both a challenge and an opportunity for the UK.

c) Industry has to promote the value in such learning, unselfishly, yet incentivise it as a key to employability. This needs to be significantly more than ‘badge collection’ of relevant topics, but has to set concrete foundations of understanding applicable to all consuming industries; It must allow new graduates, on taking up employment, to focus and purpose on acquiring the industrial domain knowledge whilst extending, rather than simply sustaining, the current business productivity through new methods and techniques.

389 Electronic Systems Council Trailblazer submission
d) The clear objective is to create high-calibre Embedded Systems Engineering (a combination of Electronics and Computer Systems Engineering) graduates that are aligned with industry needs, thereby creating a demand for those candidates. In order to achieve this, academia needs to attract capable and enthusiastic students and impart relevant learning. Such skills require little capital investment in teaching equipment, with many low-cost opportunities already available and are highly portable across the nation within both educational establishments or for industrial on-site delivery.

e) For these ‘problem solvers’, evolving an ‘abstract’ mentality and being able to re-purpose an idea to a different domain is part of the education, so sample projects from outside the ‘home’ industry or domain are equally applicable for core skill development.

3.1 SMEs, Funding, Government and Local Enterprise

a) We should strive to protect the investment in training and opportunity for Intellectual Property value by returning the UK economy to a new-model engineering and manufacturing base targeted at embedded systems skills that are world-leading, enabling national access to a market that will dominate the world economy.

b) The large pool of SMEs, significantly the major source for innovation in the sector, that already exist need more support to help market their products within the UK and overseas. In doing so, we help elevate the UK’s position with regards technical competence, innovation and improve our export potential.

c) All industries share the same concern of investment in training, lest that employee then take his new skills elsewhere. This is a common challenge that is magnified in SMEs who (according to the ESCO report) make up the vast majority (99% of enterprises) of the industry, because an individual is a high-proportion of the capability.

d) Whilst the industry is short of capable candidates this concern may persist. Subsidising the creation of a national talent pool will help all industries, and in real terms disproportionately advantage the SMEs (who own 46% of the workforce, the remainder being in the 1% of large enterprises), by improving availability and in curbing inflated rewards and therefore mobility.

3.2 Interfacing to the Real World

a) For embedded engineers the most significant attributes beyond the logical computational understanding, is dealing with the real world. At the closest ‘fringe’ to the microcontroller this implies a reasonable understanding of electronics; at outer layers this needs further understanding of the ‘physics’ of sensors; the mechanics of delivering power systems through electronic and electrically operated equipments including hydraulic, pneumatic and direct mechanical systems and their idiosyncrasies; or from communications systems for point-to-point and network or bus systems.

b) This wide-ranging knowledge cannot be taught purely in academia, but comes from steady exposure, mentoring and knowledge acquisition, becoming most secured and valued by industry when an individual has experienced multiple, differentiated industrial domains. Mobility of these engineers in the UK then is potentially an advantage to Skill growth.
3.3 Emerging Challenges

a) In our future, the newest emerging topics are those of visualising complex problems and routes to their solution; ensuring Safety both of the product design and in its operation; minimising its vulnerability to mis-operation from Security breaches; designing for and managing obsolescence; system optimisation (across potentially many working points or modes, cost of operation as well as development and changes of use throughout its life) and probably most significantly, managing complexity and growth, system evolution as components of the system are replaced or renewed, or additional features and capabilities added to the system that were not within the original design specification.

b) The “Eight Great Technologies” recognize areas of great potential within the UK as Internet of Things and Robotics and Autonomous Systems. Such applications, and many more traditional sectors such as Aerospace (civil and military), Automotive, all rely heavily on “Embedded Systems”.

c) At the moment, education systems major on ‘well-contained’ problems, ‘clean-sheet’ design and relatively low-complexity problems in order to be able to readily assess achievements. Future learning and assessment must incentivise application of knowledge, novelty, problem-solving approach, inventiveness; it must embrace imprecise requirements, an ever-changing landscape, connected systems that evolve and customers who will use a systems in ways for which it was not intended.

4. Summary

a) First and foremost, it’s imperative that “Digital” is not considered as a sector, which it most certainly is not. “Digitisation” demonstrates the permeation of electronic systems into every industrial sector that exists today, or will exist in future. It underpins every aspect of modern life and is built on expertise in Electronic and Software Engineering.

b) As a Nation, the fact that we are considering future skills at a National level gives room for hope. There is clear evidence that we are already falling behind other economies yet we still have the opportunity to build the UK’s economic future on talent-led innovation. To do so requires a significant re-think, starting with greater understanding of industrial application and requirements amongst policy-makers.

c) We are concerned that there are few leading examples in the UK. However, we would cite the UK Electronic Skills Foundation (www.ukesf.org) as a leading initiative. From a proposal supported by £50K of investment from BIS subsequently enabling £1M of investment from industry, UKESF is an exemplar of how minimal public sector support can enable a program that seeks to address the key challenges of:

- Informing and exciting school-age children
- Providing industrial work-placements for under-graduates
- Improving the ability of graduates to progress into employment and quickly add-value to their employers

390 https://www.gov.uk/government/speeches/eight-great-technologies
d) UKESF is currently examining how it expands from Electronic Engineering into the domain of Software Engineering and Computer Science.

e) Whilst there are a myriad of challenges, we regard the output of sufficient quantity of high-calibre graduates, ideally coupled with exposure to industry during their education and in the form of workplacements or high-level apprenticeships as the most critical areas.

f) This is not a regional issue, it is a National issue and is vital to address it at a National level. UKESF has already demonstrated exceptional leadership and has built a program where companies that compete in the market collaborate on developing the next generation of skills in the UK.

g) It is critical that Government Policy reflects the trend that “Digitalisation” permeates every aspect of industry; helps reduce the economic burden on employers to invest in skills well-ahead of employment and provides tangible encouragement for employers to work together and engage academia in developing next generation skills.

5 September 2014
I have pleasure in enclosing a response to the Digital Skills Committee’s request for information from Northern Ireland to inform the inquiry into ICT, competitiveness and skills in the UK.

The inquiry questions relate to a range of issues which fall within the remit of several Northern Ireland Departments, in particular the Department of Education, the Department for Enterprise, Trade and Investment and my own Department for Employment and Learning. I am grateful to Ministerial colleagues for providing input relevant to their areas of responsibility.

The prosperity of Northern Ireland is dependent on the skills of its workforce and its ability to meet the needs of the local economy, to support a strong export oriented market, and to secure the wealth creating opportunities of the future. I consider ICT to be a hugely important sector for the future of the economy.

The Executive’s Programme for Government highlights the priority we place on growing a sustainable economy and investing for the future, and acknowledges the important role of science, technology, engineering and maths (STEM) in delivering on this priority. The Skills Strategy for Northern Ireland, ‘Success through Skills – Transforming Futures’, also recognises the importance of STEM skills and my Department, in partnership with business, academia and other Government Departments, is progressing commitments outlined in the ‘Success through STEM’ strategy which was endorsed by the Executive in 2011. This includes the provision of an additional 1587 undergraduate places in STEM subjects by 2015/16. ICT is also one of six priority sectors on which my Department is focussing its resources.

To this end, and in response to industry concerns regarding skills shortages being experienced locally, I established and chair the ICT Sector Implementation Group, which is a regional coalition of stakeholders. The Group manages an Action Plan, which sets out the short, medium and long term actions required to ensure that the local ICT industry has access to the skilled workforce it needs to grow and flourish, both now and in the future. Some of the innovative work taking place includes the establishment of ‘academies’ in Software Testing, Cloud Computing and Data Analytics; provision of ICT scholarships in partnership with local universities and employers; ongoing support for a public/private ICT apprenticeship scheme; creation of an ICT ‘Leaders into Industry’ programme and the expansion of the ‘Professional Software Development’ course.

I have included further information on the work of both the STEM Strategy and the ICT Sector Implementation Group in the attached response. I trust that the information provided is helpful to the Committee as it takes forward its inquiry and I shall look forward to seeing its report in due course.
NORTHERN IRELAND INFORMATION PROVIDED TO THE HOUSE OF LORDS INQUIRY INTO ICT, COMPETITIVENESS AND SKILLS IN THE UK

DEPARTMENT FOR EMPLOYMENT AND LEARNING

Introduction

The Executive’s Economic Strategy and Programme for Government are absolutely clear that growth and prosperity for all will be attained only through a sustained, prioritised focus on skills. As we compete more intensely for international business and inward investment, skills are a key driver of growth performance and rising prosperity. Research shows that a highly and appropriately skilled workforce has a crucial role to play in a modern, knowledge-intensive, export-driven economy. Moreover, skills are also at the heart of the drive to tackle poverty and encourage social inclusion in Northern Ireland.

We are working closely across Government to drive the skills agenda. For instance five departments, namely Employment and Learning (DEL), Education, Culture, Arts and Leisure, Agriculture and Rural Development and Enterprise, Trade and Investment formed the Science, Technology, Engineering and Mathematics (STEM) Government sub-Group. This group produced the STEM Strategy, ‘Success through STEM’ which was endorsed by the Executive in 2011, and continues to work to implement its recommendations. DEL also represents the STEM Government sub group at the ‘National Forum for Public Engagement in STEM’ which engages with other officials from Departments and public bodies in England, Scotland and Wales.

The Minister also chairs a number of priority sector working groups which are helping to address skills needs in specific areas, in collaboration with employers and other departments. In particular, the Information Communication Technology (ICT) Sector Implementation Group has close links with Invest Northern Ireland and its ICT Employer Board-led Align IT Collaborative Network, which has been instrumental in delivering the Group’s Action Plan, with special reference to addressing the future needs of employers and ensuring that there is a suitably skilled pipeline of trained people to fill skills gaps. Further details on the ICT Group and the Collaborative Network are set out both in this section and in that of the Department for Enterprise, Trade and Investment.

ICT is recognised as the driving force of a globally competitive economy, underpinning innovation, competitiveness and long-term prosperity.

Information provided by the e-skills Snapshot Survey (2014) indicated that:

- Evidence of the sector’s growing importance is illustrated by Northern Ireland’s ICT & Telecoms annual GVA contribution totalling £0.8 billion over the next ten years.
- There are 28,000 people (or one in every 33 people working in Northern Ireland) employed in ICT & Telecoms – 13,000 of which work in the ICT & Telecoms industry itself, with a further 15,000 working as ICT or Telecoms professionals in other industries.

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391 E-skills ICT Skills Snapshot (May 2014)
• There is a requirement for 1,900 new entrants to replace those leaving the ICT &
Telecoms professional workforce every year. These entrants will need increasingly
advanced skills.
• Across all ICT related Higher Education courses in 2010, 77% of acceptances are male
and 23% are female, highlighting the need to develop solutions cognisant of female
perceptions.

Science, Technology, Engineering and Mathematics (STEM)
We know that the economy we aspire to over the next decade and beyond will be
increasingly dominated by demand for higher level skills which include a particular demand
for skills in Science, Technology, Engineering and Mathematics (STEM). The Skills Strategy for
Northern Ireland, ‘Success through Skills – Transforming Futures’, recognises the
importance of STEM skills and DEL is in partnership with business, academia and other
government departments, progressing the STEM commitments through the ‘Success through
STEM’ strategy. ICT is a key component of the STEM agenda and is one of six priority
sectors on which my Department is focussing its resources.

DEL aims to deliver an effective ICT skills pipeline to address skills needs. In doing so DEL
supports a range of actions and interventions across three key strands of ensuring the
provision of appropriate skills; enhancing sector attractiveness; and achieving effective
communication and collaboration.

The ICT Sector Implementation Group was convened in January 2012 by the Minister for
Employment and Learning, Dr. Stephen Farry MLA, in response to industry concerns
regarding skills shortages being experienced locally. It is a regional coalition of stakeholders,
including representatives from relevant government departments, higher education, further
education, employers, employer representative bodies, sector skills councils and trade
associations. The Group manages an Action Plan, which sets out the short, medium and long
term actions required to ensure that the local ICT industry has access to the skilled
workforce it needs to grow and flourish, both now and in the future.

Interventions to date have already had an impact on increasing the quality and quantity of
the skilled workforce available to the local ICT Industry. This has been achieved by raising
applications for ICT-related degrees at our local universities, developing ICT apprenticeship
schemes, and running conversion courses to train individuals for the ICT sector.

In seeking to improve the image and attractiveness of the ICT sector, DEL has supported the
‘Bring IT On’ programme to encourage individuals to consider the ICT sector as a viable
career option and to encourage the workforce to seek skills in the areas required to pursue a
career in ICT. It includes a high profile advertising campaign and website and also delivers
activities such as university open days; school engagement activities; girls’ ICT events; and
primary school engagements.

There is statistical evidence to suggest that the ‘Bring IT On’ programme to date has been
successful and has had a significant impact on the increase in university enrolments from
domiciled students at UK HEIs. Findings indicate that overall there has been a circa 20% 
increase in enrolments to UK universities for computer-related courses since the launch of
the campaign in 2008 and evidence shows that the ‘Bring IT On’ Campaign has been directly attributable to the increase in applications to ICT-related courses.

The Academy model is also one of the main methods of delivery for work undertaken by DEL. The aim of an Academy is to provide a company with competent and skilled applicants for employment. The Academy targets HND, degree or equivalent graduates from any discipline and offers an intensive 16-week training programme, including a six week company placement. Academies have been established by the Department in Software Testing, Cloud Computing, Data Analytics and Sales and Marketing.

Other initiatives being taken forward include the expansion of the ‘Software Professional Development’ course to all six local colleges. This course enables non ICT graduates to gain the skills required to seek employment in the ICT industry. Ten scholarships in ICT have also been created in partnership with local universities and industry. These scholarships provide financial assistance and provide the opportunity for students to gain paid summer work experience. The ‘ICT Leaders into Industry’ programme was created in 2014 and delivered to 25 managers from the local ICT sector. This programme, aimed at middle to senior ICT managers, was developed by the William J Clinton Leadership Institute at Queens University and is accredited at Level 5 by the Institute of Leadership and Management.

Additionally, in response to the local ICT sector’s demand for new talent, DEL works with local ICT employers and the Department of Finance and Personnel on a Public/Private ICT Apprenticeship programme. The scheme recruits and trains individuals for ICT positions, in both software development and infrastructure roles, in the public and private sector. When the apprentice completes the ApprenticeshipsNI framework, they will have a Level 3 qualification in ICT. Since its inception, 100 apprentices have been recruited through the scheme and further cohorts are being considered, subject to demand.

The STEM Charter
In June 2013, the Minister made a statement to the Northern Ireland Assembly where he highlighted the need to encourage more young women to consider careers in STEM, as currently only 25% of those working in high level STEM jobs are female. Since then, the STEM Business sub-group has launched a report entitled ‘Addressing Gender Balance – Reaping the Gender Dividend in STEM’ and working with the Equality Commission for Northern Ireland, launched a STEM Charter in June 2014. By signing up to this Charter, companies send a strong public message, demonstrating their commitment to supporting gender diversity and equality, to increase the participation and progression of women in STEM and to date, thirty organisations have signed up to the Charter, many of which are ICT employers.

Creative Media
The Creative Media industry is a growing sector for the Northern Ireland economy and is continuing to increase its demand for high quality, versatile and high level digital skills. The Creative IMAGE Centre at the Enniskillen Campus of South West College is a hybrid creative digital studio, focusing on digital creativity in both an educational and industry context, in which students and industry are exposed to highly trained creative practitioners, using cutting edge industry equipment and software that is at the forefront of digital creativity in a modern and emerging sector. Through the ConnectEd programme, which connects
industry, FE and HE, students and staff are able to work on a number of live projects and provide assistance to a number of new animation businesses. In addition, the programme has a number of on-going projects with, Queen’s University (QUB) and UU. The centre has approximately 200 students attending courses every week, with courses from Level 2 to Foundation Degree. In addition, there are regular transfers of Animation and Game Design students to the University of Ulster from the level 3 qualification in Creative Media and the Foundation Degree in Creative Technologies.

**Northern Ireland Strategy on Apprenticeships**

In June of this year, my Department published the Northern Ireland Strategy on Apprenticeships, which sets out the way forward for our apprenticeship system, through a series of 20 new policy commitments.

In the strategy, we have articulated a blueprint for the future of apprenticeships in Northern Ireland. We hope it will have a transformative impact on the supply of skills, particularly at higher levels for employers and, at the same time, inspire all who participate in an apprenticeship programme.

The new strategy will be central to transforming our skills and to securing our economic success. The most important change is that our new model puts employers in the driving seat of apprenticeships, through a Strategic Advisory Forum to inform Government, alongside sectoral partnerships, which will design and agree apprenticeship content.

Sectoral Partnerships, comprising employers, employer representatives and further and higher education representatives will ensure apprenticeships are economically relevant and meet the needs of employers; have sufficient breadth to support portability and progression; and build the capacity of the model and its operation. This includes an ICT Sectoral Partnership which will aim to deliver an industry led agenda to support the development of skills in the ICT sector through the provision of apprenticeships.

The Department is also working to develop Higher Level Apprenticeships in ICT, in both software and infrastructure, which will allow apprentices to continue with the model of on and off-the-job training to achieve a Level 5 ICT qualification.

**Careers Review**

Following an extensive inquiry into careers by the Northern Ireland Assembly’s Employment and Learning Committee during 2013, the Department for Employment and Learning and the Department of Education commissioned an employer-led independent review of the careers system in Northern Ireland. The outworking of this will result in the development of a significantly improved work experience programme allowing young people from an early age to sample and explore careers in the priority and emerging sectors, and the development of accessible online support for all.

The review has also highlighted the vital role employers play in the careers system; Employers have the ability to inspire and support young people to explore a range of careers, and this is particularly important for growing and emerging sectors. It is envisaged that the work experience offer should encourage both males and females the opportunity to explore careers which they may not have previously considered to address gender
imbalance. In addition, it should ensure that young people are aware of, and have the opportunity to experience, the jobs available in Science, Technology, Engineering and Maths (STEM) related careers.

The independent careers review highlighted the importance of accurate labour market information which reflects current and future labour market trends, to inform career decisions. The Department’s Careers advisers are all professionally qualified, trained in the use of labour market information and undertake regular placements in industry. This will be further supported by the emerging work on a Skills Barometer for Northern Ireland which will provide the Department with a clear indication of where the skills gaps/shortages are currently, where they are emerging and where they are likely to emerge over the longer term.

DEPARTMENT OF EDUCATION

The Curriculum

The curriculum has been designed to provide flexibility for schools to develop experiences that suit the needs of their pupils. Embedding mandatory, cross curricular skills and keeping prescribed content to a minimum, allows schools to choose the most appropriate approach to take with their pupils to ensure they are engaged and challenged to reach their full potential.

Using ICT is a cross-curricular skill which is embedded in the curriculum and which places emphasis on developing in young people a range of ICT competences and their use in practical situations. The cross-curricular nature of using ICT means that by the time pupils leave primary school, the ability to use digital technologies should be well embedded, as well as the potential desire to study computing in more detail.

Computer Science, which includes computer coding, is a specialised field and the flexibility already in place within the curriculum enables schools to teach Computer Science in any Key Stage, including at primary school level, if they feel it appropriate.

There are no plans at this time to make computer programming mandatory in the curriculum, however, should schools feel it meets the needs of their pupils, there is sufficient flexibility in the curriculum to allow them to teach it.

Qualifications Development

The local exam body, the Council for the Curriculum, Examinations and Assessment (CCEA), has recently developed and introduced a new ‘A’ level in Software and Systems Development.

Thirteen teachers in total have been involved in training events organised by CCEA. The training events took place from May 2013 through to March 2014. Five of the thirteen teachers are from the centres that commenced teaching the specification in September 2013.

The first full ‘A’ level award will be in summer 2015. CCEA has worked in partnership with Allstate in providing two week long training sessions in C# for 30 teachers each time in June 2013 and June 2014, as part of its AT3 (Allstate teacher training) initiative.
Training and Development

In order to contribute to the skills gap in the ICT sector, the Department of Education (DE) commissioned the development and delivery of a bespoke, practical computer programming initiative aimed at pupils in the Key Stage 2 to post-16 range. The programme was launched in September 2013 and aims to deliver approximately 10,000 pupil engagements annually. It includes a strand/programme aimed at primary level and engaged approximately 1,600 primary pupils in 2013/14 academic year.

In June 2014, DE approved a proposal from Queen’s University, Belfast to pilot a course to train post-primary teachers to deliver CCEA’s new Software Systems Development GCE ‘A’ level qualification. The pilot aims to train twenty teachers by September 2015, with a further twenty receiving training by the end of September 2016.

DE also funds a Smart Technology programme, which includes an ICT element to introduce primary pupils to computer programming, using both drag and drop software and the writing of computer code using Basic language.

Capacity of schools to teach coding using C2k (Schools IT network)

An online Computer Programming Environment is now available to local schools on the C2k (schools IT) network to support the teaching of computer programming at GCSE and ‘A’ level. Students can gain practical experience of designing and writing computer programs, and an understanding of the fundamental principles of computer science.

Developed as part of the new schools C2k service (free to all grant-aided schools) in partnership with Capita, the service provides access to a range of programming tools and applications within a virtual desktop, accessed via Capita’s My-School portal.

This provides students with a safe, secure environment in which programming can be carried out.

DEPARTMENT OF ENTERPRISE, TRADE AND INVESTMENT

The changing technological landscape

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

- Through Invest NI’s engagement with industry, academia and the wider stakeholder base we are increasingly seeing a demand for experienced IT professionals, particularly those in the area of Data Analytics and big data leverage.
- Significant opportunities exist for Northern Ireland based companies in the areas of Cyber Security, Network Security, Secure payment systems and IT sentiment analysis. Northern Ireland also has significant business cluster expertise in the areas of Telecommunications hard networks and Mobile technologies including internet integration systems.
- Invest NI is currently supporting a number of groups through its Collaborative Network Programme with a focus on identifying and exploiting commercial opportunities arising from the innovative application of data analysis across multiple industry sectors, including healthcare and energy.
MATRIX Study into the ICT/Digital Market

- There is a huge potential for companies in Northern Ireland to tap into the ICT/Digital market. In order to facilitate this, the Enterprise, Trade and Investment Minister has tasked MATRIX, the Northern Ireland Science Industry Panel, to identify the future global business opportunities, in the medium to long term, which can be exploited by Northern Ireland companies bringing existing and emerging ICT and Digital technologies and capabilities to market.
- The current study is the second foresight study into the ICT sector which will review the recommendations of the previous MATRIX report and carry out an updated and extensive assessment of the ICT and digital markets to identify, sector capabilities and the key enablers that will drive the ICT and Digital exploitation in the Northern Ireland economy. The first study is available to view at [http://www.matrix-ni.org/ict/4571128119](http://www.matrix-ni.org/ict/4571128119).
- The outputs from this study will provide MATRIX and other stakeholders within the ICT/Digital sector with a clearer understanding of the current range of activities, products, services and technological capabilities in Northern Ireland which relate to the ICT and Digital market. The study will generate foresight into the emerging and future global market prospects to help businesses, government and research providers who wish to commercialise and exploit the opportunities available within the sector.

2. What is the employment impact on the UK’s labour market? What are the regional differences?

- According to the Northern Ireland (NI) Knowledge Economy Index Report 2014, produced for NISP CONNECT:
  - NI Knowledge Economy employment grew by 5.5% from 2011 to 2013, which is impressive when considered in the context of a 0.2% decline in workforce jobs over the same period, illustrating the resilience of the sector. The rate of growth also outpaced the UK average (+4.0%).
  - The Knowledge Economy now accounts for 4.3% of total employment compared to 5.3% in the UK, and whilst the differential with the UK has been narrowing a little, the proportion remains lower.
  - In the context of the other UK regions and over the year, NI’s regional ranking declined by one place to 11th (out of the twelve UK regions). Scotland’s Knowledge Economy employment grew most rapidly (+18.7%) and moved ahead of NI in the regional rankings followed by Wales (+12.1%). The Knowledge Economy is heavily concentrated in the South Eastern corner of England.
  - In summary, the NI Knowledge Economy performed well in terms of employment growth. Despite this, NI would need to create almost eight thousand Knowledge Economy jobs just to equal the UK as a proportion of total employment.
  - Members of NISP Connect in 2012 set a number of targets to be achieved by 2030. If the targets are achieved by 2030 it is estimated that the growth of the NI Knowledge Economy would create an extra 39,100 direct employee jobs and a further 22,500 jobs in the wider NI economy as businesses make purchases and staff spend wages.
- At a UK regional level, Northern Ireland normally ranks near the bottom or at the bottom across most key indicators that are monitored in the NI Knowledge Economy Index 2014 report.
o Instances where NI does rank bottom includes: knowledge economy businesses as percentage of total business stock; knowledge economy business start ups per 100,000 population, percentage of firms stating that they are innovation active and number of patents granted per million inhabitant.

o NI does however rank more highly on a regional scale across some indicators. For example, it ranks second in the number of private equity investments per 100,000 VAT registered businesses, ranks fifth on R&D as percentage of workplace based GVA and sixth on number of patent applications per million inhabitant.

Future workforce

3. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

Skills and employability

- The Northern Ireland Economic Strategy recognises that to enhance employment and productivity, we need to develop skills at all levels in Northern Ireland, including employability and essential skills. That is why improving the skills and employability of the workforce is one of the five key themes the Economic Strategy has prioritised to rebalance the Northern Ireland economy.

- Investment in STEM skills, improved management and leadership and sales & marketing skills are recognised in the Economic Strategy as forming a critical foundation for economic growth. It also recognises that at a school level, we need to deliver a renewed focus on raising standards in literacy, numeracy and ICT capabilities.

- At the post primary level, the Economic Strategy outlines the importance of ensuring that all our young people have access to a broader and better range of academic and applied courses that meet their needs and aspirations and lead to clear progression routes in educational achievement.

Priority Sectors

- The Economic Strategy recognises the need to target those areas which have the greatest potential for growth. Telecommunications & ICT is one of the five key markets, identified by MATRIX which we should look to further exploit, and in which we already have considerable strengths on which to build. The five key markets are:
  o Telecommunications & ICT
  o Life & Health Sciences
  o Agrifood
  o Advanced Materials
  o Advanced Engineering

- Work is underway to identify new opportunities for Northern Ireland businesses in the ICT-Digital and the Life & Health Sciences sectors. Both of these reports will be complete in early 2015.
4. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

- Invest NI and the Department for Employment and Learning (DEL) work collaboratively to ensure that industry and the education sector in Northern Ireland are aligned in respect of IT skills. The DEL-funded Bring It On programme is jointly supported by both organisations, with delivery led by eSkills, the Sector Skills Council for Business and IT.
- Working closely with educators and industry it offers a range of support to inspire both students and teachers as to the opportunities offered by a career in IT. These include university open days, in-school events, and individual school engagement and teacher update days.
- Continuing professional development is also available for teachers via an ILEX (Urban Regeneration Company for Derry/Londonderry)-led initiative, part sponsored by Invest NI, to offer professional development training for teachers in the North West engaging in delivering the new GCE A Level in Software Development; 16 teachers have signed up for the initiative, which was designed in conjunction with industry.
- The Department of Education (DE), DEL and Invest NI are co-funding a teacher up-skilling programme for the new CEA A Level in Software and Systems Design, delivered by Queen’s University, Belfast.
- Invest NI is also funding the ICT Employer Board-led Align IT Collaborative Network, which comprises representatives from industry, education and the public sector with the specific aim of addressing long term skills shortages in the IT sector. The network has four work-streams:
  - Automate Demand and Supply – working with employers and educators to enable regular monitoring and reporting of employer skills needs to inform and support educators;
  - Curriculum Alignment – collaborative working to ensure courses are aligned to industry need;
  - Talent Draft – developing innovative ways of identifying, nurturing and attracting talent from within Northern Ireland and further afield;
  - Career Appeal – building on the work of Bring It On to highlight and celebrate IT as a career choice rich in opportunities

5. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

- Invest NI are currently seeing strong demand for experienced IT professionals. As noted above, Invest NI’s Align IT Collaborative Network has a dedicated work-stream focused on strategies to attract skilled IT individuals into Northern Ireland, as well as attracting back those originally from Northern Ireland who may be working elsewhere.

6. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

- Invest NI and DEL collaborate to offer a bespoke approach to skills delivery in Northern Ireland. As noted below, a number of programmes are in place to deliver training tailored to the needs of individual companies.
In other instances, as appropriate, Invest NI works collaboratively with industry, academia, other public sector organisations and the wider stakeholder base to address skills shortages on a sectoral basis. Examples of this include the Bring It On and Align IT projects detailed above.

Industry

7. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

- The barriers for businesses, particularly small and medium enterprises preparing to operate in a knowledge-driven economy are similar to barriers to innovation in general. These are cited in the NI Innovation Strategy and include:
  - Access to finance: availability of finance and the cost of finance
  - Skills: including leadership, technological capability and creativity.

8. How can businesses help equip the workforce with new skills in a rapidly changing environment?

- Invest NI offers a number of bespoke programmes to assist companies in up-skilling their workforce to meet evolving demands. These include:
  - the Skills Growth Programme, available to all Invest NI companies (based, or planning to establish a base, in Northern Ireland) who wish to undertake tailored training linked directly to areas of improvement;
  - the Skills Advancement Programme, available to small enterprises involved in manufacturing or internationally tradable services;
  - the Training Needs Analysis Programme, which helps companies identify the skills and training necessary to improve their competitiveness and productivity.

Infrastructure

9. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

Northern Ireland Economic Strategy

- The Northern Ireland Economic Strategy recognises the importance of a competitive economic infrastructure in supporting economic growth. It outlines the importance of increasing investment in areas such as telecommunications to improve our capacity as a digital and knowledge-based economy.

Broadband

- The Northern Ireland Executive fully recognises the importance of digital technologies and the opportunities that access to such technologies can provide for work, education, leisure and social interaction.
- For that reason, over the last decade the NI Executive has invested over £50m in initiatives aimed at encouraging the private sector to improve the telecommunications networks across Northern Ireland, with a focus on the availability and quality of broadband internet connectivity.
- This includes the £52m Next Generation Broadband Project which involved the widespread deployment of ‘Fibre to the Cabinet’ technology. This project lead to
Northern Ireland having the highest availability of superfast broadband services in the UK – currently estimated by Ofcom to be in the region of 96%\(^\text{392}\).

- Presently 80% of premises across Northern Ireland have an internet connection of which around 73% are via a broadband technology\(^\text{393}\). Of these broadband connections around 29%\(^\text{394}\) are obtaining superfast speeds. This is the highest uptake of superfast services in the UK.
- Proximity to the cabinet is a factor and those premises located too far from the cabinet, may not be able to avail of fibre based services. In such circumstances, alternative technologies are available.
- Through initiatives with companies such as Avanti Communications and Onwave, the NI Executive has ensured that satellite broadband services have been available to all premises in Northern Ireland where it is not currently possible to access a fixed-line broadband service of more than 512 kilobits per second. The current contract with Onwave ensures the availability of services with download speeds of 20 Mbps.
- In many other parts of Northern Ireland, supported by the Department of Enterprise, Trade and Investment’s (DETI) Broadband Fund, fixed wireless services offering speeds of between 3 Megabits per second and 100 Megabits per second, are widely available.
- However recognising that more can be done DETI, in partnership with the Department of Agriculture and Rural Development (DARD), Broadband Delivery UK (BDUK) and BT, has embarked on the £23.5m NI Broadband Improvement project\(^\text{395}\) which seeks to provide improvements in access to a basic fixed-line broadband service (2Mbps) and to increase availability of superfast (24Mbps or more) broadband by the end of 2015.
- It is anticipated that this project will bring more choice and improved broadband speeds to over 45,000 premises across Northern Ireland by the end of 2015.
- Furthermore, DETI is developing an additional project, with support from BDUK, which will further increase the coverage of superfast broadband services with a view to meeting the UK-wide target of 95% of premises by 2017. Total Government funding to this project is expected to amount to just under £14.5m.
- Building on its telecommunications infrastructure investments, DETI ran the Logon-ni Programme\(^\text{396}\) which sought to ensure that Northern Ireland businesses were exploiting the opportunities and benefits provided by having access to the region’s world-class broadband networks. Through the programme, participating companies have improved marketing, business operations and sales and have experienced cost reductions and increased employment. The programme ran from November 2008 to November 2013 and led to a 16% increase in the e-sophistication of the participating firms.

Mobile

- Until relatively recently, Northern Ireland has suffered from having some of the lowest levels of mobile communications coverage in the UK. However, over the last couple of years, due to significant investments made by the Mobile Network Operators, the region...
has seen considerable improvements in 2G and 3G network coverage. Most operators are set to continue their investments to the end of 2015.

- The telecommunications regulator has recently reported that at a premises level, outdoor 2G and 3G coverage in Northern Ireland (from at least one operator) now stands at 98.9% and 99% respectively and is on a par with other parts of the UK with outdoor 4G coverage currently standing at 79.2%, the highest level of any UK nation.  

- Nevertheless, areas remain where there is no coverage from any operator (not-spots) and it is significant therefore that Northern Ireland is set to benefit from the UK-wide Mobile Infrastructure Project, which aims to address the issue of mobile not-spots across the UK by 2015. It is expected that the first site in Northern Ireland under this £150m initiative will go live in early 2015.

- It is noted that the UK Government is also looking at options for addressing partial mobile not-spots i.e. those areas where mobile phone coverage is provided by only one or two of the four mobile networks. This is a problem for around 7% of Northern Ireland premises in relation to both 2G and 3G coverage.

15 December 2014

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397 The Communications Market Report – Northern Ireland: Ofcom (7 August 2014)
Transcript to be found under Professor Patrick Barwise
Wendy Olphert, Professor Leela Damodaran and Jatinder Sandhu – Written evidence (DSC0093)

Wendy Olphert, Professor Leela Damodaran and Jatinder Sandhu – Written evidence (DSC0093)
Submission under Professor Leela Damodaran
1. The One Voice for Accessible ICT Coalition is an umbrella group of bodies across government, education, health, banking, IT and other sectors. It aims to become a strong single voice calling for fair access to digital goods and services by people with disabilities, across all technologies and for people of all abilities. It has more than 50 members including Leonard Cheshire Disability; BT; Middlesex University; Barclays Bank; Bloor Research; and AbilityNet.

2. Our submission to this inquiry is designed largely, though not exclusively, to address Question 11 of the series of questions being posed by the committee. This asks: “Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?” Below, we offer some broad initial answers to these questions, and would welcome the chance to offer further detail in oral evidence.

3. When it comes to digital skills, one social group stands out above all others as one that is lagging behind, disadvantaged, and underserved. The government’s new digital inclusion strategy, published in July 2014, cites ONS figures which find an estimated 3.6 million disabled adults in the UK have never used the internet. This represents more than half (53%) of the total 6.7 million UK adults who had never used the internet.

4. This is not simply a disaster for those people unable to access the basic means and daily communication methods of modern life, it is yet another bar to the ability of disabled people’s entry to the workplace. While it is well-known in the disability community that many disabled people are in fact more resilient and resourceful than other employees, and more loyal to their employing organisations, people with disabilities are disproportionately unemployed. Common (though illegal) discrimination among recruiters is a major factor here but another key factor in the digital age is a lack of access to the internet; inaccessible online recruitment processes; digital skills; and accessible hardware, software and other digital goods and services.

5. In tough economic times, and with an ageing population, this is an injustice the UK economy can no longer afford. Digital exclusion makes bad sense for our fragile economy: it is vital for growth to ensure everyone can access goods and services; learn new skills; and have the opportunity to work. Wasted talent in the UK workforce is a benefit for nobody. The UK government and UK plc must take concerted and co-ordinated steps to improve the accessibility of the digital world to people with disabilities. Areas for action include:

6. Simple awareness of these problems and issues, and their magnitude, remains one of the biggest areas where work is needed by government and business. Employers may not realise that potential employees are being excluded through the formats in which recruitment material is provided, or recruitment tests are presented. Education, awareness, campaign and marketing work is urgently needed.

7. Greater awareness is also needed of standards to which digital goods and service must be produced to allow everyone to access them – including both generic and specialist software
and hardware used in education and the workplace. For example, BS 8878 – the British Standard on web accessibility provides guidance on making websites accessible for disabled and elderly users. Many other national, European and international accessibility standards and guidance documents exist for all kinds of software and hardware.

8. There is also a lamentable lack of compliance with such guidelines and standards; and a lack of enforcement of such compliance, even where it infringes on equality law.

9. Consequently, a review of anti-discrimination laws, guidelines and standards is urgently needed to see how access to digital services by disabled and older people can be enhanced and promoted in the digital age. This has been a key demand from One Voice of all political parties and policymakers in the run-up to the 2015 general election and beyond, and it should be the subject of urgent action by whichever government comes to power following this election.

10. Such a review should be supported by a five-year action plan, leading to concrete steps taken to improve digital accessibility within the lifetime of the next government.

11. The Equality Act 2010 (England, Wales, Scotland) includes a public sector Equality Duty which stipulates that public bodies have to consider all individuals when carrying out their work. The range of tools set out for the Equality and Human Rights Commission for both public and private sector enforcement include compliance notices and judicial review. Since its establishment however, the commission has issued little guidance and carried out little enforcement work in the field of digital accessibility. When other bodies such as charities have sought to take or support legal action, they have always been stymied by the condition that only individuals with an interest can take action against organisations for potential infractions of the Act. This means actions have always settled out of court.

12. There is also a weakness in the Equality Act standard of “reasonable adjustments” required by employers to ensure disabled employees can access work. The vagueness of this formulation means it is hard to take action with confidence, and the risk in losing a case is high. Both issues (this one, and the one highlighted in the previous paragraph) point to the need for a review of practice in this field.

13. We are also concerned that these standards are not strongly enough promoted across the whole of government. There are also problems with accessibility of ICT systems internally, in some large government departments employing tens of thousands of staff. And outside central government, in local government and the NHS for example – even larger employers – the pattern of accessibility of digital services is even more patchy.

14. Activity in this field will also help boost the market for companies working in the accessible and assistive technology sectors, and give UK companies a lead in this sector worldwide. Accessibility work is also a driver for creativity and innovation: many cutting edge technologies in mainstream IT such as optical character recognition, speech recognition and gesture computing came first from the world of accessibility.

15. It is also a well-established principle that a focus on those with 'special needs' improves services for everybody: text that is easier to read helps people with low literacy as well as those with impaired vision, for example.
16. In the area of education and skills, accessibility improves access to digital learning systems, e-learning, digital materials and e-books. At work, it improves access to skills training at work; workplace ICT systems and flexible working. Accordingly, the government must show that it has carefully thought the economic and skills impacts of any changes it makes to the Disabled Students Allowance (DSA) scheme, as recently announced. Student in higher education must have all the equipment they need for fair and equal access to course work, research materials and learning platforms to ensure they gain the qualifications and digital skills they need to enter the modern workforce.

17. At the level of schools education, these issues are also growing in importance, not least because of the (welcome) introduction of a more complex and sophisticated approach to IT teaching. Digital learning systems and tools are now widespread in schools education at all levels. There is also now a requirement for schools to adhere to the Equality Act, but as we have already highlighted, this needs to be reviewed to ensure it is meaningful and enforceable.

18. These issues are not party-political, and in the early stages of our campaign we have found there is great goodwill across the political spectrum and a desire to address these injustices. However, the pace of change of technology which is correctly identified by the Committee as a key driver for its inquiry; and the general difficulty in legislating to keep pace with these changes, have hampered our progress. As each new technology comes into being, the lessons of digital accessibility for people with disabilities seem to have to be learned all over again.

19. The time to try and break this cycle is now. As Parliament begins to get to grips with the fast-changing digital age across all areas of UK life and work, we must ensure awareness of and protection for the most vulnerable sections of our society are built into all of its future actions from the outset.

3 September 2014
Executive Summary

1. The Open University (OU) welcomes the inquiry by the House of Lords Digital Skills Committee. Our views may be summarised as follows:

(a) The impact of digital technologies on the UK economy will increase. Big data is a particular catalyst for change and the emerging field of ‘data science’ will be increasingly important.

(b) The greatest challenge for economic growth in the UK is the widening digital skills gap. Supply is not meeting demand from the UK’s increasingly digital economy. The shortfall is growing and will not be solved by a digitally skilled future workforce alone.

(c) The current workforce, most of whom will remain in employment for decades to come, need to upskill or reskill if they are to be active contributors in a digitally enabled economy. Acceptance by employers and employees of the need for through-life digital skills acquisition is required, with delivery via new models of flexible learning.

(d) A culture of positive change is necessary. The interplay between Government push and industry pull will be critical in developing a coherent holistic approach.

(e) The digital skills requirements for technical roles are multiple and diverse. Data scientists, for example, need skills linked to a number of core areas of expertise.

(f) Developing a digital mind set, including a willingness to experiment, is just as important if not more so than developing a digital skill set, given new technologies will emerge continually. There is a valuable place for free informal learning in engaging learners and bridging the gap to further study. Soft accreditation of informal learning through ‘badging’ is a promising development.

(g) Uniquely in the higher education sector, The Open University delivers digital skills via digital means, transforming the supply side away from traditional campus-based delivery. The University has an institution-wide approach, incorporating digital, information literacy and other employability skills into its undergraduate curriculum.

(h) The ability to shift flexibly from one type of job to another is an implicit part of the digital skills revolution.

(i) In the short and medium term the digital sector can be supported by raising awareness and understanding of career options in the sector through informal learning.

(j) The digital sector can also be supported by development of long-term collaborations between digital industry groups and universities, and by new collaborative models of learning and teaching.

(k) There is a significant skills gap for the disadvantaged. ‘Access’ courses are part of the solution, as are work-based online modules designed for particular roles, e.g. health care assistants (who are mainly women).

(l) Partnerships between educators and business/industry trade groups can deliver focused solutions across key industry sectors.
The changing technological landscape

1: What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

2. As our ability to capture, analyse and interpret data continues to evolve, so the impact of future digital technologies will increase. In particular, the impact of ‘big data’ will be felt across most industries as a catalyst for change.

3. The pace of change is set to increase, driven especially by development of analytics and a growing ability to interpret multiple data sets, creating new products and services.

4. Knowledge management will be more focused on designing processes and organisations to exploit underlying technologies.

5. Handling digital data in all its forms (textual, geographical, financial, photographic/video, etc.) is now a core competence for many businesses, and also increasingly important for governmental agencies.

6. This surfeit of information, supported by rapidly evolving technologies, creates new opportunities to spot business trends, optimise supply chains, prevent diseases, detect earthquakes, combat crime, promote citizen engagement and so on. This data-centric phenomenon, referred to as ‘data science’\(^\text{400}\), represents a leading innovation.

2: What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

7. The widening digital skills gap in the UK is the main challenge. This is not only an issue for the future – it is a well-documented problem for the UK economy now.

8. A study by O2 in 2013 indicated the UK will need more than 750,000 digitally skilled workers by 2017\(^\text{401}\). If this demand cannot be supported economic growth will be compromised, as will UK competitiveness.

9. Back in 2011 a McKinsey study\(^\text{402}\) estimated that the United States would soon require 60 percent more graduates able to handle large amounts of data as part of their daily jobs. Europe, with an economy of comparable size (by GDP) and growth prospects, will most likely be confronted with a similar talent shortage of hundreds of thousands of qualified data scientists in particular, and an even greater need of executives and support staff with basic data literacy.

10. An indication of the scale of current demand in the UK and Europe for data science jobs alone can be seen by a 2014 analysis\(^\text{403}\) of job vacancies listed on the job site eurojobs.com. Of over 6,000 data science adverts, 52% (3153) were for jobs in the UK. Most of the remaining vacancies were in Germany (9.7%), Ireland (8.9%), the Netherlands (8.3%) and

\(^{400}\) http://online.wsj.com/articles/academic-researchers-find-lucrative-work-as-big-data-scientists-1407543088
\(^{402}\) http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation
\(^{403}\) Unpublished research by the European Data Science Academy, a consortium led by the OU’s Knowledge Media Institute.
Switzerland (8.1%). This heavy UK weighting is probably in part due to fact that only adverts in English were considered, but even so it gives a useful indication of current demand and the challenge already upon us. The research has also revealed that while the data scientist role is the ‘data’ job most in demand, open data and big data vacancies are also significant.

11. Despite the high demand, data scientists are relatively rare. Beyond the occasional data-centric start-up and the data analytics departments of large corporations, the skills scarcity is already becoming a threat for many UK and European companies and public sector organisations as they struggle to seize big data opportunities in a globalised world.

12. A related challenge is that as technology evolves and its applications widen, it is becoming more difficult for both skilled and unskilled workers who are already in the workplace to keep-up-to-date. Redressing this issue needs to be an urgent priority. Much of the current workforce will be a significant part of the UK skills base for another three, four or even five decades.

13. Building understanding and acceptance of the ongoing need to acquire new digital skills throughout working life is a way to accelerate employer and employee adoption and maximise economic growth. Fundamental to this will be acceptance of new models of flexible learning and genuine adoption of a culture of through-life education and refreshment.

3: What is the employment impact on the UK’s labour market? What are the regional differences?

14. As mentioned above, employees must be able to acquire new, relevant digital skills throughout their working lives. Increasingly, digital technologies will change the way goods and services are designed, produced and taken to market. Some job roles may decline, but new roles and indeed industries will continue to appear. It is anticipated that ‘just in time’ approaches to knowledge acquisition, skills development and working practices will increase.

15. Economic growth is the key to maintaining full employment, which in turn is driven by our collective ability to embrace these new technologies. Again, training and education at all levels and throughout working life is critical.

16. In terms of regional differences, although key areas such as London’s Tech City are hubs for digital skills growth, there is no reason why this transition to digital skills/greater digitalisation should not benefit all regions, across all four nations of the UK. Indeed, the growing role of technology to facilitate effective remote working suggests this could help address current regional imbalances.

17. For the UK to be truly successful and competitive the benefits of digital skills need to be spread across all four nations.
Future workforce

4: What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

18. There is a need to train and educate across all areas of the workforce and indeed the general public. The skills required will be at multiple levels, and should not just focus on the obvious need for more computer science graduates or statisticians. The ability to work in a global online environment will also be vital. Already, differences are emerging between skills needed for face-to-face team work and those for global interactions facilitated by technology, where time zones become irrelevant.

19. Whatever the discipline, formal learning at tertiary level needs to reflect changing markets and incorporate learning around how new technologies will impact the discipline. For example, the impact of new technologies on medicine will be significant. The challenge is to train doctors, nurses and healthcare assistants to use these new services as part of their medical education and update their skill set as future relevant technologies emerge.

20. Essential to the UK’s competitiveness in these emerging markets will be awareness and understanding of new technologies and the opportunities these can create. If employees see opportunity or benefit for themselves they will adopt new approaches. This is about creating a culture of positive change. Workers need to see themselves as flexible. Already the notion of a ‘job for life’ has largely disappeared, even so the view that a worker will change jobs and indeed career should be further encouraged.

21. The current supply chain can address this need. Encouragement by Government to invest in development of flexible learning options is required. The cost of education to the wider workforce must be low to encourage widespread uptake.

22. The interplay between Government push and industry pull will be critical in determining the success or failure of digital skills provision, support and development. Market forces and organic thought development are not sufficient to ensure success. Clear leadership and investment in educational process and outcomes are necessary to facilitate this.

23. It is difficult to generalise about the specific skills needed by those in technical roles – but in all specialisms a multiple skill set, both technical and non-technical, is likely to be required. Using the example of data scientists – a role of particular economic importance that is currently understaffed – skills are typically linked to a number of core areas of expertise, from the ability to operate high-performance computing clusters and cloud-based infrastructures, to the know-how that is required to devise and apply sophisticated Big Data analytics techniques, and the creativity involved in designing powerful visualisations.

24. Beyond purely technical roles, organisations are already looking into novel ways to capitalise on the data they own and to generate added value from an increasing number of data sources openly available on the Web, a trend which has been coined as ‘open

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404 http://www.oreilly.com/data/free/stratasurvey.csp
405 http://blog.digital.telefonica.com/2013/12/05/open-data-intelligence/
To do so they need their employees to understand the legal and economic aspects of data-driven business development, as a prerequisite for the creation of products and services that transform open and corporate data assets into decision making insight and commercial value.

25. Surviving in the knowledge-driven economy depends on hiring data professionals who master both the technical and non-technical facets of data science, from big data technology and data-driven storytelling, to new data monetisation and innovation models. The challenge for managers is thus to identify and prioritise their knowledge gaps in this rapidly evolving and to some extent interdisciplinary field, secure new data science talent and train existing staff to be proficient data practitioners and entrepreneurs.

5: How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

26. Making learners aware of change and creating excitement about the opportunities and benefits digital technologies present – both in their personal and work lives – is necessary. The way Gen Y embraced the internet is an encouraging indication of how new technologies can excite people and lead them to think in many different ways.

27. Educators should aim to provide the core knowledge and tools needed to understand the opportunities and then encourage students to experiment and test out new ideas. Digital technologies come and go, but much can be done to develop a person’s digital mind set, changing and developing the ways they learn, their approach to experimentation and their flexibility to take on roles in the future that may not yet exist – all aspects of employability.

28. Higher education institutions share significant responsibility in the development of employability skills, including digital skills. A coherent holistic approach is needed. The OU, as part of its student employability policy, has embedded the seven CBI/UUK employability skills, including the application of information technology, across its entire undergraduate curriculum.

29. The archaic model of pre-work education setting a person up for life, with a minimum of Continuing Professional Development, no longer suffices. Through-life learning and adaptation should become the norm, rather than an interesting possible paradigm. Models of pedagogy and crucially andragogy will need to change to reflect the pace of technology and process development.

30. Uniquely in the higher education sector, the OU has a strong focus on digital skills. It is the leading online university in the world, with over 200,000 students, which through its supported open learning model delivers digital skills via digital means – a transformation of the supply side away from traditional campus-based delivery. Through the very act of learning, OU students develop their digital fluency, and their aptitude for assimilating and analysing information from digital sources.

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406 http://okfn.org/opendata/
408 http://www.universitiesuk.ac.uk/highereducation/Documents/2009/FutureFit.PDF
31. The University’s Learning & Teaching Strategy includes an institution-wide approach to digital and information literacy skills acquisition, including a Digital Information Literacy framework which focuses on developing a digital information mind set as well as promoting the creation and sharing of digital content (Being Digital). Because OU learning takes place online, this can be developed in context, with an increasing focus on peer supported learning and collaboration.

32. In terms of inspiring learners, there is an important role for free informal learning (which inspires many to become formal learners). New flexible models of curriculum delivery can engage people in a wide range of informal learning opportunities. These include hundreds of thousands of hours of open educational resources (OERs) published on the OU’s OpenLearn platform and syndicated out to OU channels on YouTube, Bibblio, AudioBoo and iTunes U; in addition, the development of Massive Open Online Courses (MOOCs) and Badged Open Courses (BOCs).

33. OU research indicates that informal online learners are keen to have their learning achievements recognised. One option shortly to be launched by the University is to award digital ‘badges’ (or ‘soft accreditation’) as evidence of skills and achievements. In 2013 the OU piloted badging as a way of motivating learners in various free online learning environments. The approach was successful and led to the creation of a suite of free Badged Open Courses on OpenLearn that focus on employability and skills development.

7: How can the education system develop creativity and social skills more effectively?

34. The current education system is based on exam achievement and qualifications. Yet arguably to develop social skills, creativity and enterprise, students need to be encouraged to experiment, to try new ideas and to be prepared to fail and learn from such failings. Introducing programmes to spark creative thinking and enterprise around a scheme of new technology and business would help to encourage students invent and develop new ideas. Past successes such as ‘Start a business with a Tenner’ show that imaginative programmes can be adopted easily, and get students thinking in new ways, developing new skillsets and confidence.

Short- and medium-term support to the digital sector

9: How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

35. The digital sector could be helped by improving the overall understanding of the sector and by showcasing opportunities in it. Many people, both young and mature, are unaware of the opportunities and challenges created by new technology or have only a shallow understanding of them. There is an important role for universities in structuring and contextualising learning pathways and relating these to careers.

36. A recent survey commissioned by FutureLearn identifies a learning gap between school and university study that could be bridged with free online courses, so inspiring

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[^409]: http://www.open.ac.uk/libraryservices/beingdigital/
[^410]: http://www.open.edu/openlearn/
[^411]: http://oro.open.ac.uk/40480/
[^412]: The UK platform for MOOCs. See: https://www.futurelearn.com/
independent learning. The survey polled 1,000 16 to 18-year-olds about their aspirations for university and beyond and found coding and software development were favoured careers (23% expressed an interest in a career in coding)\(^\text{413}\). Free, open programmes/courses, as offered by OpenLearn or FutureLearn, can plug the gap.

37. An example is the newly launched MOOC on cyber security\(^\text{414}\) developed with Government support by The Open University and available on FutureLearn. The course is designed to inspire and educate the next generation of cyber security professionals and has been developed in conjunction with the Department for Business, Innovation and Skills and a range of government departments and agencies, including the Cabinet Office and GCHQ.

38. The digital sector can also be supported in a more direct way through development of broad-ranging, long-term relationships between universities and industry groups, allowing detailed mutual understanding and trust to develop. One such example is the relationship between the OU’s Department of Computing & Communications and digital industries in Manchester and the North West.

Digital industries in Manchester and the North West

Digital industries typically comprise SME and microenterprises which individually may find it difficult to sustain collaboration with universities. For the past five years, the OU has worked successfully with Manchester Digital (MD), a trade association for the sector in Manchester and the North West.

OU students tend to be part-time and already have experience in work, potentially making them attractive to employers. Our relationship with MD has made the sector aware of OU students as potential employees and our students aware of, and prepared for, opportunities afforded by the sector.

The long-term engagement with MD and its members has deepened the University’s understanding of the sector’s skills requirements, enabling us to develop these in our students and maximise employability. It has also brought opportunities for collaboration with other HEIs and other institutions in supporting the sector. Interpretation of ‘skills’ and ‘employability’ is necessarily broad, with support including joint industry/academic talks (professional development), improved preparation of students for work in the sector, improved relevance of curriculum to industrial needs and collaborative R&D which contributes to the development of employers’ high-level and strategic skills.

39. In the medium term, there is a need for new, collaborative models of learning and teaching in areas such as data science, models that can deliver at scale and bring international perspectives. As an example, the OU is working towards a European Data Science Academy (EDSA)\(^\text{415}\) in a joint venture with eight other EU partners (including the University of Southampton and the Open Data Institute here in the UK). As part of the EDSA research programme, the consortium notes that there are only 17 UK universities that offer data science learning modules currently at a masters or doctoral teaching programme level. Through its research work, EDSA is planning provision of over 60 data science learning

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\(^{413}\) http://universitybusiness.co.uk/News/learning_gap_between_schools_and_he


\(^{415}\) http://edsa-project.eu/
modules at all levels, to include learners who may be technologists, business professionals, managers, analysts or journalists.

11: Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

40. There is a particularly wide digital skills gap for the disadvantaged. Provision of accessible and affordable learning opportunities will encourage groups with protected characteristics to participate. Such education needs to be reflective of learners’ needs, interests and concerns to achieve successful engagement.

41. Part-time learning is part of the solution here, particularly as it enables people to earn while they learn. The OU has a suite of ‘access’ courses aimed at those who may have no prior educational qualifications. These prepare learners for undergraduate study by building study confidence, developing studentship skills in those who may not have studied for a long time, and providing a low risk entry to higher education for those from the most disadvantaged communities.

42. The OU has found that lack of confidence and competence in digital learning is not confined to older learners – a minority of younger students may be users of social media yet are not capable digital learners.

43. In designing its access programme, the OU chose not to assume students would be digitally literate or even have a computer. The modules take a gradual trajectory, preparing students to gain confidence as digital learners. There are no online elements for the first eight weeks of the 30-week courses. Students can submit their first piece of coursework in hard copy but gradually they are introduced to the electronic system we use to access online materials, and to undertaking interactive computer-marked assignments. Engagement with online forums is not compulsory but by the end of their module, students have the digital skills necessary to learn in today’s online world (this aspect of the module design has been seen as very successful by our external advisor and our external examiners, and in learner responses to the OU’s Student Experience on a Module survey).

44. In North and Mid Wales, as a pilot exercise, the OU has employed ‘OpenLearn Champions’ successfully to encourage people from disadvantaged backgrounds to start their learning by using OpenLearn’s free content. A March 2014 report by the Online Digital Learning Group, commissioned by the Welsh Government, recommended the approach be extended across Wales.\(^{416}\)

45. Women employees are a group that can also benefit from learning digital skills in the workplace through supported online learning. One powerful example relates to Health Care Assistants (HCAs), many of whom are women. HCAs perform a crucial role in the NHS – the

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staff banding they fall within (bands 1–4) delivers 60 per cent of the care patients receive\textsuperscript{417} and represents 40\% (480,000)\textsuperscript{418} of the total NHS workforce.

46. Milton Keynes Hospital NHS Foundation Trust is collaborating with the OU’s Department of Nursing to provide learning opportunities for the hospital’s HCAs, ensuring that these important frontline personnel are able to develop and improve their ICT skills in the process of learning other skills relevant to their role (dementia and end of life care).

<table>
<thead>
<tr>
<th>Health Care Assistants in Milton Keynes</th>
</tr>
</thead>
<tbody>
<tr>
<td>When we put a cohort of nearly 50 HCAs through the OU module in dementia care last year a key driver for us was to raise their IT and digital literacy skills. Each week 10 computer terminals in the hospital library were booked out to them and, with a librarian, they were supported to access the course. Supporting them in this way was very important in building their confidence, given at the start some didn’t have their own email address and had relied on others to access digital information for them. The transformation in their confidence and IT skills has been phenomenal and our HCAs are very proud to be dementia champions.</td>
</tr>
<tr>
<td>Jane Naish, Deputy Chief Nurse, Milton Keynes Hospital NHS Foundation Trust</td>
</tr>
</tbody>
</table>

47. For learners who have a disability, a long-term health condition, a mental health difficulty or a specific learning difficulty (such as dyslexia), online learning environments can be much more accessible than traditional campus-based universities. The OU has 20,000 disabled students who benefit from its flexible supported open learning approach. They can learn wherever they are and at a time that suits them, using high quality multimedia materials and supported by a tutor who keeps in touch by phone or online.

\textbf{Industry}

14: \textit{How can businesses help equip the workforce with new skills in a rapidly changing environment?}

48. There needs to be a mechanism in place to ensure that market demand from companies and organisations is fed back to universities, so helping to drive development of courses and programmes that provide the digital skills needed. Key to achieving this for the OU is having a commercial team that can build relationships with organisations in the market, understand their learning and development needs, and feed these back to the University. Fostering these relationships and connections in HEIs is essential to ensure that digital skills courses and qualifications meet the needs of organisations – developing skills at a sector level, as well as developing digital literacy more generally.

49. Individual businesses or industry trade groups can work with education providers to develop and support training programmes which are focused on their particular objectives.

\textsuperscript{417} Health Education England ‘Talent for Care’ consultation, 2014
\textsuperscript{418} NHS Workforce Statistics, May 2014
The Open University partnership with Innovate Finance

The OU is working with IF members to develop a commercial 50-hour online course aimed at educating finance sector employees to build understanding of the impact of new technologies such as mobile banking on the financial sector as a whole.

One example of this type of partnership is the OU’s work with Innovate Finance (IF), the recently launched industrial group for the emerging financial technology (FinTech) sector. The OU, working with financial partners, is building a series of commercially viable courses on financial technology to educate the sector’s employees and ensure the UK FinTech sector remains highly competitive within the global market.

50. Government support and encouragement of this and similar programmes across all the industrial sectors it has identified as priorities would speed up the UK’s readiness to exploit opportunities offered by new technologies, both domestically and for export markets.

Infrastructure

15: Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

51. The digital skills gap affects all countries. Those that are able to address this most quickly and effectively will be those that are able to take a leadership position and maximise economic growth. In the UK, this growth will not merely arise as the result of successful implementation within the UK. Achieving a global, exportable leadership position in education and training for this digital skills revolution will deliver a wider market and create a short, mid and longer term sustainable force for economic growth.

5 September 2014

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419 http://innovatefinance.com/
Organisation for Economic Co-operation and Development – Written evidence (DSC0016)

Summary

- English adults perform near the OECD average for problem solving in technology-rich environments, but adults in Northern Ireland score significantly below average.
- Performance of young adults in problem solving in technology-rich environments is considerably lower in England and Northern Ireland than in many other countries, raising concerns about the skills of the future workforce.
- Access to information and communication technologies is widespread in the United Kingdom, with above-average use in England but below-average use in Northern Ireland outside of work.
- In England and Northern Ireland, individual characteristics such as education and gender have a stronger relationship with proficiency in problem solving in technology-rich environments than in other countries.
- Higher performance in problem solving in technology-rich environments is associated with higher employment and wages, especially in England.

Data sources

The submission is based on the OECD Survey of Adult Skills (PIAAC) which provides a picture of adults’ proficiency in literacy, numeracy, and problem solving in technology-rich environments. This submission focuses on performance in problem solving and the use of information and communications technology in everyday life and at work. Problem solving in technology-rich environments is defined as the capacity to access, interpret and analyse information found, transformed and communicated in digital environments.

Proficiency is described in terms of a scale of 500 points divided into levels. Each level summarises what a person with a particular score can do. Four proficiency levels are defined for problem solving in technology-rich environments (Levels 1 through 3 plus below Level 1). See page 9 for detailed descriptions of the levels.

The survey also provides a rich array of information regarding respondents’ use of skills at work and in everyday life, their education, their linguistic and social backgrounds, their participation in the labour market and other aspects of their well-being.

The Survey of Adult Skills was conducted in England and Northern Ireland from August 2011 to April 2012.
A total of 8,892 adults aged 16 to 65 were surveyed.

English adults perform near the OECD average in problem solving in technology-rich environments, but adults in Northern Ireland score significantly below average.

Across the countries participating in the Survey of Adult Skills, 34.0% of 16-65 year-olds are in proficiency Levels 2 and 3 in problem solving in technology-rich environments, the highest
levels (Figure 1). The rate is similar in England, at 35.0%, but it is well below average in Northern Ireland, at 28.7%. The proportions in both England and Northern Ireland are significantly less than the proportions seen in the Nordic countries (Sweden is at 44.0%), the Netherlands (41.5%), Australia (38.0%), and Canada (36.6%). However, England performs significantly better than Austria (32.5%), the United States (31.1%), and Korea (30.4%).

### Figure 1
Problem solving proficiency and computer experience

<table>
<thead>
<tr>
<th>Country</th>
<th>High levels of proficiency (Levels 2 and 3)</th>
<th>No computer experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td></td>
<td></td>
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<tr>
<td>Finland</td>
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<tr>
<td>Netherlands</td>
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<tr>
<td>Norway</td>
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<tr>
<td>Denmark</td>
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<td>Australia</td>
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<tr>
<td>Canada</td>
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<tr>
<td>Germany</td>
<td></td>
<td></td>
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<tr>
<td>England</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flanders (Belgium)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
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<tr>
<td>Czech Republic</td>
<td></td>
<td></td>
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<tr>
<td>Austria</td>
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<tr>
<td>United States</td>
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<tr>
<td>Korea</td>
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<tr>
<td>Northern Ireland</td>
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<tr>
<td>Estonia</td>
<td></td>
<td></td>
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<tr>
<td>Russian Federation</td>
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<tr>
<td>Slovak Republic</td>
<td></td>
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<tr>
<td>Ireland</td>
<td></td>
<td></td>
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<tr>
<td>Poland</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Countries are ranked in descending order of the percentage of adults scoring at Level 2 and 3

Source: Survey of Adult Skills (PIAAC) (2012), TabB2.1

In England, performance relative to the OECD average is somewhat better for problem solving in technology-rich environments than it is for literacy and numeracy. England performs just above the OECD average in problem solving, at the average in literacy and below the average in numeracy. Northern Ireland performs below the OECD average in all three domains.
A relatively small proportion of adults in England report **no computer experience** – only 4.1% compared to an average across participating OECD countries of 9.3%. In Northern Ireland, the proportion of adults without computer experience is slightly greater than average – 10.0%.

**Performance of young adults in problem solving in technology-rich environments is considerably lower in England and Northern Ireland than in many other countries, raising concerns about the skills of the future workforce**

In both England and Northern Ireland, the proficiency in problem solving in technology-rich environments of the youngest group of adults – aged 16-24 – is markedly lower than the average across other countries. For 16-24 year olds, the probability of being in proficiency Levels 2 and 3 in problem solving is 42.3% in England and 44.2% in Northern Ireland, compared to an average across countries of 50.7% (Figure 2). In comparison, high-performing countries have much larger shares of young adults in top proficiency levels – 63.4% in Korea, 61.9% in Finland, and 61.7% in Sweden.

This comparison highlights concerns for future global competitiveness in skills that England and Northern Ireland will need to address. The proficiency in problem solving in technology-rich environments of young adults is crucial, as this group reflects the skills of the future workforce in an economy that is increasingly technologically demanding.

The shortfall in the skills of young adults with respect to problem solving in technology-rich environments is not an isolated deficit. A skills gap is also seen in literacy and numeracy. In both England and Northern Ireland, the literacy and numeracy scores of young adults fall well below the OECD average for young adults.

The higher-than-average performance of England in problem solving in technology-rich environments comes from the higher performance of the older portion of the population. For example, the oldest group of adults in the survey – aged 55-65 – had a 17.6% probability of being in proficiency Levels 2 and 3, compared to the OECD average of 11.7 % for this age group. As a result, the gap between younger and older adults in England and Northern Ireland is smaller than the average for other countries.
Access to information and communication technologies is widespread in the United Kingdom, with above-average use in England but below-average use in Northern Ireland outside of work.

**Access** to information and communication technologies is common in the United Kingdom. In 2013, 82.6% of households had a computer at home, well above the OECD average of 73.8%. Both figures have increased by over 12 percentage points since 2005. The proportion of households with access to the internet is not quite as high, but it is still
substantial: 69.5% in the United Kingdom in 2009, above the OECD average of 62.9%. Although the figures for the United Kingdom are higher than the OECD average, they are substantially lower than the countries with the highest levels of internet access – by comparison, 97.5% of Korean households and 82.6% of Swedish and Norwegian households are connected to the internet. [OECD, ICT database and Eurostat, Community Survey on ICT usage in households and by individuals, November 2011.]

In everyday life, use of information and communication technologies is higher than average in England and lower than average in Northern Ireland. For example, 77.0% of English adults use email at least monthly, compared to 71.7% on average across countries (Figure 3). For Northern Ireland, the figure is only 63.6%. Similarly, 70.3% of English adults use the internet at least monthly to better understand issues, compared to 68.7% on average across countries. For Northern Ireland, the figure is 58.2%.

The situation for use of information and communication technologies at work is more favourable, with both England and Northern Ireland using them more frequently than the average. For example, 45.8% of workers in England and 39.7% of workers in Northern Ireland use spreadsheet programmes on at least a monthly basis, compared to an average of 38.9% across countries. Similarly, 54.7% of workers in England and 48.9% of workers in Northern Ireland use word processing programmes on at least a monthly basis, compared to 47.8% on average.

The lower rate of use of information and communication technologies in Northern Ireland is likely to at least partly explain the below-average performance in problem solving in technology-rich environments in the region. The Survey of Adult Skills found that use of information and communication technologies is strongly associated with proficiency in problem solving in technology-rich environments.

Source: Survey of Adult Skills (PIAAC) (2012), Tables 2.4a and 4.2d
In England and Northern Ireland, individual characteristics such as education and gender have a stronger relationship with proficiency in problem solving in technology-rich environments than in other countries.

In all countries, a number of individual characteristics – such as education and gender – have a strong relationship with proficiency in problem solving in technology-rich environments. These relationships are even larger in England and Northern Ireland than in many other countries, raising questions about possible inequalities in the opportunities for developing problem solving proficiency.

With respect to education, there is a large gap between adults with low and high education in the proportion who have proficiency Levels 2 or 3 in problem solving in technology-rich environments. This gap primarily reflects the below-average performance of adults with low education. While 19.0% of adults with lower than upper secondary education attain proficiency Levels 2 or 3 across participating countries, the figures are only 10.1% for England and 7.5% for Northern Ireland (Figure 4). For adults with tertiary education, the figures are closer to the average across OECD countries of 51.8% scoring at proficiency Levels 2 or 3, with England slightly higher (53.5%) and Northern Ireland slightly lower (49.4%). This performance for adults with tertiary education is well below that of high-performing countries, such as Sweden (62.1%) and the Netherlands (63.8%).

A relatively small proportion of English adults with lower than upper secondary education do not have computer experience – 11.1% compared to an average of 22.2% across countries; in Northern Ireland, this figure is slightly above average, at 23.1%.

**Figure 4**

Problem solving proficiency and computer experience, by educational attainment

Percentage of adults scoring high in proficiency in problem solving in technology-rich environments and not having computer experience

<table>
<thead>
<tr>
<th></th>
<th>Tertiary</th>
<th>Lower than upper secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>High levels of proficiency (Levels 2 and 3)</td>
<td>England</td>
<td>Average</td>
</tr>
<tr>
<td>60</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>No computer experience</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Survey of Adult Skills (PIAAC)(2012), Tables 3.4a and 3.4b*

With respect to gender, England and Northern Ireland show one of the largest gaps across countries related to performance in problem solving in technology-rich environments. In
both countries, men have a higher probability than women of being in proficiency Levels 2 or 3 in problem solving, with a gap in England of 8.2 percentage points and in Northern Ireland of 8.8 percentage points (Figure 5). The average gender gap in problem solving proficiency across participating countries is 4.7 percentage points, and in some countries is less than 2 percentage points (Australia, Canada, Estonia and the Slovak Republic).

England has similar proportions of men and women reporting no computer experience – 3.9% and 4.3%, respectively; this gap is smaller than the average across countries, where 8.9% of men and 9.7% of women lack computer experience. A higher fraction of adults in Northern Ireland have no computer experience, though the gender gap is smaller – at 10.0% for men and 10.1% for women.

Higher performance in problem solving in technology-rich environments is associated with higher employment and wages, especially in England

In general, proficiency in problem solving in technology-rich environments is associated with higher labour force participation and lower probabilities of unemployment. In England, these associations are particularly large. Across countries, adults with proficiency Levels 2 or 3 in problem solving have a probability of participating in the labour force of 80.8%, compared to a rate of 46.8% for adults with no computer experience, for a gap of 34.0 percentage points. The corresponding labour force participation gap for Northern Ireland is quite similar – 34.5 percentage points – but for England it is 44.6 percentage points.

There is a similar difference in the relationship of proficiency in problem solving in technology-rich environments with the probability of being unemployed. Across countries, labour force participants with proficiency Levels 2 or 3 in problem solving have a probability of being unemployed of 5.4%, compared to a rate of 9.4% for labour force participants with no computer experience. This results in a gap of 4.0 percentage points. The corresponding unemployment gap for Northern Ireland is 3.5 percentage points, but the gap for England is 7.8 percentage points.
Proficiency in problem solving in technology-rich environments is also associated with higher wages in general across countries and shows a more extreme relationship in England. For example, across participating countries, 55.4% of workers in proficiency Levels 2 or 3 in problem solving are in the highest wage decile (above the 90th percentile), and the proportion for Northern Ireland is similar at 52.1%. In England, by contrast, workers in proficiency Levels 2 or 3 are much more concentrated in the highest wage decile, with 72.4% of workers with high problem solving proficiency earning above the 90th percentile.

Key facts about the Survey of Adult Skills (PIAAC)

What is assessed

- The Survey of Adult Skills (PIAAC) assesses the proficiency of adults from age 16 onwards in literacy, numeracy and problem solving in technology-rich environments. These skills are “key information-processing competencies” that are relevant to adults in many social contexts and work situations, and necessary for fully integrating and participating in the labour market, education and training, and social and civic life.
- In addition, the survey collects a range of information on the reading- and numeracy-related activities of respondents, the use of information and communication technologies at work and in everyday life, and on a range of generic skills, such as collaborating with others and organising one’s time, required of individuals in their work. Respondents are also asked whether their skills and qualifications match their work requirements and whether they have autonomy over key aspects of their work.

Methods

- Around 166 000 adults aged 16-65 were surveyed in 24 countries and sub-national regions: 22 OECD member countries – Australia, Austria, Belgium (Flanders), Canada, the Czech Republic, Denmark, Estonia, Finland, France, Norway, Ireland, Italy, Japan, Korea, the Netherlands, Norway, Poland, the Slovak Republic, Spain, Sweden, the United Kingdom (England and Northern Ireland), and the United States; and two partner countries – Cyprus** and the Russian Federation.
- Data collection for the Survey of Adult Skills took place from 1 August 2011 to 31 March 2012 in most participating countries. In Canada, data collection took place from November 2011 to June 2012; and France collected data from September to November 2012.
- The language of assessment was the official language or languages of each participating country. In some countries, the assessment was also conducted in widely spoken minority or regional languages.
- Two components of the assessment were optional: the assessment of problem solving in technology-rich environments and the assessment of reading components. Twenty of the 24 participating countries administered the problem-solving assessment and 21 administered the reading components assessment.
- The target population for the survey was the non-institutionalised population, aged 16 to 65 years, residing in the country at the time of data collection, irrespective of nationality, citizenship or language status.
- Sample sizes depended primarily on the number of cognitive domains assessed and the number of languages in which the assessment was administered. Some countries boosted sample sizes in order to have reliable estimates of proficiency for the residents.
of particular geographical regions and/or for certain sub-groups of the population such as indigenous inhabitants or immigrants. The achieved samples ranged from a minimum of approximately 4,500 to a maximum of nearly 27,300.

- The survey was administered under the supervision of trained interviewers either in the respondent’s home or in a location agreed between the respondent and the interviewer. The background questionnaire was administered in Computer-Aided Personal Interview format by the interviewer. Depending on the situation of the respondent, the time taken to complete the questionnaire ranged between 30 and 45 minutes.

- After having answered the background questionnaire, the respondent completed the assessment either on a laptop computer or by completing a paper version using printed test booklets, depending on their computer skills. Respondents could take as much or as little time as needed to complete the assessment. On average, the respondents took 50 minutes to complete the cognitive assessment.

**A. Note by Turkey**
The information in this document with reference to “Cyprus” relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the “Cyprus issue”.

**B. Note by all the European Union Member States of the OECD and the European Union**
The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.
<table>
<thead>
<tr>
<th>Level</th>
<th>Score range</th>
<th>The types of tasks completed successfully at each level of proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>No computer experience</td>
<td>Not applicable</td>
<td>Adults in this category reported having no prior computer experience; therefore, they did not take part in the computer-based assessment but took the paper-based version of the assessment, which does not include the problem solving in technology-rich environment domain.</td>
</tr>
<tr>
<td>Failed core test in information and communication technologies</td>
<td>Not applicable</td>
<td>Adults in this category had prior computer experience but failed the core test in information and communication technologies, which assesses basic computer skills, such as the capacity to use a mouse or scroll through a web page, needed to take the computer-based assessment. Therefore, they did not take part in the computer-based assessment, but took the paper-based version of the assessment, which does not include the problem solving in technology-rich environment domain.</td>
</tr>
<tr>
<td>“Opted out” of taking computer-based assessment</td>
<td>Not applicable</td>
<td>Adults in this category opted to take the paper-based assessment without first taking the core test in information and communication technologies, even if they reported some prior experience with computers. They also did not take part in the computer-based assessment, but took the paper-based version of the assessment, which does not include the problem solving in technology-rich environment domain.</td>
</tr>
<tr>
<td>Below Level 1</td>
<td>Below 241 points</td>
<td>Tasks are based on well-defined problems involving the use of only one function within a generic interface to meet one explicit criterion without any categorical or inferential reasoning, or transforming of information. Few steps are required and no sub-goal has to be generated.</td>
</tr>
<tr>
<td>1</td>
<td>241 to less than 291 points</td>
<td>At this level, tasks typically require the use of widely available and familiar technology applications, such as e-mail software or a web browser. There is little or no navigation required to access the information or commands required to solve the problem. The tasks involve few steps and a minimal number of operators. Only simple forms of reasoning, such as assigning items to categories, are required; there is no need to contrast or integrate information.</td>
</tr>
<tr>
<td>2</td>
<td>291 to less than 341 points</td>
<td>At this level, tasks typically require the use of both generic and more specific technology applications. For instance, the respondent may have to make use of a novel online form. Some navigation across pages and applications is required to solve the problem. The task may involve multiple steps and operators. The goal of the problem may have to be defined by the respondent, though the criteria to be met are explicit.</td>
</tr>
<tr>
<td>3</td>
<td>Equal to or higher than 341 points</td>
<td>At this level, tasks typically require the use of both generic and more specific technology applications. Some navigation across pages and applications is required to solve the problem. The task may involve multiple steps and operators. The goal of the problem may have to be defined by the respondent, and the criteria to be met may or may not be explicit. Integration and inferential reasoning may be needed to a large extent.</td>
</tr>
</tbody>
</table>

**Description of proficiency levels in problem solving in technology-rich environments**

*27 August 2014*
Organisation for Economic Co-operation and Development and European Commission – Oral evidence (QQ 221-231)

Organisation for Economic Co-operation and Development and European Commission – Oral evidence (QQ 221-231)

Transcript to be found under European Commission
Boosting the digital economy: Input to the Select Committee on Digital Skills, House of Lords, London

The OECD’s Directorate for Science, Technology and Innovation (STI) is focused on analysing and supporting new sources of growth, as well as advancing knowledge and innovation for the future. It has led the establishment of a comprehensive OECD policy framework for the digital economy, supported by influential guidelines as well as statistical definitions, classifications and methods to measure the digital economy. The OECD’s work covers a range of digital economy issues, from communication infrastructures and services, digital content, security and privacy, to consumer policy. STI’s long tradition of maintaining internationally comparable databases underpins this work with robust evidence and indicators of country performance.

This note is submitted to the Committee on Digital Skills, House of Lords, for its information regarding its inquiry “to consider information and communications technology, competitiveness and skills in the United Kingdom”. The note provides evidence and information on the importance of the digital economy to economic growth, the performance of Europe with respect to infrastructure for the digital economy, and the policy settings most conducive to fostering the digital economy.

The digital economy and economic growth

Assessing the importance of the digital economy to economic growth and performance is challenging, for several reasons. First, the Internet and ICTs are now so ubiquitous that distinguishing between the “digital economy” and the overall economy is increasingly difficult. Second, rapid change in the real world has not always been followed by countries’ statistical measurement systems, which may be unable to fully or accurately capture the impact of the digital economy on growth, productivity and other economic indicators.

New OECD work (OECD, 2014 forthcoming) provides a number of measures of the importance of the digital economy, generally defined as the information economy sector (that is, the ICT plus digital media and content industries). In the OECD, the share of this sector in total value added fell between 2000 and 2012, from around 6.1% to 5.8%. At the same time, there was a fall in the share of employment accounted for by the sector, from 3.85% to 3.68%. Nevertheless, within the sector, IT services saw their shares of value added and employment increase, while ICT manufacturing (and telecommunications to a lesser extent) saw their importance diminish as production shifted to other countries.

421 The information economy sector is defined as the aggregate combining ICT and digital media and content industries. This aggregate includes ISIC Rev. 4 Division 26 (Manufacture of computer, electronic and optical products) and Section J (Information and communication services), consisting of Divisions 58-60 (Publishing and broadcasting industries), 61 (Telecommunications), and 62-63 (Computer programming and information services). ICT trade and repair activities are also included but not considered here due to issues of data availability.
Despite the information economy sector falling in its share of value added, **ICT investment contributed between 0.2 to 0.6 percentage points per year to GDP growth** in a sample of 20 OECD countries from 2000 to 2012 (Figure 1). In fact, it contributed more to growth than investment in non-ICT capital in 9 out of 20 countries (not including the United Kingdom, whose ICT investment contribution [0.38 percentage points per year] was slightly lower than the contribution of non-ICT investment [0.42 percentage points per year]. But as ICT products (such as software) often contribute to non-ICT investment, these figures may understate the importance of ICT investment for GDP growth.

![Figure 1: Contribution of ICT and non-ICT investments to GDP growth, 2000-12](data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAAAEAAAAABCAYAAAAfS9CAAAAGAElOgAAggrAAABXJRU5ErkJggg==)

**Data source:** OECD (2014), [http://dx.doi.org/10.1787/888933148682](http://dx.doi.org/10.1787/888933148682)

In all OECD countries for which data are available, the information economy sector is more productive than the total economy (Figure 2). In other words, **the value added per person employed in the information economy sector is higher than the total economy average.** In the United Kingdom, for instance, the apparent labour productivity level in the information industries in 2012 was 144.1, compared to 90.8 for the total economy. What’s more, during the period 2009 to 2012, **in the midst of the economic crisis, the ICT sector continued to add to the net firm population,** and usually at a faster rate than for the total business economy (Figure 3). Net business population growth in the ICT sector was about 4.5% on average, compared to 1% in the business economy overall. The difference was notable in the United Kingdom, where the ICT sector saw net growth of 1.92% in its business population, versus -0.87% for the total business economy.

The **information economy sector is, however, relatively volatile with respect to its employment profile over the economic cycle.** During upturns, such as before the dotcom crisis, employment in ICT industries has typically grown faster than total employment, but it also suffers deeper swings in the downturns (Figure 4). ICT sector employment at the end of 2012 sat at around 3.7% of total employment, some way below its peak of 4.1% in 2001.
The digital sector plays a strong role in innovation, which is a key driver of economic growth and productivity. Figure 5 below shows that the information economy sector has an R&D intensity well above that of the all-industry average; this is particularly so for the ICT sector.
manufacturing sector, which invests 27% of its value added in R&D compared with, say, the machinery and electrical equipment sector, which invests 7.7% of its value added. The information economy sector’s share of total business expenditure on R&D is also substantial – 17% for ICT manufacturing, and 13.5% for information and communication services, for example. These inputs translate into a number of innovative outputs – Figure 6 for instance shows that **ICT-related patents are typically more radical than the average patent application** (where radicalness means that the patent is citing previous patents from a wide variety of patent classes outside its own – implying “newness”). And in general, patents in ICT technology classes make up around one-third of applications to main patent offices.

Looking ahead, the innovations spurred in and by the digital sector hold huge potential for boosting new growth trajectories and driving societal improvements. In particular, the rise of data-driven innovation (DDI), where large volumes of data (“big data”) from ubiquitous and interconnected applications are analysed in real time, will create new knowledge, drive value creation and foster new products, processes and markets, as well as empower autonomous machines and systems that can learn and make decisions independently of human involvement.

The opportunities from DDI are immense. The global market for “big data technology and services” alone is estimated to be USD 17 billion in 2015, up from USD 3 billion in 2010. But the biggest impact will be in the application of DDI, for instance in public administration,
health, education and research, where much more could be made of the wealth of data collected. For instance, the scope for linking clinical, biological, and other data with the massive amounts of health system transactional data can create a tremendous new resource for accelerating innovation and for better prevention and care for people with dementia and other age-related diseases. Already, second generation sequencing techniques with embedded data-mining algorithms have spurred a plunge in the costs of genome sequencing, from around USD 1 million in 2011 to less than USD 5000 in early 2014.

Infrastructure for the digital economy

A high-speed communications infrastructure is one of the building blocks of the digital economy. Yet despite improvements, European countries still have a mixed performance regarding their communications infrastructure. For instance, three out of four OECD inhabitants now have mobile wireless broadband, following a massive explosion in coverage between 2009 and 2013 (Figure 7). The United Kingdom is above the OECD average, with 77% of people subscribed to terrestrial mobile wireless. The differences among countries are still striking however, with countries such as Belgium, Germany and Portugal, among others, below the 50% penetration mark.

Figure 7: Mobile wireless broadband penetration, by technology, December 2009 and 2013 (Subscriptions per 100 inhabitants)

Source: OECD (2014), http://dx.doi.org/10.1787/888933147973

Just over one in four OECD inhabitants have fixed broadband subscriptions, mainly through DSL and cable technologies (Figure 8). The United Kingdom is again above average, with over a third of inhabitants having a fixed broadband subscription, predominantly via DSL, but there are many European countries with below-average rates (including Austria, Italy and Poland). However, in some countries access to mobile broadband has been substituting rather than complementing fixed broadband access, and people may be choosing to rely on mobile access to this technology.
Broadband speeds have also increased substantially, with subscriptions to fixed broadband at speeds greater than 10 megabytes per second now above 20% in 16 of the OECD countries. Here too Europe has a mixed performance (Figure 9). Over 30% of fixed subscribers in the United Kingdom are connected to speeds greater than 10 megabytes per second; in Italy it is less than 5%, while in France and Spain it is around 12%. Deploying fibre closer to homes is an ongoing process in many OECD countries.

Policies for the digital economy

Given the importance and opportunities of the digital sector, what policies should governments pursue? The basic building blocks of the digital economy are essentially three-fold: a high-speed communication infrastructure, as noted above; digital content; and smart Internet applications. Governments can play a role in establishing and maintaining these building blocks through their actions on framework policies, particularly competition, intellectual property regimes and skills, and on establishing digital-friendly conditions,
specifically openness and trust, the latter of which encompasses issues of security, privacy and consumer protection. Getting these policies and conditions right is ever more important as DDI becomes more widespread.

The OECD has a comprehensive policy framework on the digital economy and has also developed guidelines to help governments, including the 2011 Recommendation on Principles for Internet Policy Making developed through an active multi-stakeholder process and endorsed by all 34 Member countries and several partners, and the 2008 Seoul Declaration for the Future of the Internet Economy, also endorsed by India and Indonesia and providing a roadmap for advancing all key building blocks of the Internet economy. In July 2013 the OECD revised its privacy guidelines to address the world of data abundance that we now inhabit. Risk management, data breach notification, global interoperability, and national strategies all feature as new elements to address the change in scale evident in the volume and value of data use today. The OECD is also currently well into a multistakeholder process to update the OECD security guidelines, reflecting insights from studies conducted by the OECD of the national strategies that are emerging as cybersecurity vaults towards the top of Government agendas. These instruments all provide practical guidance for policy makers seeking to unlock the potential of the digital sector.

As DDI emerges strongly as a new source of productivity and growth opportunities, governments must pay special attention to establishing and maintaining the free flow of data across borders, a trustworthy and inclusive environment, and workforce skills and the readiness/ability of organisations to change business processes. On the latter point, there are some concerns that lower-skilled workers may bear a disproportionate share of labour market restructuring and that businesses may not be flexible enough to tap into the full potential of DDI for their activities. Governments could consider:

- **Upgrading skills through formal education institutions and vocational training**: Reaping the full benefits of data requires a sufficiently high level of analytical capabilities, but domain-specific skills and the ability to interpret and use results are just as important.

- **Protecting privacy and security**: A fear of loss of autonomy and freedom could create a backlash towards DDI. Effective protection of privacy is essential, but at the same time, there needs to be a culture of digital security risk management that does not stifle DDI to the detriment of growth and employment opportunities. Transparent public dialogue is essential, as is a good working relationship between competition, privacy and consumer protection authorities.

- **Supporting free flows of data**: An open Internet and free flows of data across national and international borders are key enablers of DDI and should be encouraged by governments. This has multiple policy elements, from supporting interconnection, to promoting investment and competition in network infrastructure, to supporting more open data regimes, to establishing effective data governance regimes.

- **Underpinning entrepreneurship**: DDI will largely be realised by entrepreneurs that spot the potential of data analytics in their organisation and beyond. However, for many organisations, the change required in culture and practices may be a barrier to fully benefitting from the opportunities of DDI. Seeking to encourage data entrepreneurs and the organisation change required could be an important role for governments.
Suggested reading


8 December 2014
Overview of OCR

1. OCR (Oxford Cambridge and RSA Examinations) is a leading UK awarding body committed to providing qualifications that engage learners of all ages in schools, colleges, training organisations, work or part-time learning programmes, to enable them to achieve and enhance their potential. We offer a wide range of general and vocational qualifications that equip learners with the knowledge and skills they need for their future.

2. We work with a range of education providers including schools, colleges, workplaces and other institutions in the public and private sector. Over 13,000 centres choose OCR A Levels, GCSEs and vocational qualifications including Cambridge Progression, Nationals and Technicals, NVQs, Functional Skills, and the components of Apprenticeships.

Response to questions on future workforce

What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

3. A wide variety of digital skills are needed, supporting a range of roles to ensure the UK is globally competitive. Whilst developers are important, not all learners will be interested in or wish to acquire the skills in development. What is important is that all learners understand the development process for digital products, the considerations and the core skills required for digital technologies such as process, logic, problem solving and testing, so whatever career path they choose they have a solid foundation which can be built upon.

How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

4. Learners are taught vocational content but are not always able to contextualise what they are learning. Contextualisation should be encouraged during delivery, where learners develop skills, examine how they can be used and then have the opportunity to apply them within context. By allowing learners to contextualise their learning (thereby also forming a good foundation of knowledge of the technologies), learners are able to develop their skills in a way where they understand how to repurpose their skills as technologies, and therefore role requirements, change and move on.

5. It could be argued that a generation of learners will shortly be coming of age who have grown up with technology and to whom digital skills are second nature. A recent Ofcom report\(^2\) highlights that the “millennium” generation are “the most technology savvy” and that young people are at their most confident in terms of using technology when they are in their teens. The report goes on to say that “this [confidence] drops gradually up to our late 50s and then falls rapidly from 60 and beyond.” We need to ensure the infrastructures are

in place to maintain and build on that confidence from a young age, and for current
workforces to learn from younger generations.

6. Schools and colleges must ensure that they have access to practitioners who understand
the sector. Delivery to learners must be able to explain the concepts and realities of careers
in the digital skills world and also relate key employability requirements for the sector. This
can be done by up-skilling teachers and can be supported by commercial experience and
input from employers. It is important that teachers have the commercial exposure to impart
to their students so that learning stays relevant. Learners should also be encouraged to use
online forums and have access to case studies about digital skills needs and how the digital
economy is evolving and the pace of technological development. It is vital that the learning
experience for digital skills is current and reflects the realities of the sector and employer
needs.

7. It is also critical that digital skills be applied across the curriculum, as they do not sit within
any single specific area. The education environment should have greater links to the world
of work that students will experience. By encouraging cross curricular delivery of digital
skills, learners will come to understand and expect digital skills in each area of their learning.
These skills acquisitions will help students be prepared for the future world of work.

8. Further and higher education establishments also have a vital role to play in providing
links to real business practice and an insight into changing job roles. One of the most
effective ways of doing this is to secure work experience in appropriate organisations. Work
experience will equip students to better understand what digital skills are, how they can be
flexibly applied and where their specialisms lie. No one learner or teacher is likely to be
specialist in all areas, and so exposure to the work place can expand learners’ horizons.

9. Education institutions must be encouraged to modernise their approach to resources,
particularly in the digital skills area. For example, fast moving areas like cyber security are
unlikely to have textbooks, as they would be out of date before they are published.

**How are schools preparing to deliver the new computing curriculum in an innovative way?**

10. Many teachers are lacking in confidence when it comes to delivering the computing
curriculum and are struggling to develop their curriculum and skills. Many are following a
scheme of work that keeps them ahead for delivery but removes any opportunity for
creativity or innovation. Creativity and innovation can only be incorporated when there is
confidence and understanding of the sector and the content.

11. It is critical that support is provided to teachers to understand the requirements of the
computing curriculum. Frequently teachers delivering computing are not computing
specialists and, in our experience, many are not IT specialists either. A large proportion of
the teaching staff delivering computing has moved into these roles from other subject areas.

12. A key component of this support must be approaches to delivery for the new curriculum.
Many teachers may assume that it is purely coding that is required. Resources for delivery
could include clear information on the scope and application of computing, case studies for
context in the business sector, which would also facilitate wider engagement for learners
and encourage a greater depth of knowledge and understanding. This may also help deliver the curriculum in an innovative way.

**How can the education system develop creativity and social skills more effectively?**

13. Creativity and social skills can be developed through cross-sector delivery and a more holistic approach to teaching, so that learners can identify their own skills and attributes relating them to working with others in a range of situations and understanding the approaches of others. This will also allow them to creatively extend ideas with their peers whilst learning how to communicate effectively as part of a team.

14. The CBI *First Steps* report recommends that there is development of a clear, widely-owned and stable statement of the outcome that all schools are asked to deliver. This should go beyond the academic, into the behaviours and attitudes schools should foster in everything they do. The report calls for the delivery of these outcomes to be formally stewarded by Ofsted (and equivalent bodies) in order to cover both the academic and behavioural development, and the use of these findings to be used for the assessment of schools rather than exam league tables.

15. This system would recognise that social skills, character, resilience and mental toughness are essential to progress in life and work and would allow the learning time to focus on this. It would recognise and encourage young people to develop the attributes (good manners, resilience, tenacity, working independently, enthusiasm, confidence, ambition, respect) which enable them to take positive learning from failures experienced.

16. These steps have begun to be embedded within OCR’s approach to our qualifications, but we believe there needs to be an educational shift, such as the views supported by the CBI, to be implemented fully in order for these wider benefits to be properly realised.

**How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?**

Due to a lack of understanding of the sector by many deliverers, they are not able to communicate the opportunities (real or potential) for learners in the developing digital world. There is a need for employers to actively engage with learners. This will provide an insight into the digital employment sector for a range of roles explaining the need for skills both sector specific and transferrable within their organisation.

*19 August 2014*
Pera Training and Digital Youth Academy – Written evidence (DSC0029)

Pera Training and Digital Youth Academy – Written evidence (DSC0029)
Submission to be found under Digital Youth Academy
Key Points:

(a) Discussions in this area are frequently subject to misunderstandings due to different knowledge and interpretation of the scope of the subject and the character of different parts of it. Most particularly, but not solely, there is widespread conflation of ICT and computing. The changes in the school curriculum (changing the title and a substantial change in content) will unfortunately not lead to greater understanding of their different purposes and characters.

(b) University courses in the area of computing vary widely both in content and the way they relate to employment needs.

(c) The range of specific employer recruitment desires is so broad and diverse that HE course designers inevitably see their task as to focus on general principles rather than training for specific jobs, and particular technologies.

(d) Some employers expect graduates to be essentially 'job ready' with little if any need for technical training in their specifics. Generally this is an unrealistic desire. There seems to be no solution other than employers taking on more of this burden.

(e) Employers need to express clearly what they see as being their skills gap. Sometime it relates to specific technical expertise but sometimes it seems to relate to more general issues such as English, Mathematics or personal or professional skills. Different aspects will probably require different solutions.

(f) The revised National Curriculum in computing has been introduced with very little notice. This is requiring many teachers (particularly many primary teachers and ICT teachers) to learn completely novel concepts in computing. This is very challenging for many of those staff and to expect them to become comfortable and confident with the ideas and to develop exciting, engaging schemes of work in the time available was totally unrealistic. There is a serious risk that many pupils will experience computing in a way which they find off-putting, uninteresting and alienating. This forms a serious risk to even maintaining the current level of supply of computing skills. Many teachers need more time.

(g) IT suffers from a long-term image 'problem'. It is often seen as a profession for social isolates. However most roles require team working and many roles have aspects which are externally-facing. A more accurate image would make IT more appealing to potential recruits.

(h) Computing should be routinely treated as a STEM (Science, Technology, Engineering and Mathematics) subject, in the context of Government and Government-funded initiatives. Not only does its content draw on all four areas, but such support would assist computing in rebuilding its image and public profile, benefiting recruitment.
Introduction:
1. After some introductory and general paragraphs, I have structured my evidence around some of the questions posed in the Call.

2. This is a personal submission and may not reflect the views of my department or institution.

3. This submission is largely based on evidence collected as part of a 3-year PhD study (2010-2013) into why pupils choose to study computing at university. It therefore largely focused on technical computing but did draw on some evidence related to broader-based, more general digital skills. It was an interpretive, rather than quantitative, study designed to gain an understanding of the issues at play for research participants. I amassed an evidence base of 100 hours of interviews, with 29 students, 13 school pupils and 19 computing lecturers, from a range of types of universities. My research was additionally supported by experience gained over 25 years, working as a computing lecturer in Higher Education.

4. My evidence relates dominantly to the development of digital skills but my research did draw some conclusions about employment matters.

Terminology:
5. I shall use the term 'pupil' to refer to youngsters studying pre age 18, typically in schools, and 'student' to refer to older learners, often studying in universities. I shall use ICT to refer to the school subject, only. I will clarify the use of the term 'computing'. Sometimes it will refer to the whole discipline area and sometime a course of that title, which will tend to deal with a subset of concepts from the discipline (and might alternatively be called Computer Science, for example).

6. Terminology is used inconsistently in debates of this area and often leads to misunderstanding and misperceptions. Most particularly it is important to distinguish between areas of computing which are of broad population-wide relevance and those which are specialist, typically highly technical, and of niche relevance in employment. However there is a spectrum of positions and employment needs between these extremes.

7. Recent research\(^{423}\) has usefully distinguished three types of computing activity: user, designer and professional user. The latter are people who are skilled at installing, configuration and problem solving within computer systems. These are often the technicians who know the intricacies of hardware and software, and understand their foibles. Outsiders to computing often see these as being the computer experts, whilst the essential role of the designer and developer of new systems can be invisible externally. By contrast staff who design and develop systems are more likely to see these skills merely as useful adjuncts to their core activities (see also §27). In terms of discussing the skills crisis some such categorisation of activities may help to reduce potential for misunderstanding and misinterpretation.

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School provision:
8. The recent Royal Society report\textsuperscript{424} made a similar point in their investigation of computing in schools, referring the confusion between ICT and computing (see also §27). To address this they proposed that the school curriculum be changed so that three distinct subjects were delivered: digital literacy, IT and computer science (their recommendation #1). It is unfortunate that the changes currently being implemented do not follow that model but introduce a single subject called Computing. Most particularly (i) the revised curriculum does not clearly separate technical Computer Science (or Computing) from the more general and business-facing ICT (or IT) skills and (ii) the revised curriculum is heavily biased towards the former, despite the latter being more widely applicable, although significant change was needed. There are reasons to be seriously concerned about the implementation and impact of these changes (see §18).

University Courses:
9. University computing courses vary widely. Some deal with a specialist sub-area, such as Games Programming, but many have a title such as Computing or Computer Science. However the content within these courses is hugely variable. Some are very abstract and deal with the theoretical underpinnings - they are essentially applied mathematics - whilst others, although varying in the extent to which they consider theory, are much more practical and of broader direct vocational relevance. However even across that spectrum degree courses vary a lot in their content (and the options available to students).

10. Institutions vary widely as to the technologies they adopt and have available for students. This, of course, influences the specific skills which students develop. (Whilst I am particularly referring here to specialist resources, there is no commonality of provision. Even at the most basic of levels, not all institutions provide Windows and Microsoft Office but provide one of the many alternatives.) (See §13)

11. My research confirmed that some institutions struggle to provide resources which academics feel are adequate for their students. This refers to facilities which are not as up-to-date as they would like or may be rather obscure. Some academics spoke about being only able to use specialist software which was available for free in their teaching. Some manufacturers provide institutions with software at highly discounted rates. However this does not remove all the barriers to its uptake: some budget is still required for the purchase; adequate hardware is needed (in sufficient volume); staff require the time and opportunity for the necessary training and to develop their expertise; software needs to make the relevant learning points evident to students (it needs to fit the adopted pedagogy) and lastly many academics are uncomfortable about tying students into particular manufacturer’s products but see their role as developing generic, transferable understandings.

Future workforce (supply chain) – Question 4:
12. The purpose of a university education is central to this discussion. Universities are mostly very conscious that their students need to secure employment on graduation.

However they tend to see their role as providing an education (rather than specific training) which develops students' understanding of their discipline in a manner that will support them throughout their career, helping them in their learning and development as needs (and technologies) change. This requires students to understand principles, many of which have endured through decades of change and development in computing. Learning and becoming skilled with particular technologies must be built on that principle, if the graduate is going to be able to adapt in the future. This seems to be the only sustainable position.

13. Some part of the reason for the computing skills gap is that some employers seek to recruit people (both new graduates and others) who are 'job ready' and can undertake their role almost immediately. In addition, some job advertisements are highly specific as to the precise skills and knowledge being sought. (In the past, say 20 years ago, this practice was probably even more prevalent than it is now. However there was probably a less diverse range of technologies being used in industry then so there was more chance that a particular candidate would fit the specified profile.) For example, an advertisement for an unpaid internship specified that candidates should have "a fairly good working knowledge of XHTML, CSS and in particular PHP and Object Orientated programming – some experience with WordPress is also required." XHTML and CSS are fairly generic technologies so specifying them would not be particularly excluding. However, whilst PHP and WordPress are quite common technologies, there are many alternatives in use. For example we do not teach these at Coventry University: our students would mostly not be eligible to even apply for this post. We do teach equivalent technologies though and, given some training, our students might well suit this post (see §16). Similar situations are quite common for early career professional posts, as well as more senior technical roles.

14. Whilst some employers do a lot of staff development there is a real tension for some computing employees as to how they can stay up-to-date, both for the benefit of their current employer and to allow them to remain employable. This problem is of a different order of magnitude when considering learning how to use the latest version of some product (say a new version of Windows); how to use an alternative product to one which is familiar (say different web-development or database software); and how to get to grips with some new way of dealing with, and thinking about, a situation (such as the paradigm shift which occurred when Object Orientated programming languages or client-server web technologies emerged). Some employees are able and willing to take responsibility for this – although access to the necessary resources can be an impenetrable barrier – but I do wonder if some employers should not be doing more, for the long-term benefit of the industry overall (see also §16).

15. One of the main skills gaps relates to computer programming (see also §30). The new National Curriculum will ensure all affected pupils experience some programming, so the available skills in this area may improve over time (but see §18). Programming languages vary in how hard they are to learn and, like foreign languages, some people find them easier to learn than others. However they also vary in their power and usefulness: some contain many complex ideas whilst some are quite small. As well as understanding the concepts used by the language the learner must develop their abilities in how to employ them to achieve the required effects. This takes much time, practice and patience. Some people find this pleasurable but some do not.
16. There are some general concepts which almost all programming languages employ and thus there is a degree of skills transferability between languages. However this depends on the similarity between them, as well as the confidence and experience of the learners. Some transfers are almost trivial; others require a substantial effort and time. The new Curriculum will expose pupils to programming, along with other core ideas central to computing. Universities can endeavour to teach students so they become competent. However a degree does not allow time for the development of sophisticated use of more than one language. As mentioned (§14), employers probably need to do more in supporting this skills development – and this is likely to remain the case even when the Curriculum is fully implemented. There seems to be no other real solution to skills supply.

17. The National Endowment for Science, Technology and the Arts (NESTA) report425 (page 39), stated that in 2010 of the 28,767 teachers who gained QTS status in 2010 only three qualified in computing or computing science as their primary qualification (compared with 750 in ICT). This is factually correct but has been widely misinterpreted as meaning only three new teachers that year had a degree in Computing.426 In fact it relates to the subject selected by these new teachers in their General Teaching Council (GTC) registration, rather than any previous degree and must, reflect the nature of advertised teaching vacancies and anticipated career routes.427

18. The revised National Curriculum has been introduced at some speed. As described (§8), the changes are very significant and require many teachers to become comfortable with technical skills and concepts with which they may be totally unfamiliar (see Royal Society424, recommendations 2, 6). Whilst a number of sources of support are available for them428, little time has been allowed for their retraining. (Many ICT teachers will require a complete reorientation: very much more, and more challenging, than a simple subject update (Ofsted429 page25).) This is particularly concerning since the way this new material is delivered in schools will be crucial to pupils’ interest in, and acceptance of, it. This comment is pertinent to those secondary schools which have needed to introduce the teaching of computing afresh but is also relevant to almost every primary school teacher (where, of course, the norm is that they teach across the whole curriculum).

19. Whilst these changes should mean more pupils have a reasonable understanding of the character of a technical computing career there is significant evidence, particularly from mathematics teaching, that a poor early experience can deter a pupil, essentially for life430.

425 NESTA (2011) Next Gen: Transforming the UK into the world’s leading talent hub for the video games and visual effects industries. http://www.nesta.org.uk/publications/next-gen
426 A Department for Education census in 2010 found there were 18,400 teachers of ICT in secondary schools in England of whom 35% (6,440) had a relevant first degree [any computing or mathematics subject]. This data is quoted in Royal Society (2012) Shut down or restart? The way forward for computing in UK schools (para 7.2.1) http://royalsociety.org/education/policy/computing-in-schools/report/
427 I have a full explanation of this and the underlying data, as supplied by the now disbanded GTC, if it is of interest to any reader.
430 For example Solomon, Lawson and Croft (2011) Dealing with “fragile identities”: resistance and refiguring in women mathematics students. Gender and Education 23(5) 565-583
(Mathematics-phobics often place their problems back with poor experiences in school.) Computing used to be a specialist subject taught in some schools, before the 1989 curriculum changes introduced universal IT (then ICT). (Of course it remained available in a very few schools at A-level and has recently been re-introduced as a GCSE subject.) A Her Majesty's Inspectors (HMI) inspection of this provision, during 1987-9, concluded that: "the study of Computing can and should be stimulating and fascinating for pupils. As experienced by many, it is sometimes dry, dull and unexciting". The distinct possibility is that we are about to recreate such experiences in schools – and a consequence could be a reduction in the supply of computing skills. A slower introduction of the Curriculum, or a delay in being obliged to deliver it, may lead to a more satisfactory long-term outcome.

20. Additionally, the revised Curriculum pays little attention to the usage of pre-existing computer systems: the substance of the old ICT curriculum. This seems to be a consequence of two factors: some ICT teaching, particularly in some secondary schools, was judged to be poor but also some pupils report being taught things that they already know (Ofsted page4). It may be that there has been some poor coordination of skills development. However neither of these points justify the current substantial move away from the core of ICT. Some young people can, and do, self-teach these things – perhaps with parental support. However the core curriculum must ensure that every pupil not only develops the user skills which are absolutely essential to the digital literacy of the general population (see §21) but also the slightly more advanced skills needed by, say, clerical and administrative staff (characterised as the skilled use of some of the less common features in MS Office). Pupils still need to be taught these things: they will not all learn them for themselves. Indeed one part of the current skills gap relates to the poor development of these user skills.

21. Basic IT skills are needed by almost all employees, as well as for reasons of social inclusion. Everyone needs basic keyboard (or touchscreen) skills, be able to navigate websites, email, social media, file uploading, managing file systems, and to be able to use a smartphone. It is a new requirement that low-skill manual employees such as cleaners need digital skills, for instance to manage their holiday requests and other HR activities through websites.

22. The supply of skills is diminished by the shrinking pool computer science graduates (although in the recent past many large IT employers recruited across the numerate graduate disciplines). Additionally, the proportion of women has reduced throughout computing, both in the IT industry and all stages of education. In 2010 only 18% of computing graduates were female having fallen from 23% in 2003. Some women possess the necessary aptitudes for IT, as past employment shows. In 2012 only 15% of IT

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employees in the UK were female\textsuperscript{433}; whilst as recently as 2001 it was 22\%\textsuperscript{435}. The changes in the National Curriculum will ensure that girls do try computing and this may help attract more women into the area. Over past decades, numerous initiatives have been set up to help attract women but engagement in computing education and employment continues to diminish. A more appealing image of the profession would help but women also need to see that they could be comfortable and successful working in IT. The nature of delivery of computing in schools (§19) could be crucial to increasing uptake and particularly of females. Girls in particular need their computing experiences to be positive, relevant ones.

23. Having computing routinely encompassed within STEM (Science, Technology, Engineering and Mathematics) initiatives would provide more opportunities for public engagement, outreach and image reshaping. Currently computing is often excluded, despite its fundamentals lying at the heart of the STEM subjects. This apparent illogicality seems to relate to ICT having become associated with Business Studies.

**Future workforce (students and their teaching) – Question 5:**

24. Graduate employment for graduates of computing degrees is the worst of all subject areas: in January 2013 14\% of the previous year's graduates reported that they were yet to secure employment (\textit{cf}. 9\% across all discipline areas).\textsuperscript{436} Against a background of employers finding recruitment difficult, and reporting a skills shortage, this mismatch requires explanation.

25. In part, the weak employment of computing graduates has been shown to be partly explained by graduates' gender, age and ethnic profile, with biases in computing students which tend to associate with poorer employment prospects.\textsuperscript{437}

26. Sometimes the explanation offered is that some university courses are of poor quality (for example \textit{The Guardian}, 10 January 2012, p1-2). However this, at least in part, raises the questions as to the purpose of a university degree (see §12) and the nature of their content (see §9, §27). A widely publicised report from NESTA\textsuperscript{425} looked at the skills gap in the video games and visual effects industries (see also §17). They identified scarcities in both design and computer programming skills and made suggestions concerning both (p7). They found that few computer games degrees currently satisfy the accreditation requirements defined by Skillset (p49). Whilst this could be indicative of weaknesses in the training value of these specialist degrees, it bears no relevance to mainstream computing degrees, as has sometimes been reported. The NESTA report did however lead to the widespread recognition that many pupils currently get no exposure to computer programming in schools (p30), which perhaps expedited the revision of the school ICT/computing curriculum.


27. My research indicated a web of factors (Figure 3) which have led to there simultaneously being a skills shortage and graduate unemployment. As well as factors related to employers’ recruitment desires (see §13-§16), my and other research\textsuperscript{438} has shown that a sizeable minority of pupils apply to computing degrees on a misunderstanding about their nature, thinking that their computing degree will be a continuation of their school ICT or a course in the use of pre-existing computer systems. They do not appreciate that computing degrees are about learning to create new systems, and the rigour and intellectual challenge necessarily associated with that. The lack of exposure to such technical computing in schools has, in places, led to some people seeing computing as lacking credibility as a degree. One student reported how a friend had been told by her father that computing "was not worthy-enough as a degree" but could be learned by self-exploration and another student had been told computing was "a doss degree". These examples clearly indicate a misunderstanding as to the nature of the subject, with negative consequences for recruitment.

28. As well as some inappropriate applications it is inevitable that sometimes a university may recruit some students who, even with support, cannot really cope with the intellectual demands of their course. As well as impairing graduate employment these factors lead to poor degree completion rates and inevitably must be impacting on student satisfaction too.

29. Employment opportunities available to new graduates have changed over the last say two decades. Roles which were in the past often seen as a starting point for a competent graduate (perhaps help desk and support roles) are now often delivered offshore. Whilst there is some evidence that some employers are bringing such functions back in-house\textsuperscript{439}, this can make it harder for some computing graduates to even start their careers. Vacancies exist but employers tend to expect more of the candidates than was perhaps the case in the past.


\textsuperscript{439} Computer Weekly (2013) ‘Skills shortage a concern as development returns In-house’. Computer Weekly. 19 February, 19-21
past (§13). Thus the strongest graduates readily gain employment while weaker, but competent, graduates struggle.

30. Employers' comments related to the difficulty in computing recruitment are very diverse and sometimes poorly defined\(^{440}\). They can relate to candidates' lack of specific, specialist, technical skills or more general IT skills (see §13, §15, §20, §26). However they may refer to more general difficulties with say Mathematics or English or general professional skills: comments heard about graduates from many disciplines. In computing there are also sometimes concerns about candidates' difficulty with business skills: maybe in their personal interactions; expressing ideas appropriately for different audiences or just understanding how their work fits the business-need. Whilst universities can (and many do) support the improvement of some of these areas, in part this relates to the way computing is perceived and the general aptitudes of young people attracted. The 'geek' stereotype and much careers advice suggests that IT is a career which would suit people who are not particularly sociable. Some IT-savvy, socially-able pupils may be directed to more people-focussed areas instead. Whilst there are a few computing roles where an employee can do their job with little human interaction, increasingly they are required to work within teams and to take on externally-facing tasks. If it ever was, this is no longer a profession for the social isolate. Professional bodies and careers advisors could help in this area.

Future workforce (innovative school teaching) – Question 6:

31. Whilst there clearly is some extremely innovative practice related to the teaching of computing examples seem to be drawn from relatively few locations. Some of this has been well publicised\(^{428}, 429\), so others can learn from it. However it seems likely that many schools (or perhaps individual teachers) will struggle, at least in the next few years, to deliver the curriculum in a manner which pupils would find energising and exciting (see §18, §19).

Future workforce (Creativity and Social skills) – Question 7:

32. My research showed that many students enjoyed flexible assignments - being set work which was very open in its specification – and they needed to decide what sort of solution they would then create. This was done in groups to allow students to learn from one another, to think creatively and to develop their team work and communication skills. At Coventry University this was often presented as Activity-Led Learning\(^{441}, 442\). Many computing degrees contain a ‘group project’ which offers some elements of this sort of work. In all cases such activities need to be designed carefully to ensure every student

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\(^{440}\) For example, a headhunter in the City, commented that he was surprised that as few as 17% of that summer’s computing graduates were still unemployed. He asserted that many graduates do not have a wide-enough range of technical skills, cannot write English correctly and that academics are under-qualified. He rejects many graduates because "bog standard languages like SQL, VB, Perl, et al. [are] alien to them" but then asserts, without recognizing his contradiction, that "a good programmer knows that it is how you think, not the language you code in, that determines your ability". Connor, D. (2010) ‘No wonder CompSci grads are unemployed’. The Register. 1 October 2012. http://www.theregister.co.uk/2010/11/01/comp_sci_graduates_need_more_skills/print.html


achieves the relevant core learning outcomes. However ensuring that students appreciate the importance of such skills can be problematic (see §30).

**Future workforce (future skills) – Question 8:**

33. The transferability of computing skills over the decades has been discussed (§12-§16). However young people can be inspired to enter computing by being introduced to 'creating' artifacts, using the latest technologies. When I was an undergraduate (in the late 1970's) all new students were taught some FORTRAN programming (which was one of the few ways of interacting with computers at the time). In later decades all students were taught the use of office software (wordprocessing, spreadsheets); more recently still many students, across the disciplines, were being shown how to write webpages. Today some students are being taught to write 'apps' for mobile devices. Such approaches help individuals to understand what they can achieve and can enthuse them to do more.

**Short- and medium-term support to the digital sector – Question 10:**

34. If the level of immigration of computing professionals were significantly increased then this would serve to take the pressure off deriving a 'proper' long-term solution to the skills problem. Employers may see less need to provide specialist training to new or existing staff (see §14 and §16).

3 Sept 2014
EXECUTIVE SUMMARY

i. The Committee will have heard much about the rapid growth of information and communication technology (“ICT”) and its many beneficial applications. We are in the middle of a ‘digital boom’. There has been much discussion of the skills that UK plc needs to be competitive in this boom, but what skills does it need to avoid a ‘digital bust’?

ii. British businesses and organisations must develop new risk management skills in tandem with innovative ICT. Otherwise, there is potential for a global information crisis analogous to the global financial crisis that began in 2007. The financial crisis was caused in part by systemic risk management failures within financial institutions and their regulators. As these financial institutions exploited new business opportunities around the origination, packaging and redistribution of financial assets, they failed to develop adequate controls to manage, track and mitigate the corresponding financial risk.

iii. Organisations are now using information in exciting, innovative and complex ways, and often beyond the scope of both traditional risk management frameworks and the competency of risk management practitioners. There are already many examples of digital enterprise risk management failures, reducing consumer trust in digital enterprises, undermining the integrity of data and identity, reducing resilience and causing harm and distress through data losses. UK businesses that exploit the opportunities of the digital economy without integrating suitable risk management principles will ultimately fail.

iv. The missing ingredient in the recipe for safe and secure growth is a new set of skills to manage the emerging risks facing digital enterprises. We call these skills digital enterprise risk management (“D-ERM”), which encompasses information security and privacy, technology risk management and consumer protection through digital channels. In this paper we briefly describe the skills required to put D-ERM in place, and we encourage the Committee to ensure that these skills are at the top of its agenda.

1 MOVING FROM ANALOG TO DIGITAL BUSINESS MODELS

1.1 The Committee will be well aware of the multitude of innovative digital business models that UK businesses are developing and using. The Committee will also have received many submissions about the skills required to support these new business models, whether collecting, managing and exploiting datasets, designing and developing new products and channels, or marketing and promoting these new products and services.

1.2 Digitisation has allowed content to be more easily captured, commoditised, and instantly delivered. Firms as diverse as Netflix, Skype, Expedia and Amazon have disrupted and restructured existing markets. Entirely new services such as internet search; SaaS and cloud platforms; social networks; and consumer comparison sites could not have existed prior to the digital era. Similarly, automation of the end-to-end supply chain for retailers (for example) was not possible before data about consumer behaviour could be captured ‘live’ in stores and transmitted back up the supply chain to allow rapid re-stocking and decision-making.
1.3 The common theme driving these developments is the collection, analysis and exploitation of data; either relating to the product itself, or to potential and actual consumers. We suspect that the Committee has heard little so far on risk management skills and their critical role in enabling the rapid development of new industries without endangering the safety and security of personal information and of the critical infrastructure of UK business.

2 DIGITAL ENTERPRISE RISK MANAGEMENT

2.1 The volume of data being collected and processed is already huge, and grows at increasing rates. The types of data being held, and how this data can be used, are also evolving, bringing additional opportunities and challenges. This complexity and scale means that both businesses and regulators struggle to understand the risks inherent in the data they use. Current risk management approaches cannot respond to this challenge.

2.2 The worlds of information security and privacy provide examples of how digital innovation is already outstripping existing risk management techniques:

- The volume and size of information security incidents continues to increase. Recent examples are numerous among major retailers and restaurant chains. These have the potential to be devastating both for consumers and businesses. Despite high-profile incidents in recent years, and heavy ongoing investment in information security, the threats seem to evolve more quickly than the defences deployed.
- The UK Data Protection Act 1998 regulates the handling of ‘personal data’. Identifying ‘personal data’ was once (relatively) straightforward, meaning organisations could judge which operations were in scope. It is now often beyond the ken of consumer, business, or regulator to identify exactly when data becomes ‘personal data’. The MIT Technology Review summarises it thus: “Much of this data is invisible to people and seems impersonal. But ... nearly any type of data can be used, much like a fingerprint, to identify the person who created it ... In effect, the more data there is, the less any of it can be said to be private, since the richness of that data makes pinpointing people ‘algorithmically possible.’”

2.3 The similarities between the financial crisis and the current approach of organisations to the collection and exploitation of data are striking. In the years leading up to the financial crisis, many financial institutions bundled financial assets (for example, subprime mortgages) and repackaged them in the form of financial instruments, sometimes repeating the cycle and selling those instruments in repackaged bundles to investors worldwide. Ultimately,

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444 The total number of breaches in 2013 was 62 percent greater than in 2012 with 253 total breaches. It was also larger than the 208 breaches in 2011. But even a 62 percent increase does not truly reflect the scale of the breaches in 2013. Eight of the breaches in 2013 exposed more than 10 million identities each. In 2012 only one breach exposed over 10 million identities. In 2011, only five were of that size. (Symantec Internet Security Threat Report, Volume 19 2014 Available: http://www.symantec.com/security_response/publications/threatreport.jsp).

investors were unable to accurately price the risk involved with these financial products, and regulators were unable to track the transfer and concentration of risk and identify the capital backing it. The demand for these new products, however, encouraged the originators to create and sell more, creating an opaque financial bubble.

2.4 Likewise, digital businesses are collecting an increasing amount of data as their business models demand it. That data is being aggregated, sorted, re-aggregated, transferred, sold, and repackaged. It is becoming increasingly hard to both track its path and location, and to assure its security and proper treatment along this digital value chain.

2.5 Processing personal data places regulatory obligations upon the organisation, as well as reputational risks if they are perceived to be mishandling people’s information. We see many organisations struggling to identify when a data set contains personal data, and also to assess the risk to those individuals and to the organisation from its processing. This confusion and uncertainty is akin to that experienced by banks in 2008 as they struggled to identify which of their assets included material tranches of subprime debt, prompting a succession of write-downs as new issues were identified. In each case, the rapid development of the new business model had outrun the ability to track assets and therefore risk.

2.6 One of the major factors that caused the financial crisis was the lack of properly developed financial risk management skills in financial institutions, especially among top management, and a tendency to place greater emphasis on modelling risk than managing it. In particular, top management at many institutions, remote from the trading floor or the salesforce, were critically lacking the risk management skills required to understand what they were doing and act on their true risk exposure. As a result, enterprise risk management (“ERM”) in these institutions has become dramatically more rigorous and sophisticated since the financial crisis.

2.7 ERM must continue to evolve rapidly. Currently, the new risks associated with the digital economy are typically lumped in with other operational risks in firms’ ERM. Current risk taxonomies (and the controls matched to them) have not kept pace with the rate of digital innovation. And of course many nonfinancial institutions do not have the same well-established and formalised ERM frameworks.

2.8 Extrapolating ERM techniques, we have developed a framework for managing risk in digital business models which we call Digital Enterprise Risk Management and which is instructive in illustrating the skills required by businesses to address the new digital risks they face.

2.9 D-ERM consists of the strategy, governance, controls, monitoring and measurement of risk across three key types of risk facing the digital enterprise, each of which has specific skills requirements if it is to be managed effectively. (The attached chart at Appendix 1 illustrates collectively the types of skills required in each element of the D-ERM framework). The three types of digital risk are:

- Information security and privacy — the risk of damage through data loss;
- Technology and operational risk — the risk of interruption or failure of systems; and
• Customer protection risk — the risk of damage to customers through, for example, mis-selling.
• We explore the skills required in each of these areas in more detail below.

2.10 **Information security and privacy** require technology and people skills:

• Technical security, addressing identity management, access controls, network security etc., which is clearly fundamental. The need to grow this skill base above others has been focused on by the press and policymakers to date;
• Creating, implementing, maintaining and adapting policies and procedures effectively across the organisation; and
• Managing people and culture to minimise risk, where many of the most challenging risks lie, since the most effective technical controls can be bypassed by inappropriate behaviour by staff.

2.11 **Technology and operational risk** for digital enterprises require the ability to design resilience into systems and to manage day-to-day operations (and any incidents that occur) effectively to prevent loss or damage of sensitive data. It also requires skills at minimising project delivery risk, through agile development for example.

2.12 Finally, new channels and new customer propositions carry risks relating to consumer protection, of mis-selling or mis-buying, of confusion or incorrect decisions at the point of sale or product comparison. These risks to the consumer are also risks to the provider’s reputation, and concerns to regulators (for example in financial services, energy or utilities). These risks require the ability to analyse the emerging consumer behaviour around new channels and products, and the skills to adapt the digital business model to avoid problems that negatively affect the consumer.

2.13 D-ERM builds on traditional operational risk definitions, but recognises that new concepts are needed to supplement existing models. For the UK workforce, this will require new skills, and will require the combination of different skill sets currently spread around the business.

2.14 Likewise, information risk management is now split, to varying degrees if at all, between a number of roles, including the Chief Risk Officer, the Chief Privacy Officer, the Data Protection Officer, the Chief Information Security Officer, and the General Counsel. We already see a wide range of job descriptions and departmental scopes, as different organisations decide how they want to manage information risk, and who they want to do it. We believe this is indicative of:

(a) A skills deficit in information risk management, meaning that organisations are struggling to find people in their firms, and in the job market, with the right skills to help them utilise data appropriately; and

(b) Uncertainty in organisations about exactly what skills are required to best address this risk. For example, some organisations see privacy and data protection as solely a legal issue, and rely on lawyers to promote compliance. Others place responsibility for this area within their technology functions. The culture and skill sets of both disciplines are very different. Effective risk management involves integration of many skill sets
across the business, and requires effective visibility and influence across the whole business.

2.15 As a practical illustration of these risks, we have attached a brief case study at Appendix 2.

3 CONCLUSION

3.1 It is in everyone’s interests that the impressive growth of the digital economy continues in a safe and secure manner. As the financial crisis showed, risk management must not be ignored in the rush to exploit business opportunities, and effective risk management and sustainable business growth are not mutually exclusive. The issues outlined in this submission merit a full discussion, and we would welcome the opportunity to present further evidence to the Committee.
Appendix 1: Skills and Capabilities Required for Digital Enterprise Risk Management
APPENDIX 2: CASE STUDY ON INBLOOM

A. How was it possible that a $100 million technology enterprise, funded by the most prestigious charitable organisations in the United States, was forced to close its doors after only 15 months of operation? The answer: catastrophic failure in its approach to and management of data and privacy risks.

B. Founded in 2011, InBloom was an innovative nonprofit with the ambitious vision of transforming public education in the US. Its stated aim was to “solve a common technology issue facing school districts: the inability of widely varied electronic instructional technology tools used in classrooms to work in coordination with (or “talk to”) one another.” This was to be achieved by analysis of information and personal data about individual students on a huge scale in order to customise lessons and streamline personalised learning.

C. InBloom repeatedly failed to allay privacy concerns, mainly from the parents of school children whose data would be utilised, that that data could be protected. Initial concerns around the collection and transmission of data from schools to private companies were compounded by an inability of parents to opt out of the program. Further, there were concerns that administrators had insufficient policies in place governing scope, retention and transfer of data. It was not clear who could see the information, which in some cases included children’s Social Security numbers. Legal arguments ensued and the organisation announced it was ceasing operations on 21 April 2014.

D. The technological skills of those involved in the project were sound. It was the absence of a risk management strategy for personal and sensitive data, and the proper communication of that strategy to concerned parties, which caused the failure of this promising and much publicised organisation.

8 September 2014

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446 Statement by Iwan Streichenberger, CEO of InBloom as appeared on the InBloom website, 21 April 2014 https://inbloom.org/
Prospect – Written evidence (DSC0064)

Introduction and summary

1. Prospect is an independent trade union representing 120,000 managers, specialists and professionals in both the private and the public sectors in a range of industries and organisations in aviation; agriculture; communications, digital and media; defence; energy; the environment; the heritage industry; scientific research; and children’s services.

2. This response has been written by Prospect’s Communications, Media and Digital Sector Executive, a body of lay representatives committed to promoting the interests of those members of the union who work in the digital sector of our economy.

3. We are specifically interested in commenting on a couple of strands of the Committee’s inquiry: the process of the acquisition of digital skills by individuals both privately and as workers (thus we are largely focused on adult education, and are particularly exercised about women and digital skills); the extent to which digital skills are supported by public policy initiatives; and the issue of the sufficiency of the digital infrastructure.

4. In summary, our views are as follows:

- we do not think enough is being done to secure the skills base for the UK’s digital future, and that the diverse range of institutions involved is confusing and risks dissipating the effort that is being made
- there is a continuing need to address why people are not online, and to take practical steps to get them there
- the private sector has had a leading role in occupational training provision based on a reliance on the market and the plethora of institutions with a degree of responsibility. In consequence, the results have been very mixed and we would like to see the adoption of a new approach focused on the adoption of a planned, strategic approach
- in the highly competitive environment that forms the communications infrastructure industry, network suppliers are doing their best to deliver timely upgrades to infrastructure; however, they need support in doing so, both in terms of the wider regulatory environment and in terms of extending network upgrades to more remote and rural areas.

5. Securing the mechanisms for the delivery and the financing of the technological awareness that we all need to get the best out of our lives online – and including with regard to the delivery of public services – are clearly key to the development of the digital skills base that the UK requires. If the Committee can get this vital issue on the public agenda, then it will have done a good job.

Securing the digital skills base

6. The future can be frightening. As long ago as 1990, it was noted that, even if useful knowledge in the context of the information revolution had a half-life as long as ten years,
intellectual capital was deteriorating as quickly as 7% per year – far more quickly than the recruitment of new graduates. Amongst a sample of Dutch tertiary education graduates around a dozen years ago, almost one-third of the skills obtained in tertiary education were obsolete just seven years later. The pace of change will, at the very least, have been maintained (and probably it will have quickened), while globalisation and the international nature of information and communications technology makes a study carried out in the Netherlands of no lesser relevance to one carried out in the UK. Furthermore, over two billion jobs – roughly 50% of employment across the planet – will disappear by 2030 and that is likely to include large numbers of professional analytical and interpretive jobs as robots, having swept aside manual labour, come next for professional and managerial jobs based around analytical and interpretative skills.

7. It is something of comfort in the context of this onslaught that we may realise that the jobs we now have were not done 100 years ago (or even, in several cases, even ten years ago). Additionally, it is worth pointing out that this process of destructive change has been accomplished, largely and with clear exceptions in some areas and industries of the UK, incrementally and non-destructively. Of course, the past is not necessarily a guide to the future. But we can be clear that change will be a constant state and that adaptation will be a core skill.

8. The Committee is right to divide the need for digital skills into two distinct pathways – for a general workforce able to work in an increasingly digital environment (skills for digital competitiveness); and for specialists to build and maintain that environment (high-level digital skills). Nevertheless, we would go further in pointing to the existence of two distinct target audiences: ‘digital natives’ – having been born in and grown up in a digital world – and ‘digital migrants’ – those of us who require at least some level of assimilation into such a world. The needs of both are currently quite separate, although we should note that skills obsolescence will make digital migrants out of all of us in the end.

9. Predicting the future, but more so the precise skills we will need in the future, is, in all probability, something of a mug’s game and we would do well were we to resist the temptation to engage in such a process. What we do know is that digital skills will underpin our employment futures, since it is digital skills that will unleash the creativity and ability to innovate that constitute two of the keys to our survival in paid employment. What is more important here is that we focus on getting the framework right for the development of digital skills and on implementing focused structures and initiatives where we know we need to better.

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450 See: http://www.theguardian.com/money/work-blog/2013/apr/04/five-jobs-didnt-exist-10-years-ago.

451 Here, we should note both that adaptability is a skill that can be learned and that not all of us possess it.

The institutional framework

10. As regards the framework, there are two things that we fear and which we would urge the Committee to address in its report:

- a plethora of institutions (and initiatives) leading to a dissipation of effort
- the exclusion of whole groups of people from becoming IT literate.

11. On institutions, then we observe that, in the UK, the social partnership landscape consists, on the employer side, of employer representative associations, both general, regional and sector-specific; professional bodies and associations; sector skills councils; local enterprise partnerships; government-industry councils; strategy boards; specific government funds, including growth funds; and various commissions.453 No doubt amongst others. All are likely to be doing good work, and it is good to see industry leaders taking the responsibility at least of arguing for skills development. However, we fear that the essential message – that employers must provide more training, with the government stepping in to provide for those not in work – is getting lost under the weight of initiatives, organisations and missions, risking a dissipation of the effort and a disappointing lack of training outcomes. Less really is more.

12. In Prospect’s view, the Committee needs to consider how to re-invigorate a national responsibility for strategic training (particularly – but not exclusively – with regard to digital skills), so that the UK does not continue to be held back by the lack of an ability to take a strategic focus on skills development issues.

13. Firstly here, we would point to the loss of grant-in-aid funding to all the sector skills councils in 2012-13. The UK Commission for Employment and Skills has moved to a position in which the councils bid for projects in rounds of competitive bidding (and for which, importantly, there is a lower amount available than was previously provided in core funding). We substantially regret this move, and the cuts to public financing for skills projects, since it diminishes the good work being done. In view of the National Audit Office’s assessment of the value of public funding for adult apprenticeships,454 and its call for the level of training provided in them to be stepped up, Prospect urges the Committee to request that the government restore core funding to the sector skills councils.

14. Secondly, we think that the Committee needs to promote strong and unified, cohesive action to address digital skills. What we are currently missing is a strategic focus on the issues that all the various initiatives are trying to address which would allow us to establish real progress against the need. Where efforts and initiatives are spread too thinly, we will miss the overall goals that we all share. This requires a strong hand, and a degree of rationalisation of structures and initiatives, but both are essential if we are to exert the required level of focus and of achievement against fundamentally important and economically strategic tasks.

453 The list of stakeholders from which the Committee is keen to take evidence – and to which we would do need, incidentally, to add ‘trade unions’ specifically – is sign enough of the problem.

15. The goal ought to be clear: a more strategic, coherent and planned approach to digital skills within which responsibility for training might be more clearly identified and the actual provision of training actually made.

**Digital exclusion**

16. On the essential issue of the extent to which people, and groups of people, are excluded from participation in the digital economy, there are three things on our mind:

- the digital divide, in terms of groups of people with a lack of access to the internet, which has both geographical, socio-economic and age-based dimensions
- people losing their jobs as a result of industrial restructuring and for whom specific provision may well need to be made as a result of skills obsolescence and a potential shortage of people with digital skills, at both basic and specialist levels
- (the lack of) women in IT

17. The digital divide is not a particularly new issue, but it is one whose resolution has so far proved tough. Digital participation remains a key issue – not least from the perspective of a ‘digital by default’ strategy which, whatever the actual delivery achievements, and we would have some critical comments here, will require people to be online to access public services.

18. Stepping up investment in superfast broadband, and widening access to superfast broadband to communities where access was unlikely to be provided by the private sector on a commercial basis, in partnerships between BT and local authorities, has helped and it is clear that progress is being made. We would point here to Glasgow which is demonstrating a level of catching-up over the last year as a result of the attention which has been paid to it, as well as to Openreach’s roll-out plans, although is still exhibiting lower levels of access than the UK average. More can always be done, and we would urge the Committee to question government representatives very closely about the greater levels of access that we believe could be secured by additional public monies being invested in such projects. We have called in the past for greater public resources to assist the roll-out of broadband, in the context of an open access obligation for networks built with public money, and repeat that call here.

19. Clearly we cannot force people online when they have no wish to do so – although, as we have said, this is the effect of turning to online mechanisms for the delivery of public services. There are institutions already active in this field, Go On UK being central, with a mission not least to tackle the issue of digital skills, lack of confidence here being one reason for why people are not online. With the passing of time, and web access becoming the norm for an increasingly-higher percentage of households, the problem is becoming less but we suspect that it is not one that will disappear entirely. Consequently, we believe that the government will need to continue to pay attention, and commit resources, both to addressing the gaps that remain as well as for what those gaps mean for the comprehensiveness of its digital strategies and policies regarding those who remain ‘offline’.

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456 ‘Lack of interest’ remains the biggest, and is proving stubbornly and consistently high at around four-fifths of the declining proportion of adults who are not online. See Ofcom (2014) Communications Market Report Section 4 http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr14/UK_4.pdf, Figures 4.33 and 4.35.
20. Evidently, the result of continuing industry restructuring is that workers facing redundancy as a result of job loss will (inevitably, in the context of skills obsolescence and likely concomitant changes in career direction) require training and retraining in order to retain their employability. We also observe that the jobless rate for young people under the age of 25 is already nearly four times the adult rate, and increasing. It is clear that much more needs to be done to tackle transitions, both from school into work as well as from unemployment into employment. The development and improvement of digital skills should clearly form a substantial component of such programmes: the evidence on the return on investment in the digital economy is clear. However, with younger people more likely to be anyway digitally literate, this alone is not the only answer to resolving the crisis. The key to getting the economy (and, therefore, the labour market) moving towards a digital future is to invest in it, towards establishing growth-friendly policies and so as to create quality jobs. This calls for a major change of direction from governments away from austerity and towards traditional concepts of counter-cyclical investment, and in which public strategy and finance has a clear role to play.

21. Furthermore, we believe Britain does need a pay rise, and endorse the TUC’s campaign.

22. Particularly at a time of skills shortages of ICT professionals – a clear sign of market failure and of a voluntarist training tradition – it is ridiculous that there continues to be such a divide in the numbers of entrants to ICT on the basis of gender. In one major employer employing Prospect members, the proportion of women in IT has successively declined to reach something like one in ten of the current workforce, while recent graduates intakes see women numbering barely more. We need to ensure that, in the first place, girls and young women are better encouraged to see IT as a viable career path. Prospect believes that something that is as potentially job creationary as ICT, and into which such public impetus, not to say resources, is put, ought not to be as male-dominated as it currently is.

23. Some of the issues here are cultural but Prospect believes that there is a lot more that organisations could do to help counter the public alienation of women in technology. Having a male-dominated IT industry means not only a substantial degree of omission in terms of the skills that women IT professionals might provide, but also that websites are designed much less with the needs and approaches of women in mind. Given the increasingly interactive nature (and requirements) of internet usage, as well as a public policy based on ‘digital by default’, this is an important gap which must be overcome if we are to achieve the required degree of pervasiveness of digital skills. The newly-created Tech Partnership has a target of a 50:50 gender balance in young people entering digital careers by 2020, but this laudable aim will not be accomplished without specific actions targeted on employer training provision.

24. Organisations might, for example, seek to look at providing positive action in the sense of training and training support, or to return to some level of IT aptitude testing which – although a long way from perfect – provided a better gender balance in the area of

458 For example, BT-commissioned research puts the social return on investment in digital skills is £3.70 for each £1 of investment. See: http://www.btplc.com/Betterfuture/ConnectedSociety/Valueofdigitalinclusion/index.htm.
computing technology and which may produce quicker returns than the existing reliance on the output of higher education institutions. At the same time, women who are returning to work after a break or who are otherwise career changers may be well-placed to consider a future in IT, so organisations need to be testing both for attitudes and potential abilities in digital skills among this core group. This may provide a substantial route into evening up the current imbalance.

25. Some attention from the Committee to this issue, and some leadership from it in this area, would constitute a substantial contribution to getting employers to recognise their responsibilities in this area.

Digital skills training responsibility

26. It is not only in the area of women in IT that a market-based approach is failing. A shortage of ICT professionals across Europe, forecast to reach 900,000 by 2015, against demand rising at 3% per year, demonstrates a failure of a reliance on the market to provide people with skills at the right level and at the right time. Given the level of unemployment, not least among young people, and given the importance of digital to the UK economy, it is clear that not only is the need there, but that so also is the opportunity to do something about it.

27. We think that there is a key role to be played here by the government in providing digital skills/getting connected courses in local colleges. Consequently, we repeat here our call for greater public investment in delivering training in digital skills. Regardless of how it is delivered, and there are clear arguments behind the provision of a voucher scheme, at least in pilot form as the Digital Skills Taskforce has recently recognised, but the government needs to commit to a major programme of funding the extension of digital skills. Furthermore, it needs to do so on the basis of a radical step-up in the overall level of activity and a commitment to extend it to groups and sections of the community that are less touched by existing initiatives.

28. We also support the Digital Skills Taskforce’s recommendation that the government commission a major review of the provision of lifelong learning for digital skills across the UK.

29. As far as organisational training initiatives are concerned, we are already experiencing generic skills shortages, even at this stage in the economic cycle, with one survey, from the UK Commission on Employment and Skills, pointing to 22% of vacancies being the result of skills shortages – a rise of six percentage points since 2011 – while the amount of money spent on training has dropped by £2.5bn in the same period. The Commission itself points

462 ibid. Recommendation 5.
out that ‘This is not a new phenomenon’ and that there is a need to take ‘decisive action’ to prevent such shortages becoming a brake on economic growth. We would agree with this, but make the evident point that we appear to have failed to learn from the mistakes of the past that have already led us into this position on more than one occasion.

30. The lack of counter-cyclical training among employers is well-known, but we should identify that it is our voluntarist training system which has led to a lack of ability to promote strategic training, i.e. that which has a perspective on the interests and needs of the wider economy. All too often, employers’ response to shortages has been to seek to import skills from abroad – frequently leading to a ‘brain drain’ of trained talent in overseas countries – and to seek to do so at below-market median low rates of pay in this country, rather than to make the appropriate strategic response by developing domestic talent. There is a major strategic and development failure here that we need to address. Resolving these issues will require the implementation of an integrated, targeted and, most importantly, planned and co-ordinated effort stretching across government, industry and the education system rather than the continued deployment of a piecemeal, ad hoc approach relying on employer provision, a certain amount of goodwill and enthusiasm and the so-called invisible hand.

The communications infrastructure

31. Prospect has long been involved in campaigns seeking to encourage investment in the communications infrastructure to deliver broadband, and now superfast broadband. Clearly, with high-speed internet access in place, this revolutionises the provision of training and the digital acquisition and testing of skills, facilitating the development of new methods of learning and collaboration between students, and students and mentors/lecturers, as well as access to courses and to other learning opportunities.

32. We recognise that network providers, in both the fixed and mobile segments of the industry, have made great strides in developing the UK’s communications infrastructure, via substantial programmes of network investment and by stepping up the timing of these to provide earlier delivery. Where there is no commercial case for investment, BT has, in conjunction with local authorities, stepped in to provide additional resources of its own to trigger the funding which BDUK has provided from central government sources. In the latter, more could be done with a greater level of public funding, and we have argued for this on the grounds of the essential role that the communications infrastructure plays in the lives of citizens right across the UK. Furthermore, we will continue to make the case.

33. We believe that superfast broadband will be sufficient to support a knowledge-based economy, but the essential caveat is that, to aid social cohesion, such links must be spread throughout the UK and provided on an equal basis to all. We believe in the universal service provision of high-speed broadband links. An additional caveat is that network providers must continue to invest in their networks. We are seeing this with successive generations of mobile technology; and the same is true with regard to the way in which BT is delivering

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464 Prospect is actively involved with the Home Office’s Migration Advisory Committee, seeking to ensure that routes into the UK for skilled professionals trained overseas is in response to genuine shortages of skills and that the people brought into the country in this way receive a proper, competitive wage for the work that they do.
fibre in the network: first to the street cabinet and then, in the future, increasingly to the premises. High-speed networks will not only facilitate a knowledge-based economy, they will, indeed, lead the development of economic growth.

34. However, to get to this point, there needs to be a number of things in place. Government needs to recognise that it has an essential role in supporting private sector investment by helping to fill in the gaps; and the regulatory environment needs to be right. We have made some remarks already about public sector involvement, but we want to close our brief submission here with a few remarks on the regulatory environment.

35. In spite of the level of investment currently being made in the communications infrastructure by network operators, we are not confident that the regulatory model currently being followed is sustainable or capable of delivering continuing investment in the future. Injecting competition at as deep a level in the infrastructure as possible brings with it risks and we believe that the value of having competition in the infrastructure is frequently over-stated – an assertion of the primacy of competition risks wasteful over-provision in some areas and socially inefficient under-provision in others. Neither do we believe that Ofcom’s relentless focus on driving prices down is in the interests of consumers in anything other than the short-term: an ‘ever-faster for ever-cheaper’ model risks creating immense distortions in the pricing signals in a market which is dependent on generating substantial amounts of investment finance both now and in the future. Revenues in the industry are falling, in both mobile and fixed line communications, and that provides an unhelpful backdrop to the need to invest and concerning which there is intense public pressure on network operators. In such circumstances, continuing to shout at operators is not a model for the future: all branches of government need to work better with network operators to deliver the communications infrastructure that we all want to see.

We believe that Ofcom needs to see its duty to further the interests of citizens and consumers not only by promoting competition, wherever possible, but also by promoting investment to which Ofcom is only currently obliged to ‘have regard’. Consequently, we would argue – again, as we have done on several occasions in the past – for an amendment to the 2003 Communications Act to provide Ofcom with a statutory duty equally to promote investment. This, we feel, would change the focus of the regulatory regime by reducing the emphasis on falling prices and thereby encouraging a more secure, more stable and more certain outlook for all network operators to make their investments with confidence.

5 September 2014

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465 The amount the average consumer spends on communications services in a month has fallen by £10.50 over the five years to 2013 (a drop of 11.5%); while the amount of monthly household expenditure going on communications has fallen to less than 3.8%. Consumers are getting a very good deal from their communications suppliers. See Ofcom (2014) Communications Market Report Figure 5.54, available at: http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr14/2014_UK_CMR.pdf.
QA Limited – Written evidence (DSC0069)

About QA

QA is the UK’s leading training company in IT & Business Services, with particular heritage in technical learning for over 25 years. Since 2008, QA has expanded to become a broader education and training business by adding Apprenticeship and Higher Education divisions. With this in place, QA can offer the best of both worlds across commercial training and education, spanning from providing first jobs in the IT industry to master’s level degrees.

The Higher Education business division operates two major partnerships with University of Ulster and Northumbria University, whereby QA operates campuses in London and Birmingham across Business Management and Computing for both undergraduate and postgraduate degrees.

The Apprenticeship division launched in 2008, and now has over 2,000 apprentices on programme across Networking, Software Development, Cyber Security, Project Management, Digital Marketing and Data. QA was inspected in November 2013 and awarded Ofsted Grade 1 “Outstanding” in all areas.

This submission focuses primarily on professionals in the technology industry as this is our primary area of expertise.

The scale of the opportunity

There have been a multitude of research studies into the skills challenges facing the IT industry in the UK. The most complete of these was e-skills UK’s annual Technology Insights, which hasn’t been published since 2012 due to a lack of funding.

In the last of these reports, the following key trends and challenges were identified;

- Forecast for significant growth in employment in IT industry, requiring 129,000 new entrants each year to 2020.
- There has been a decline in those aged under 30 in the industry, falling from 32% in 2001 to 19% in 2011.
- Traditional education is not providing enough graduates. Numbers of applicants to Computing and IT degree halved over the decade to 2012.

In trying to bring this up-to-date, www.itjobswatch.co.uk provides useful data on the labour market. For example, there were approximately 110,000 vacancies advertised in the 3 months to 5 September, of which 88,000 were for the full range of developer roles (see note in Appendix 1). Furthermore, the average salary advertised for these roles was 6% higher than the same time last year, suggesting above-average wage inflation due to a shortage of skilled professionals already in the industry.

On the ground, QA consistently finds that employers are experiencing this skills shortage in their day-to-day business. This gap has been consistent since at least 2005 and is becoming more acute as the economy returns to growth and London’s start-up scene is thriving.
The pace of change

The technology industry moves at a uniquely fast pace, due to the regular introduction and adoption of new technologies and the associated creation of new job roles. This is well-appreciated and it means that traditional education may always struggle to keep up. This is due to the inevitable time lag involved between the design of a new curriculum and the three to five years that it takes for full-time students to be educated and ready to join the workforce. The other danger is that in trying to “future-proof” curricula, the content can become a lowest common denominator based on those skills that don’t change, rather than working on the most current technology.

QA has found that Apprenticeships offer a much more immediate solution for employers. QA works very closely with our employers, both small and large, to identify their job role and technical requirements. Once identified, we typically develop a new programme and recruit apprentices to the roles within three to six months of identifying the need, which delivers a much more rapid response for employers.

The scale of the challenge and the gap means that the industry and government need large scale solutions over the next three to five years in order to close the growing skills gap.

Whilst the new Computing curriculum in schools will eventually bear fruit, industry cannot wait for the new crop of school leavers. Our recommendation to government is to look at the benefits of the Apprenticeship model and create new sector-specific programmes for non-IT graduates and career changers that are close to industry, work-based, driven by individual and collective company requirements, and on short development cycles.

The Tech Skills Partnership (funded under the Employer Ownership of Skills pilot) offers some good flexibility, but in the grand scheme of things, this is only a small number of new entrants to the industry.

These new solutions should drive mobility for professionals to change career into the technology industry. It’s important to note that mainstream SFA funding approaches tend not to fit the technology sector, as they are too reliant on regulated qualifications. In addition, the mainstream approach to funding in advanced learning loans is overly complicated for the low level of available funding relative to the cost of the training.

If a major programme of training and education were implemented to bring new skills into the industry over the next 5 years, this would enable a highly successful business—as-usual approach after that, which would coincide with the first significant cohort of school leavers who have studied programming.

Local Economic Partnerships (LEPs)

QA is encouraged that most of the LEPs have an emphasis on Science, Technology, Engineering and Mathematics, and that some of those are more specific about digital and technology. We believe the LEPs offer an exciting opportunity for local responses and also some competition between regions and cities to become famous for their technology industries.
In addition, given the scale of the challenge, we believe these local efforts need to be complemented by a series of major national initiatives that can scale successfully to meet the size of the problem.

Appendix 1: Notes on statistics
The aggregated statistics for developer roles is taken by including the following roles from www.itjobswatch.co.uk:

<table>
<thead>
<tr>
<th>Developer</th>
<th>PHP Developer</th>
<th>C++ Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>.NET Developer</td>
<td>ASP.NET Developer</td>
<td>Lead Developer</td>
</tr>
<tr>
<td>Senior Developer</td>
<td>C# ASP.NET Developer</td>
<td>Senior Java Developer</td>
</tr>
<tr>
<td>Java Developer</td>
<td>Junior Developer</td>
<td>Senior .NET Developer</td>
</tr>
<tr>
<td>C# Developer</td>
<td>Front-end Developer</td>
<td>C# .NET Developer</td>
</tr>
<tr>
<td>Web Developer</td>
<td>Programmer</td>
<td>Software Engineer</td>
</tr>
<tr>
<td>Software Developer</td>
<td>SQL Developer</td>
<td>Business Intelligence Developer</td>
</tr>
</tbody>
</table>

5 September 2014
Recruitment & Employment Confederation – Written evidence (DSC0035)

Introduction

1. The Recruitment and Employment Confederation (REC) is the professional body for the UK recruitment industry, representing over 3,500 corporate members, who together account for around 80% of the recruitment industry by turnover. The REC is also home to the Institute of Recruitment Professionals which represents over 5,000 individuals in recruitment and provides ongoing training and support to members.

2. REC Technology and REC Engineering & Technical are specialist sector groups for recruitment agencies who supply permanent and temporary contractors to businesses working in those industries. 600 REC member organisations specialise in IT / Technology recruitment and around 700 members work in the engineering and technical space.

3. The REC’s monthly JobsOutlook tracking survey reports the responses of 600 employers questioned about their hiring intentions over the next quarter and the year ahead. Respondents are drawn from across the public, private and non-profit sectors, and from across a range of industries and sizes of organisation. The survey tracks skills shortages including digital skills.

4. The REC’s monthly Report on Jobs is produced by Markit and sponsored by the Recruitment and Employment Confederation and KPMG. The survey provides the most up-to-date monthly picture of recruitment employment, staff availability and employee earnings trends available providing both a national and regional response.

5. We believe the REC and our members are uniquely placed to provide valuable insight into the current skills shortages in the UK economy and have established a strong voice on skills, youth employment and highly skilled immigration. Our members, operating on the coalface, see the impact of a diminishing talent pool of skilled professionals with the requisite digital skills needed to supply the UK’s digital economy. We expand on our recommendations in light of these shortages below.

6. The REC would be delighted to provide additional testimony to the Digital Skills Committee. We would be happy to share our monthly tracker data to better inform the committee’s current inquiry.

Future Workforce

7. Research undertaken by Oxford Economics in May 2014 and commissioned by London & Partners suggested that the technology sector in London is on track to create an additional £12bn of economic activity and create 46,000 new jobs in the next decade. However candidate availability and skills shortages are likely to hold back a sector which promises economic salvation. The August KPMG/REC Report on Jobs confirms that candidate availability is at its lowest level for 17 years. In order to fill the projected 46,000 jobs we need to carefully consider who will fill these roles.

8. In London alone, our members are finding it increasingly difficult to find the candidates they need for a myriad of roles. Research from Spring Technology, part of the Adecco Group
Recruitment & Employment Confederation – Written evidence (DSC0035)

and published in June 2014, identified a 17% year on year increase in demand for .Net roles and a 42% increase for Java roles. These are high quality skilled roles with terrific salaries and yet our members struggle to fill these vacancies. In an economy with an unemployment rate of 6.8% and almost 1 million unemployed young people, this is deeply worrying.

9. Mid-level, permanent software developers with salaries ranging from £30-£50,000 are yet another role where candidate shortages prevail. Our members tell us that many developers currently in jobs are hesitant to consider a move due to a lack of market confidence. As the key economic indicators continue to show strong economic growth, we expect to see more of these people considering a change in employment, creating opportunities for senior and junior candidates as they transition.

10. Recruiters responding to the August edition of Report on Jobs identified candidate shortages in roles such as e-commerce, .Net, Java, SQL, PHP, Business Intelligence and developers.

Short and medium term support required to the digital sector

11. The REC believes that in the short term, the UK must adopt a flexible approach to immigration to ensure that candidates with skills in short supply or lacking in the domestic market are able to come to work in the UK. In the longer term schools, colleges and universities must do more to ensure that graduates meet the needs of the digital economy. Changes and developments in science and technology must be reflected in a curriculum that engages and equips students with key skills vital to the sector.

12. The REC believes that the UK Government must immediately reinstate a post-study work visa of at least two years for graduates with vital digital skills. While it may not be politically viable to reintroduce a post-study visa for all graduates, the acute shortage of digital skills could be addressed by a special digital skills post-study visa for those in the UK on relevant courses. Such a route could be further targeted to specific degree courses and at named educational institutions to ensure the pathway is not open to abuse. This approach was formerly utilised by the Highly Skilled Migrant Programme (HSMP) for MBA graduates. The reinstatement of a post-study work visa should include the ability to extend the initial two year period to ensure that candidates on this scheme can continue to add value to the UK economy through the provision of key digital skills.

13. The REC believes that the Shortage Occupation List (SOL) should be expanded to include those roles requiring digital skills which are in short supply in the UK economy. This will enable an easier application for a Tier 2 visa to be undertaken by the sponsoring employer. Such a move would not require the development of new policy or an administrative change to the immigration system. We understand that the Migration Advisory Committee (MAC) and the Home Office are due to review the SOL this autumn which provides an ideal time to consider such amendments but review plans are still not forthcoming. Data from the REC’s Report on Jobs along with other labour market sources should rightly be utilised to help inform this review.

14. UK Visas and Information (UKVI) have set out an agenda for customer service improvement that is welcomed, especially given some of the past problems involving excessive delays, unreachable staff and unreliable systems. If this agenda is properly
delivered, it could help encourage more employers to apply in future, but this change of outlook will take time to filter through to businesses. In the interim, a concentrated campaign to help support SME applicants with better guidance and advice, alongside a review of the fees, would be helpful. Having named UKVI advisers who are familiar dealing with SMEs would be a valuable step, as would proactive partnership events with business bodies such as the REC, the Confederation of British Industry, the British Chambers of Commerce and the Federation of Small Businesses.

15. As economic growth continues to pick up, and forecasts indicate the country is growing at a healthy rate, the current political obsession with quotas should end. Provided applicants meet the criteria for admission under the immigration system, demonstrating that their skills are needed within the UK economy, and recognising the financial investment undertaken by a sponsoring employer, an individual’s application should not fail by virtue of an arbitrary quota. Ensuring businesses can take on the talent they need will then enable them to create new jobs and progression opportunities for UK workers.

Conclusion

16. In conclusion, we would reiterate our comments that the UK is struggling to provide the high number of individuals with the skills needed to bolster the digital economy and ensure that the UK continues to play a leading global roles in the sector.

17. We call for the introduction of an evidence based immigration system which allows employers to utilise overseas skills not available in the domestic market, thus ensuring that global innovators in this sector continue to expand their operations here in the UK. Such a policy would provide tangible benefits for many UK workers to work with and learn from such highly skilled immigrants.

18. Finally, we would be happy to provide the Digital Skills Committee with more information on the current labour market picture and skills challenges for industry should you find it helpful to your deliberations.

4 September 2014
Research Councils UK – Written evidence (DSC0055)

1. Research Councils UK (RCUK) is a strategic partnership set up to champion research supported by the seven UK Research Councils. RCUK was established in 2002 to enable the Councils to work together more effectively to enhance the overall impact and effectiveness of their research, training and innovation activities, contributing to the delivery of the Government’s objectives for science and innovation. Further details are available at www.rcuk.ac.uk

2. This evidence is submitted by RCUK and represents its independent views. It does not include, or necessarily reflect the views of the Knowledge and Innovation Group in the Department for Business, Innovation and Skills (BIS). The submission is made on behalf of the following Councils:

- Arts and Humanities Research Council (AHRC)
- Engineering and Physical Sciences Research Council (EPSRC)
- Economic and Social Research Council (ESRC)
- Medical Research Council (MRC)
- Science and Technology Facilities Council (STFC)

Executive Summary

3. Major challenges and opportunities for the UK are being driven by the increasing digitisation of the economy, as everything which surrounds us becomes “connected” and “data rich” (the “Big Data” revolution). The “internet of things” — embedding chips, sensors and communications modules into everyday objects — and networking these (people) and things together will see an expansion of real-time analytics and extracting value from data.

4. The Research Councils invest in supporting research and postgraduate (mainly doctoral) training in UK Higher Education Institutes (HEIs). Postgraduate level study is extremely important for equipping the UK with the high level skills needed in an information economy. To keep ahead of the international competition the UK needs to ensure that we have the necessary pool of digitally skilled graduates to support and drive research and innovation – to drive industry, manufacturing, economy, health etc.

5. Although Computer Science graduates are a major source of the high level skills UK businesses need, graduates from other disciplines are also becoming digitally literate as these skills are now a key part of most studies. The UK needs more digitally-literate graduates who have quantitative skills, in mathematics, statistics, computational science, and data science and data analytics, to progress onto postgraduate study. The Research Councils support for Doctoral Training plays well into the digital skills agenda, supporting these relevant quantitative activities.

6. RCUK have responded by establishing various initiatives, such as the cross disciplinary Digital Economy (DE) Theme. An independent review showed it is having an impact on the UK’s digital skills agenda, tackling societal issues concerned with digital exclusion and acting as an internationally leading exemplar of UK endeavour. All the Research Councils
contributing to this Inquiry support activities to engender digital skills in highly skilled researchers.

The changing technological landscape

Q1 What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

The UK’s digital economy is growing rapidly as more companies embrace digitisation. A 2013 O2 report, The Future Digital Skills Needs of the UK economy, estimated that 745,000 additional workers with digital skills would be needed between 2013 and 2017.

The Research Councils invest in supporting research and postgraduate (mainly doctoral) training in UK Higher Education Institutes (HEIs). Of particular relevance is the RCUK Digital Economy (DE) Theme, established in 2008 to address multidisciplinary research and skills to enable the UK to rapidly realise the transformational impact of digital technologies on aspects of community life, cultural experiences, future society, and the economy. It is led by the EPSRC with the ESRC and the AHRC.

Technological aspects are cyber-physical systems and the Internet of Things (IoT) — embedding chips, sensors and communications modules into everyday objects — with leading innovations around better, faster, quicker communications, and collection, transmission and interpretation of data as more “things” becomes connected and “datafied”. Networking these people and things together will see an expansion of real-time analytics. The numbers associated with IoT and “Big Data” are huge (from 50 - 100 billion objects connected by 2020, generating $800bn in revenues). There is an increasing need for development of new creative ways to collect, manage, link and analyse data on a scale not previously encountered. Data from health care is becoming increasingly digitised and there are opportunities to harness the longitudinal electronic health records of the UK population for research aimed at improving treatments, patient care and public health. With the right skill base this could provide many opportunities to the UK’s health and wealth. There are numerous important ethical and responsible innovation issues around privacy, security, trust and governance and how people and society will interact with and drive these changes.

The application of virtual design and engineering using a combination of Modelling Simulation, Big Data and Visualisation is increasingly used in high value or performance engineering application, e.g. the design of passenger planes, automotive and Formula One application. This pattern of design can be applied to new materials, pharmaceuticals, formulation and other sectors. The computerisation of traditional industries and new high value manufacturing techniques, such as additive layer manufacturing when combined with social media could be very powerful for future employment. Many new products will be designed and certified digitally.

A recent expert independent review to identify and benchmark the impact that the RCUK DE Theme’s research has achieved and the potential for additional impact in the future noted “Digital Economy will remain a challenge area of increasing scope over the coming decade. It has the potential to increase UK competitiveness and to attract inward investment” (see http://www.rcuk.ac.uk/RCUK-prod/assets/documents/documents/RCUKDEconReport.pdf). Furthermore, it noted
“Researchers were enthusiastically embracing new modes of multidisciplinary research jointly with users enabled by the Digital Economy Theme, with a clear focus on tangible outcomes and the production of highly motivated and skilled postgraduates”. Thus, the evidence from the RCUK perspective indicates that this is a fast moving area of increasing benefit to the UK’s prosperity.

Q2 What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

12. The evolution of the internet, improved always-on mobile connectivity and technological advances such as 4G (and 5G) offer huge benefits for the economy. But large sections of society (people and businesses) fail to understand the opportunities within the digital workplace or are digitally excluded. Digital technologies and their applications are developing so rapidly that there needs to be increased awareness of what these new capabilities can offer. There is a lack of appreciation of the importance of digital skills to all jobs; a lack of awareness of just how successful UK digital companies are and a lack of role models. Access to high speed connectivity is still a challenge for increasing STEM activities in priority areas, including those in geographically remote and economically deprived communities.

13. The UK needs more people with the expertise and skills to invent new digital technologies, create software applications and keep our online economy safe and secure as well as an understanding of how people consume technology and the role it plays in and influences everyday social practices and cultures. Postgraduate level study is extremely important for equipping the UK with the high level skills needed in an information economy and the UK needs more digitally-literate graduates who have quantitative skills such as those in mathematics, statistics, computational science, data science and data analytics to progress onto postgraduate study. This is because data and extracting the value from material that no one thought held any value (which some people call datafication) is becoming the backbone of the digital economy, including many of the web’s social media companies. There is also the need for expertise and skills in understanding.

14. Increasingly innovation comes on the boundary between the application of simulation, data analytics and visualisation and a research domain. The discovery of the Higgs Boson was a feat that combined particle physics, data storage and management, e-infrastructure, statistical analysis and visualisation methods. Digitally equipping the chemists, physicists, geologists, economists, life scientists, social scientists, medics and engineers of the future will ensure that they are able to make new insights and discoveries. The growing availability of UK population level digital health data, with associated genomic and other metabolic datasets, makes the UK attractive for inward investment by the pharmaceutical, devices and digital healthcare/IT industries. Capacity building initiatives such as the Farr Institute of Health Informatics Research led by the MRC and co-funded by EPSRC and ESRC, amongst others, and MRC’s Medical Bioinformatics initiative are aimed at strengthening the UK’s capability in interrogating large and complex biomedical datasets. These large investments build critical mass in skills required to analyse biomedical data and facilitate new academic industrial collaborations, stimulating innovation and economic growth. The Administrative Data Research Network will build equivalent capability in the use of large administrative datasets for research, policy and practise.
Q3 What is the employment impact on the UK’s labour market? What are the regional differences?

15. The UK needs a sufficient supply of high quality qualified people who can invent and deploy transformative and disruptive digital technologies and adopt a cross-disciplinary problem focused mindset and find new ways to collect, manage, analyse and link data.

16. The UK does have a spread of skills in different sectors, but for many areas these are highly regionalised. For example, there is a concentration of expertise and businesses in London’s financial sector, meaning that EPSRC’s Centre for Doctoral Training in Financial Computing and Data Analytics (at London’s UCL, Imperial College and LSE) can more easily collaborate with key Financial Sector players including the Bank of England, the Financial Regulators and the Treasury.

17. Technical advances in both machinery and computing are influencing both the scale and regional distribution of manufacturing, with a drive towards smaller scale, more local manufacturing with the potential to impact on the UK’s regional labour market. The ESRC and EPSRC are commissioning a number of projects to further scope this area of redistributed manufacturing. The Hartree Centre based in Cheshire, North West England, is applying High Performance Computing, Big Data Analytics and Visualisation methods to industrially relevant problems (partners include Unilever, Jaguar Land Rover and Bentley for the development, demonstration and deployment of new software to accelerate innovation. See Case studies at http://www.stfc.ac.uk/1795.aspx)

Future workforce

Q4 What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

18. Individuals require digital skills with quantitative and qualitative methodology to operate the emerging data-focused world. The chair of the UK Forum on Computing Education, suggested over half the workforce requires digital skills extending beyond the basic skills of digital citizenship and over 90% of jobs require at least those basic digital literacies.

19. It is difficult to predict job opportunities the digital revolution will create, but high quality graduate and postgraduate education is key. The Research Councils regularly review their skills priorities to ensure we build the right skills for the future of the UK research base, with a current consultation on skills needs being conducted jointly by MRC and BBSRC. RCUK supports Doctoral Training via a range of mechanisms (see http://www.rcuk.ac.uk/RCUK-prod/assets/documents/skills/RCUKCommonTerminologyforPostgraduateTraining2013.pdf) with a high proportion supporting data-related skills allied with digital skills. The need for digital skills in the future will not just be for specialist developers, but also part of the skill set needed by a wide variety of researchers across all disciplines and sectors. They need to be confident and adept at accurately collecting, handling, analysing and utilising large scale data sets.
20. To varying degrees, all EPSRC’s 115 Centres for Doctoral Training, a number run jointly with other Research Councils, and which represent £950M investment from EPSRC, industry and the universities, include data-related skills allied with digital skills; eight main ones relevant to “Big Data” span maths, computing and other interdisciplinary areas. Many of EPSRC’s, ESRC’s and MRC’s Fellowships and Doctoral Training Partnerships provide specific capacity building in mathematics, statistics, computation and Advanced Quantitative Methods required to exploit large scale datasets to exploit big data. There is further relevant support including MRC’s 10 Advanced Course Masters programmes. ESRC is also working in partnership with the Nuffield Foundation and HEFCE to address the shortage of quantitatively-skilled social science graduates, establishing 15 Q-Step Centres (5 years £19.5M) to support the development and delivery of specialist undergraduate programmes, including new courses, work placements and pathways to postgraduate study.

**Q5** How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

21. The ESRC and EPSRC co-funded project “Teaching and Learning Research Programme: Technology Enhanced Learning (TEL)” led by Professor Richard Noss at the London Knowledge Lab looked at ways in which technology can be used to improve learner outcomes and the quality of formal and informal learning. It recognised that TEL could make accessible forms of knowledge that were inaccessible before. A key finding was that technology of itself doesn’t enhance learning. It depends how the technology is designed and implemented; how teachers are supported to use it; how outcomes are measured; and what communities are in place to support it (see www.tel.ac.uk). ‘Citizen Science’, where the wider public becomes a key contributor to the research data is also gaining prominence, engaging the public and young people in particular in the scientific process.

**Q6** How are schools preparing to deliver the new computing curriculum in an innovative way?

22. No response

**Q7** How can the education system develop creativity and social skills more effectively?

23. No response

**Q8** How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

24. No response

**Short- and medium-term support to the digital sector**

**Q9** How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

25. People need key skills to enable them to contribute to the digital sector. There are many public sector bodies in the digital landscape so there is a need for joined-up interplay to ensure coherent responses.
Q10 Is there a need for increased high skills immigration in the short-term? What are the implications of this?

26. The rate of increasing demand for individuals with high-level digital skills in the research community is difficult to meet from national sources. This was recognised by government in approving a case made by MRC, Wellcome Trust and others to the Migration Advisory Committee to include bioinformatics/computational biologists on the shortage occupation list under code of practice 2119 of the Office for National Statistics SOC 2010.

Q11 Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

27. The UK needs to work for better social inclusion through the digital economy and understanding the diverse needs of people is very important. 30% of those with disabilities do not use the Internet and 52% of those who lack basic online skills are aged 65 or older (the latter are the biggest percentage of the population). The RCUK DE Theme’s “Social Inclusion in the Digital Economy” (SiDE) research at the Universities of Newcastle and Dundee (£12M, 5.5 year, http://www.side.ac.uk/) aims to engage with digitally marginalised sections of society and attempt to increase their digital skills. They have established various groupings including elderly and disabled people who they can interact with and learn from. This increases the researchers’ understanding of these older people’s skills, how technology helps or hinders their lives; what people like and dislike about various technologies; and how to improve computer technology in order to make it more useful and usable. The University of Dundee’s drop-in sessions enables people to learn how to use computers, tablets, smartphones and digital equipment. Through the Cross-Council Programme ‘Connected Communities’ the AHRC led on a £4m activity around Community co-production of sustainable digital assets. Successful projects are working with community groups and organisations to produce assets which could take the form of open data sets, integrated search facilities, mash-ups, visualisations, mappings, gateways and portals, galleries, and tools etc. These projects are an opportunity for researchers and communities to work together and also to critically reflect on ethical issues surrounding co-production of digital outputs such as power, inclusion, ownership, openness.

28. RCUK is keen to engender diversity in all its investments. When the RCUK DE Theme Impact Review panel interviewed doctoral students supported by the Theme it was pleasing they noted “a much better gender balance in DE Theme funded research ... It was apparent that the kinds of (cross/interdisciplinary) research funded by the DE Theme were attractive to female researchers and that females were taking on leadership roles in DE Theme funded research”. The challenge is to adopt the DE Theme approach, break down perceived barriers and have digitally-relevant skills training etc. viewed as attractive to a wider section of society.

Q12 What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

29. LEPs have the ability to take a regional view on the best opportunities for the development with the region based and existing assets and future needs of the
communities. The STFC Hartree Centre is engaged with the Liverpool LEP to link with its innovation strategic opportunities in Big Data and Sensor City.

**Industry**

**Q13** What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?

30. Many customer facing businesses have informed RCUK advisory bodies they cannot secure sufficient numbers of highly qualified skilled people with the right skills, particularly in quantitative topics such as maths, statistics, physics and data analytics. STFC’s Sci-Tech Daresbury and Harwell Oxford are RCUK examples of high tech campuses for SMEs to grow their ideas into profitable businesses. Linking SMEs with the research community can work through short focused projects but there is often the issue of the absorptive capacity of the business to take the outcome and apply it to be a profitable product or service.

**Q14** How can businesses help equip the workforce with new skills in a rapidly changing environment?

31. Businesses should be encouraged to work with the higher education sector and support the development of trained individuals, for example by supporting applications for RCUK Case studentships. In RCUK’s experience, many of the Centres for Doctoral Training and University computer science and other departments have active Industrial Advisory Boards. This helps to keep them updated with industry developments and needs. Much of the expertise and many of the high level skilled training courses developed for doctoral and postgraduate students can also be used to engage industry staff in Continuing Professional Development.

**Infrastructure**

**Q15** Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries? How can this be improved?

32. The RCUK DE Theme Impact Review indicated that the UK does have a competitive infrastructure, in the elements of research and skills the Research Councils were supporting, and that we were ahead of other countries: “It is something of which the UK research community and the Research Councils can be proud, and is an example of UK leadership in research internationally”. Core assets include the broadband infrastructure itself, Government investment in a 5G Centre at the University of Surrey and access to large-scale unique data resources that can be mined and interpreted in novel ways to enable intelligent applications and services (e.g. via the NHS). This is being driven by developments such as web search engines, cloud computing and infrastructures, and open data initiatives. For example, MRC and partners have invested over £100m to create a digital infrastructure that will enable linkage between biological and ‘omics’ data and NHS patient records. Linkage across different disciplinary expertise and geographical regions of the UK through these investments will enable medical research at a scale and speed that has not been previously possible, placing the UK at the global forefront of biomedical and health informatics. Centres of Excellence to build critical mass in computing, data analytics and visualisation are important in demonstrating the art of the possible. They also train staff in the skills required in new computing architectures, data analytics and visualisation.
5 September 2014
The Royal Society of Edinburgh – Written evidence (DSC0030)

The Royal Society of Edinburgh, Scotland’s National Academy, has recently conducted a major inquiry into digital participation in Scotland. A number of the findings and recommendations presented in the inquiry report are relevant to the questions set out in the call for evidence for the above Digital Skills consultation. I enclose a copy of the report, and focus on some specific areas below. Due to the scope of our inquiry and the nature of our evidence base, our comments are made with a specific Scottish interest: but many are applicable across the UK and beyond.

What skills do future workers need in order for the UK to be globally competitive?

1. Policy in both Scotland and the UK already recognises the need for everyone to have ‘basic digital skills’, reflecting the increasingly pervasive reliance on technologies and electronic services in both our personal and professional lives. However, recent figures suggest that some 19% of the UK population and 30% of the Scottish population do not currently have such skills. Further, the concept of ‘basic digital skills’ is dynamic and will evolve over time. It is, therefore, difficult to predict the exact ‘package’ of digital skills that will be required by everyone in the workforce in the long term.

2. If the workforce is to be ‘future-proofed’, education systems in the UK must be designed to equip everyone with strong literacy and numeracy skills, information literacy and a mindset that is flexible, creative and adaptive. This will be crucial to preparing today’s young learners for a future economy in which the skills needed are not only unpredictable now, but will continue to change throughout their careers; a future in which workers must have the ability and confidence to continue to learn and adapt long after leaving formal education.

3. A broad spectrum of industries, including those of significant importance to the UK such as finance, engineering, pharmaceuticals and creative industries, already need employees with high-level ICT skills and the ability to apply computational thinking to complicated challenges. Employees must be able both to understand how digital tools and analytical thinking can be applied in creative ways to their specialist areas, and how this relates to business strategy and operations. Access to a workforce with these skills will become increasingly important as global competitiveness drives fast-paced innovation and progress. The UK’s higher and further education institutions must ensure that graduates of all disciplines are suitably equipped with these skills, when considering the design of courses.

4. Not everyone will need to understand how the technologies they use work, even if they use such technologies in sophisticated ways. However, with the potential for high-growth businesses and industries that comes from the advancement of technologies underpinning digital progression, it is also crucial that the UK is able to produce international-calibre

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466 Ipsos MediaCT for BBC; Media Literacy: Understanding Digital Capabilities follow up September 2013 and March 2014; March 2014; http://www.bbc.co.uk/learning/overview/assets/digital_capabilities_2014.pdf
467 I.e. understanding systems in terms of the ways they store, process and communicate information; top-down design; and designing, testing and implementing replicable solutions.
graduates of computing science who can support and lead the development of the UK’s high-tech sector.

**How do we teach students to prepare them for careers in a future workforce that may not yet exist?**

5. Scottish and UK education systems today must ensure that information and digital literacy and computational thinking are recognised as being the responsibility of all teachers, across all subject areas and at all stages of learning. In Scotland, the recently implemented *Curriculum for Excellence*[^468] identifies clear ‘experiences and outcomes’ expected for pupils for basic literacy[^469]. It is equally important that such clarity is provided for information literacy and digital skills.

6. The RSE’s inquiry found that, in Scotland, there is huge variation in teachers’ own abilities in these areas, and that they are not included as specific components of study for teachers in training. It is crucial that teachers are supported to up-skill in their understanding of how digital technologies are impacting industry in their subject areas; and how they use technologies for the delivery of learning. It must be recognised that most young learners entering the education system today, and certainly those who will be entering secondary education in ten years’ time, will be accustomed to using technology in all aspects of their lives. Teaching methods across the curriculum must be appropriate for this new reality.

7. The variable information skills and lack of digital skills across most of the teaching profession are critical hurdles. We recommend that all Education Faculties within Scottish universities should include components of information literacy, digital skills and computing science in their programmes of study for all primary and secondary teachers. Further, initial and refresher courses in information literacy and digital skills should be made available for all teachers and support staff.

8. Computing science (CS) qualifications in Scotland have recently been revised and are significantly improved in their depth and rigour. However, CS is not yet taught or perceived in schools on a par with other sciences (chemistry, physics, biology). We recommend that the specification of CS qualifications is kept under periodic review, informed by the on-going evidence-based approach currently being undertaken in Scotland[^470]. In addition, we call on stakeholders to work in partnership to raise the profile of CS at all levels within the education sector, including with government policy makers, school leaders, careers advisers, teachers, parents and learners. Finally, we recommend that political steps be taken to ensure that every secondary school in Scotland has at least one qualified computing science teacher.

9. A clear message that emerged from our own consultation was widespread frustration with the restrictions placed on internet access and content in schools. Over-cautious filters limit teachers’ use of digital technologies in the classroom, and their ability to support pupils

[^470]: See, for example, The Professional Learning and Networking for Computing (PLAN C) project being undertaken by Computing at School Scotland, http://www.casscotland.org.uk/plan-c/
to develop information skills fit for a digital world. Pupils are not taught to deal with risk in a safe but realistic environment, and cannot be properly supported to become responsible digital citizens. Further, such filters frequently prevent pupils from using the internet in creative ways or to become content creators. With such social and creative skills being key foundations for a future workforce, local authorities must work with schools to make a realistic assessment of the risks and benefits of more flexible internet access, and set filters and restrictions accordingly.

Is there an inclusion agenda in relation to digital skills in the workplace?

10. It is clear that women are under-represented across the STEM\textsuperscript{471} sectors, and computing science and ICT are no exception. We are pleased that recent initiatives, such as the Skills Investment Plan for the ICT and Digital Sector\textsuperscript{472} in Scotland, include a focus on attracting and supporting more girls and women to enter the digital sector. In addition, statistics on basic digital skills and uptake in both the UK and Scotland also demonstrate that older people and people with disabilities are significantly less likely to be online, and that digital exclusion is concentrated in areas and social groups facing other forms of deprivation (section 1.2 of the enclosed report provides a more detailed picture).

11. People in these groups are already more likely to be excluded from the workforce. A lack of digital skills is becoming one more barrier to be overcome, in some cases compounded by basic literacy and numeracy problems and lower levels of educational attainment. Indeed, it is the case that those who are not online, or who do not have the skills to effectively navigate the web, are becoming increasingly excluded from the job market, as opportunities may be publicised only online, or require an online application. The difficulties facing job seekers who lack basic digital skills or access to the internet, and who may face benefit sanctions for not using online job search tools, have been well-documented.

What do the best local skills delivery models look like?

12. A lack of skills is not the only barrier to be overcome in ensuring that the workforce is prepared for the digital age. The lack of affordable, reliable internet access continues to be a barrier to digital participation, despite digital infrastructure programmes being rolled out in Scotland and across the UK. Perhaps more difficult to overcome, the lack of motivation to get online (and therefore to engage with digital skills initiatives) presents a major challenge to encouraging those who have already left formal education to develop their digital skills.

13. Initiatives delivered at local level are crucial in overcoming the motivation barrier, and subsequently supporting people to develop their digital skills. Trusted contacts and peers will be able to identify an individual’s personal interests in order to find a ‘hook’ to encourage them online, and deliver the type of skills support appropriate to their needs, ranging from formal training in a classroom-style setting to highly-informal engagement in an individual’s home. The third sector is ideally placed to build on its existing grass-roots links into communities but the approach may also include the development of partnerships

\textsuperscript{471} STEM: Science, Technology, Engineering, Mathematics

with trusted service providers who are in regular contact with the hard-to-reach groups, such as Citizens Advice bureaux, GP surgeries, care workers, housing associations or trade unions. Staff and volunteers involved in these programmes must be provided with support so that they are sufficiently skilled and resourced to take on this role. Libraries will have a pivotal role to play and must be supported to provide a minimum offer of resources, support and content to support digital skills development.

14. However, in light of the scale of the challenge (with some 1.3 million people lacking basic digital skills in Scotland alone), such local digital skills initiatives must be coordinated under an overarching strategy. A central body taking such oversight, a role that is currently being undertaken in Scotland by the Scottish Council for Voluntary Organisations (SCVO), in partnership with Scottish Government, should ensure that mechanisms are in place through which initiatives can be evaluated, best practice scaled up, and expertise and resources effectively deployed. The SCVO role builds on the examples set by UK Online and, latterly, the Tinder Foundation.

What are the barriers for SMEs and how can they be overcome? (See Section 6.5)

15. The barriers facing SMEs, including micro-organisations, in adapting for a digital world are similar to those identified above for individuals. In particular, throughout our own consultation we repeatedly heard from business owners the view that the internet was not relevant to their enterprise, and they had little understanding of the capabilities of digital tools. Fears were expressed by some about the lack of ability to control the company’s image online, or the security of online transactions. Others had identified the need for digital skills but did not have the resources (time or money) to invest in training.

16. Digital skills initiatives offered to SMEs by enterprise support agencies must be well-targeted, well-packaged and properly coordinated. To match the scale of the problem, peer-to-peer and online learning will be key channels for developing digital skills, once the basics of safely getting online and navigating the online world have been addressed.

17. However, in parallel to the above, it is important that SMEs are able to buy-in good quality digital expertise. We heard numerous examples of small businesses that had had bad experiences of working with suppliers of digital services, sometimes due to the lack of ability on both sides to either articulate or understand the business’ needs, but at times due to bad service from the provider. Enterprise agencies should establish initiatives for the recognition of skilled and reputable digital service providers so that SMEs can identify reliable partners.

The comments above provide a summary of the relevant findings of our inquiry into digital participation in Scotland. These findings and recommendations are presented in more detail in the enclosed report and I would draw your attention particularly to:

- Section 3 ‘Motivation’ which discusses local skills delivery programmes;
- Section 4 ‘Skills’ which considers digital skills in both the education system and lifelong learning;
- Sections 1.2 and 6.1 which comment on the inclusion agenda; and
- Section 6.5 which considers the use of digital in business.

2 September 2014
1. About Samsung UK and Ireland

1.1 Samsung Electronics Co., Ltd. is a global leader in technology, opening new possibilities for people everywhere. Through relentless innovation and discovery, we are transforming the worlds of televisions, smartphones, personal computers, printers, cameras, home appliances, LTE systems, medical devices, semiconductors and LED solutions. We employ 270,000 people across 79 countries with annual sales of US$187.8 billion.

1.2 Samsung has been active in the UK since 1982 when we established the UK as one of our key sales subsidiaries. Over the years our presence and activity in the UK has grown as we utilise the significant growth and investment opportunities the UK offers. Our European Headquarter, design and innovation centre and European R&D centre are based here in the UK.

1.3 The UK is an important European hub for Samsung. There are now 8 out of 9 Samsung Electronic functions based throughout the UK with a growing number of employees working in sales, R&D, design, quality assurance and retail.

2. About Samsung Citizenship Programmes

Digital Classrooms

2.1 In 2013, we opened 10 Digital Classrooms across the UK. Six are within primary schools located in the most underprivileged areas, one is at the British Museum, one at the Royal Albert Hall, and two at our charity centres The Prince’s Trust and Kids Company. The facilities provided include the latest Samsung devices (tablets, E-Boards, laptops), with “best in class network connectivity” and access to relevant educational content. We provide on-site teacher training on these devices and full maintenance support as well as maintaining a close-knit online community.

2.2 In 2014, more Digital Classrooms will be opened and we are planning the launch of a content platform to share our teacher’s insights and lesson plans with the added resources from our partnerships.

Digital Academies

2.3 We have three Samsung Academies at Birmingham Metropolitan College. The first two were service academies for employed service engineers and the third ‘Samsung Experience Academy’ in Kidderminster was opened in 2012 to introduce software development and engineering courses to 16+ year olds.

2.4 Our Digital Academy at Newham College builds on our earlier partnerships with courses being offered in Digital Home & Entertainment Technologies (City & Guilds Award/Certificate) and App Development for Smart Digital Technologies (BTEC Level 2 Diploma). Our aim is to provide a route into employment in a wide range of roles across the Information Technology sector.
2.5 At Newham, Samsung has been closely involved in curriculum development and is also offering ten scholarships each academic year for unemployed young people between 19-30 years old, as well as start up funds for outstanding students through a competition launching this spring. Samsung is providing learning resources support which includes paying for textbooks/e-learning as well as exam fees for the qualifications. These qualification courses also include modules to prepare them to be fully trained to take vendor qualifications as well (CompTia, Cisco, etc) which will better their chances for future employment. We are planning to open another Digital Academy in 2015 Samsung Digital Academy for Teachers.

2.6 With the national curriculum requiring teachers’ advanced understanding of technology and coding/programming in particular, Samsung is working with Birmingham Metropolitan College’s Harborne Academy (11-18 secondary school) to build a professional development centre for teachers in their brand new facilities.

2.7 Starting with teachers at Harborne’s 11 feeder primary schools, the new Samsung Digital Academy for Teachers will provide three levels of training programmes to equip teachers with the knowledge and skills in technology and coding using Samsung’s latest products.

3 The Current Skills Landscape

3.1 Companies need to invest in upskilling their workforces to maintain their future competitiveness. This is particularly important when we consider that Britain will need 750,000 skilled digital workers by 2017, yet only 46% of businesses are investing in developing digital skills.

3.2 Whilst upskilling is important there is also concern regarding the talent pipeline. A reported 45% of Tech City’s businesses claim that a shortage of skilled workers is the biggest challenge they face, and nearly eight out of ten say that they could grow faster if there were more skilled people to employ.

3.3 Unless we take action to address this, it is likely that we may not be able to harness the full opportunities of technological developments such as the Internet of Things, Big Data and wearable technology. This is a problem that will impact upon all companies and sectors and why Samsung has developed a significant education and skills programme in the UK.

4. The UK Landscape

4.1 In global terms, Samsung now views the UK as a pace setter in welcoming and embracing innovation. We have seen the UK go from having a cautious, late adopter stance to a society where our relationship with technology is now increasingly confident, and increasingly demanding. Samsung has started to launch products here first before other markets, such as the global launch of our Galaxy Note smartphone.

4.2 A decade ago nations like Finland were seen as tech pioneers, but the UK has caught up and whether it is our capital’s transport, our children’s classrooms or even just our weekly shopping, it is increasingly technology-led and above all smart technology-led.

4.3 In short, the UK loves the digital age and we are embracing each development more enthusiastically than the last. For instance, we have noticed how strong the UK’s uptake of mobile commerce has been. It is now one of the highest rates of adoption in the world.
4.4 The business environment is also adapting to the evolution of smart technology and changing consumer behaviours. This is underlined by the Dixons / Carphone Warehouse merger which is all about the opportunity presented by ‘connectivity’ through smart devices.

4.5 Many businesses and industries will have to adapt to the new connected environment – and whilst this does have challenges around important issues such as data protection, it also presents significant growth opportunities. The UK must grasp these opportunities and to do so will need to ensure that the skill sets needed are readily available.

5. Consultation Response

The Changing Technological Landscape

What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

5.1 Britain urgently needs individuals who understand how technology works and who can harness it to create innovative new products and services. Developing this talent is key to the future success of both our technology sector and of wider industry.

The Internet of Things

5.2 Our lives are already transforming from the physical to virtual worlds. Consumers want to create and consume content “anytime, anywhere”, made possible through wearable technologies and machine to machine communication. This cuts across many sectors including retail, transport, education and health.

5.3 All of these services are supported by competing and cooperating broadband technologies, consumed on different technology and service platforms, which themselves interconnect and change based on where you are and how you want to consume them.

5.4 The growth of machine to machine (M2M) technology and the Internet of Things is enabling new markets. Samsung is a leading player in this fast growing market and it is a significant growth opportunity that is already transforming our lives.

Wearables

5.5 The wearables and mobility market is an exciting new growth area, not just because of the improvements it can make to consumers lives but also to the technological ecosystem that is needed to make it happen. This is why we have a dedicated team at our innovation centre in London, recruiting and encouraging developers for mobile and wearables to use our Samsung Developers kits and platforms. The benefits that wearables can deliver span a number of key areas:

- Health and fitness
- GPS and pedestrian navigation
- Social networking
- Messaging
- Transportation
- Travel
- Mobile payment & banking
• Music
• Sports
• Retail

5.6 The majority of this work will come to fruition in the consumer market. However, while there are no mainstream productivity applications yet in place for smart watches such as Samsung Gear, sensors such as Jawbone, or heads-up displays such as Google Glass (any applications in existence have very niche use cases) it can be expected that applications will be found in the workplace.

**Smart Home**

5.7 Samsung Smart Home’s unique functionality enables users to control and manage their home devices through a single application by connecting personal and home devices, from refrigerators and washing machines to Smart TVs, digital cameras, smartphones and even the wearable device Galaxy Gear, through an integrated platform and server.

5.8 Samsung Smart Home will initially provide three main service features enabling users to connect with their devices from anywhere, anytime: Device Control, Home View and Smart Customer Service.

5.9 With Device Control, users can use customised settings on their mobile devices or Smart TV to monitor or control home devices — turning on air conditioning or activating lighting, for example — while inside or outside the home, or even while travelling abroad. At the touch of a dedicated Smart Home app icon on their device, the service enables users to control one or multiple devices simultaneously no matter where they are.

5.10 With the service’s Home View feature, users can use their smartphone to get real-time views of the home via in-built appliance cameras; and Smart Home’s Smart Customer Service notifies users when it’s time to service appliances or replace consumables, and provides assistance in after-sales servicing.

5.11 Samsung has developed a dedicated Smart Home software protocol (SHP) to enable connectivity between all Samsung Smart Home products as well as those from other device and appliance manufacturers. Through this strategy, Samsung aims to create a foundation for an emerging ecosystem of connected home services in collaboration with its partners.

5.12 At the IFA conference this month, Samsung announced an update to the Smart Home service to cover home-energy, secure home access, healthcare, and eco home applications through the partnerships with third-party service providers in these sectors, helping foster joint commercial opportunities and grow the connected home service marketplace.

**Work**

5.13 The UK is leading the way in mobile deployment across Europe, with more mobile devices `deployed per organisation and more support for employee-owned devices. Only 22% of UK businesses do not support mobile devices, compared to 35% of European companies.
5.14 But interconnectivity in the work place is going a step further, transforming the working culture of British businesses. The future of work is going to be shaped by the tools we use, and these tools are becoming ever more mobile, smart and interconnected. New screens keep us constantly connected to cloud services, meaning that it is becoming possible to do work anytime, anywhere – as long as there is a connection. This flexibility and agility offers a step-change in terms of making the average worker more productive and efficient, both inside and outside the office.

5.15 However, it also creates a range of challenges for enterprise IT – which must proactively embrace the pace of innovations and engage with lines of business to make the most of the opportunities that these new technologies provide around improving or completely transforming business processes.

5.16 We are already seeing the consumerisation of technology in the work place, meaning employees are having more say in the products they want to work with. As employees act more like consumers in the work place, this causes huge risks for companies: how can they maintain security of corporate and proprietary, patented information that has strategic importance in their operations? IT departments are struggling to cope with these new demands.

5.17 This is why new security features are essential and why we have developed our KNOX security application, which resolves the two major enterprise mobility concerns – security and manageability – in addition to allowing users to seamlessly separate work and play.

**Transport**

5.18 Metropolitan public transport infrastructures have to contend with growing capacity demands from increasingly urbanised populations. Personalised mobile services will be vital to enable not just the transport systems, but also the passengers themselves, to be adaptive to real time events such as delays, weather, or major event-driven usage spikes.

5.19 Technology is fuelling a dramatic acceleration in the pace of change within the transport industry. Traditional planning and investment cycles used to be measured in decades, but with the advent of mobile technology coupled with a marked change in user behaviour and expectations on one hand, and major demographic shifts on the other, the industry is being forced to adapt to a far faster pace of change. There are also key challenges that the industry will have to face over the coming years:

1. Urbanisation creating massive and rapid pressure on mass transit systems
2. Growing middle classes have new demands and shifting patterns of car ownership
3. Air travel to double in demand by 2032

5.20 Transport systems have the opportunity to address these challenges by exploiting the ability to reach a transport user that has never been so connected and information enabled.

**Internet of Things: Revitalising Existing Markets**
5.21 As well as opening delivering new opportunities the increasingly connected world we live in is revitalising existing technologies and products.

**TV**

5.22 The growing SMART TV business is a good example of this and is why, as the industry leader, we have to continually innovate. In the past three years the TV industry has gone from fear, uncertainty and doubt about its overall future through to major radical change leading to it regaining its central role in our lives.

5.23 Samsung’s TVs, phones and tablets can already connect with each other, allowing us to have interactive experiences with either live or time shifted content. You can access films, social networking sites, games and even skype your friends all from your TV.

**Smartphones**

5.24 Samsung’s Galaxy S5, launched this year, shows how we are leading the way in creating an ever more sophisticated mobile phone. For example, the ‘S Health 3.0’ software on the S5 allows you to track changes in activity and health over time. It can also develop a fitness regime for you. Never before has it been so easy to monitor key aspects of your health, including ‘Exercise, food, sleep, stress, and weight’.

5.25 The future impact that this connectivity and sophisticated monitoring applications can have on health care services is significant.

**Retail**

5.26 Technology can make the shopping experience faster, easier and more personal in a multitude of ways. For example, digital signage makes it easy for retailers to promote product information and location-based mobile vouchers directly to customers, as they browse the store. Tablets can give sales assistants instant access to the information that they need to answer any customer query on the spot. And mobile point-of-sale devices let you take payment without customers having to queue.

5.27 For shoppers this means greater personalisation, information at their fingertips and seamless integration between what they do online and in-store.

**What Does the Future Hold?**

5.28 To fully capitalise on the opportunities presented by the Internet of Things it is important to understand what consumers believe could be clear benefits of it and how they see them impacting on their lives. We have been asking this question and these came top:

- Traffic management systems that manage congestion
- Internet enabled doctor appointments
- Fridges that order your food shopping
- Being able to buy products direct from your TV programming
5.29 What is really exciting about this is many of these developments are close at hand. Some of them are already here but not widely distributed.

**What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?**

5.30 It is crucial that we tackle the issues relating to ownership, trust, control, management and usage of data for the successful development of the Internet of Things, as outlined above.

5.31 The Internet of Things (IoT) is likely to create demand for a new kind of IT specialist — those who can both engineer new products and process the data they collect. Similarly, as technology becomes evermore integrated into our lives, digital literacy will be equally important, ensuring that the population are able to benefit from the connected society both in their everyday lives and in the workplace.

5.32 Samsung believes that data and security should be at the heart of any IoT-enabled product, as success depends on public trust with regards to the security and confidentiality of their data. It is also crucial that the skills are developed to optimise these opportunities and are able to deliver the security needs of the connected environment. Samsung sees cyber security skills as an area that needs further development and provision.

**What is the employment impact on the UK’s labour market? What are the regional differences?**

5.33 Although many tech businesses and clusters are focused in London and the South East, the opportunities to expand and develop subject-specific digital and technological regions are increasing. For instance, Manchester is home to a growing number of tech start-ups, the innovation hub in Leeds, and the games industry hub in Brighton.

5.34 Samsung is keen to support this emerging trend and is doing so by delivering our Digital Classrooms and Digital Academies throughout the UK (see Appendix 1 for more information on our Digital Classrooms and Digital Academies and our partners). We are also working with charities like Code Club to deliver regional hubs to support the teaching of coding and programming throughout the UK.

**Future Workforce**

**What skills do future workers need in order for the UK to be globally competitive?**

How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

5.35 Beyond essential online skills, Britain urgently needs individuals who do not merely use technology, but who understand how it works and who can harness it to create innovative new products and services. This applies to a range of sectors such as retail, marketing and sales as these all demand digital skills as consumers become increasingly demanding, knowledgeable and with access to more information.

**Developing the Pipeline for Technical Skills**
Pre 16 Education

5.36 Bringing technological knowledge and experience into the classroom at a young age is crucial. The UK has become the first G20 economy to implement mandatory computing lessons for 5–16 year olds on a national level. A major component part of the course will involve learning how to code.

5.37 There are additional benefits of learning to code. It will support the Internet of Things by strengthening problem solving skills and logical thinking, whilst also supporting the learning of key academic subjects, including STEM (Science, Technology, Engineering and Maths).

5.38 Bringing technology into the classroom will also help us to encourage the positive and productive use of technology to tackle online bullying and trolling, through educating children about the use of technology in a controlled environment.

Post 16

5.39 There is a more immediate opportunity to help improve the employment opportunities of our young people whilst gaining the skills needed for the growth in future technologies like the internet of things.

5.40 In the Samsung Experience Academy in Birmingham students learn new skills for the emerging Smart technology markets. The programmes are designed to help learners gain technical knowledge, practical qualifications and provide them with a greater understanding of the latest smart device technologies. The new Smart Experience Academy at Kidderminster delivers cutting-edge training to keep pace with these new technologies and specialises in the delivery of qualifications for the creative and technological industries.

5.41 Courses available at the Academy include ‘Software Application Development for Smart Devices’ and ‘Smart Digital Technologies and Diagnostics’, with a focus on engineering and electronics. This programme is underpinned by a nationally recognised qualification through BTEC Edexcel, which is equivalent to three A-levels and recognised by all universities across the UK.

5.42 Samsung opened its second ‘Digital Academy’ in partnership with Newham College in 2013, featuring three new training classrooms for practical and vocational training. Our partnership will support up to 150 students a year to achieve a BTEC level 2 Diploma in App Development for Smart Technology and City & Guilds Award/Certificate in Digital Home & Entertainment Technologies. These qualifications reflect the changing skills need we have as a business, particularly in relation to increased connectivity and machine to machine communication.

Digital Skills for the Wider Workforce

5.43 More broadly, we must prepare our young people for the changing shape of the workplace. The proliferation of smartphones and tablets (the global installed base of smartphones alone is set to hit 3 billion devices by 2017) has led consumers to adopt new behaviours, and develop expectations around what experiences mobile computing can offer.
5.44 Samsung recently asked Ovum to conduct research among full-time employees across the world. Results showed that almost 57% of employees are using a personal smartphone or tablet to access corporate data in some way, no matter whether such usage is approved by corporate IT or not. This is a widespread behavioural trend that can't be ignored, and indicates a general desire for increased agility around working practices.

5.45 The BYOA (Bring Your Own App) trend is also indicative of the desire from employees to use multiple screens or devices for work. 22% of full-time employees are finding their own file sync and share (FSS) applications to use at work (the common example being Dropbox). This may not be a particularly safe way of working as the business then has no way of tracking where it’s data is, but for the large majority of workers it is not malicious activity – they are simply looking for ways to help them do their jobs better. If enterprise IT can’t provide the tools that makes workers’ lives easier, they are increasingly able to source their own.

5.46 The question is therefore for businesses to respond to this consumerisation and harness the existing skills of employees into the workplace. It is becoming ever more important for workers to have digital skills to adapt to this evolving workplace. It is also increasingly necessary to equip our young people with the skills to succeed in this changing work environment.

Can the Current Supply Chain Deliver The Skills Needed?

Teaching

5.47 The replacement of the ICT curriculum with the new Computing Curriculum is welcome, but we need to ensure that it is delivered well. The new national curriculum will require teachers’ advanced understanding of technology and coding/programming in particular.

5.48 As a large technology company, we feel we have a responsibility to assist with this and are therefore working with Birmingham Metropolitan College's Harborne Academy (11-18 secondary school) to establish a professional development centre for teachers. Starting with teachers at Harborne’s 11 feeder primary schools, the new Samsung Digital Academy for teachers will provide three levels of training programmes to equip teachers with the knowledge and skills in technology and coding using Samsung’s latest products.

5.49 The future training needs of teachers is currently unknown, and will be until the curriculum starts in England. It is therefore important we monitor and assess the learning and teaching to establish what more is needed.

Technology in the classroom

5.50 We believe that technology can make a positive contribution to the lives of all learners. Samsung recently conducted a study in conjunction with education specialist consultancy EdComs to look at digitally supported learning and to assess the impact of our digital classrooms with six pilot schools in the UK. The conclusions provide some valuable feedback about how tablets are transforming learning, particularly in their power to motivate and engage pupils, boosting confidence and even attendance levels in some schools. Teachers meanwhile reported an overall positive impact on pupil performance.
5.51 Pupils’ ownership of and responsibility for their learning is a key benefit of using technology such as tablets. Children equipped with their own tablet are free to explore learning in a style that suits them, whether through an app, a quiz or a piece of audio. Student led learning allows them to work at their own pace catering for all abilities.

5.52 As well as improving learning outcomes, getting our young people confident in using technology can help prepare them for the modern workplace.

5.53 To maximise this opportunity we need to start investing in school IT. Samsung recently commissioned a report to look at parents’ perception of IT in the classroom. Findings showed that 57% of parents believe that schools do not invest enough in technology and 56% believe investment in IT infrastructure should be a priority for schools. Further to this 67% of parents believe that the lack of investment will result in a digital skills gap.

5.54 Unfortunately, there are still major barriers to the adoption of technology in Britain’s schools. The landscape is very varied as in the level of investment, access to high quality broadband and teacher support. The average child experience is hugely different, for example some schools have 1:1 tablet ownership whereas others have one pc suite for the entire school.

5.55 Research from E-Learning Foundation tells us that 756,000 school age children still cannot get online from a computer at home and 653,000 lack access to a computer at home. Samsung specifically targets the areas where this is a prevailing issue when we choose our digital classroom partners and locations.

5.56 Digital literacy is becoming increasingly necessary for young people trying to enter the job market. Job applications frequently have to be completed online and so those offline are more likely to be unemployed. Samsung works with organisations such as the Prince’s Trust and Kids Company to build confidence amongst these young people and provide access to the internet, as well as CV training and job application support. The remit of our digital classrooms is becoming increasingly widened as technology penetrates more and more aspects of our lives.

5.57 We recently supported the *Technology in Education: A System View*, a research paper put together by The Education Foundation with input from many leading academics and businesses. The report examines closely the role of technology in education and looks at ways to overcome the adoption of technology in the classroom.

> How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

5.58 The new computing curriculum is a step in the right direction as we need to teach young people problem solving and creativity – not just how things work. To compliment this development we are increasingly seeing the establishment of clubs, charities and initiatives that take this learning outside of the classroom.
5.59 These organisations have taken the lead in creating a variety of local, regional, national and international programmes which enrich learning. We fully support the growth of these organisations and there are two that Samsung is currently partnered with:

- **Apps for Good** encourage young people (10-18) to use technology to create innovative solutions to problems they care about. Samsung shares their belief in the potential of technology as a force for good that can make a difference to people’s lives and communities. Samsung is supporting 10 schools in need of devices for researching and app testing as part of our partnership, as well as Apps for Good’s annual app competition for schools as the learning category sponsor. Apps for Good’s annual competition has seen some truly inspirational ideas come to life as professionally made apps on the market. We believe this encourages entrepreneurialism, which is vital to the future growth of our economy.

- **Code Club** is a nationwide network of free volunteer led after school coding clubs for children aged 9-11. Samsung and Code Club joined up in November 2013 and throughout 2014, we will be opening 5 regional hubs across the UK at community centres who currently have no computing provisions. These 5 hubs will be equipped with laptops to run a public Code Club and future training events to further our reach.

5.60 Their programmes encourage creativity, hands on learning, problem solving, teamwork, collaborative work, communication and leadership. We need to do more to signpost these opportunities both to participants and supporters so as to encourage these organisations to grow.

5.61 The UK needs professionals who can invent new digital technologies, create software applications and keep our online economy safe and secure.

*The role of parents and teachers*

5.62 Changing the views of parents and teachers will be especially important if we are to prepare young people for the digital future. These groups are the influencers who guide young people and shape their decisions. We need to be much more explicit about the range of opportunities on offer, improve the way we describe the skills, and increase the standing of careers in the tech sector. Highlighting role models and the many successful new market entrants we are seeing is one way to do this.

**How are schools preparing to deliver the new computing curriculum in an innovativeway?**

5.63 We are already seeing that there is a mixed level of preparedness, depending on teachers’ existing confidence, competence and skills. Preparation is in progress with some teachers attending programming courses for Raspberry Pi, Scratch and LightBot. A lot of training is through the Local Authority and some have received internal training via an IT lead who shares their training with the school.

5.64 The teachers we have worked with through our digital classrooms have been very confident using technology and embraced its potential for blended learning. Technology is being used across all subjects but used regularly for literacy, maths, art and design. They will be able to apply this process to the new curriculum.
5.65 Technology is enabling teachers to be more creative in the classroom using apps and allowed teachers to be more adventurous with ICT.

5.66 Sharing expertise and experience is a powerful tool and we are developing an education website that will inspire and support teachers as well as let them share their experiences. Building an online community has been well received by teachers that we have worked with. This will allow them to share ideas about their use and experience of teaching the new curriculum.

**How can the education system develop creativity and social skills more effectively?**

5.67 Using technology in the classroom has shown to be collaborative with pupils looking for solutions together. The technology is helping schools encourage pupils to develop a more curious, guided and inquisitive form of self-learning and expression.

5.68 Pupils owning of their learning allows them to explore and create the curriculum in a way that interests and engages them. This can take many forms such as an app, quiz or a piece of audio. The technology used in our classrooms allows them to be more collaborative. Pupils naturally talk to friends and work out solutions together. Pupils can discuss and share projects in real time using Google Hangouts and can work together on projects out of school hours – a capability that will greatly help children who learn better in a group.

5.69 Coupling tablet technology with the latest touch screen, large format displays, has proven to further enhance collaborative learning. Students can share their working wirelessly onto the large screen, and multiple students can interact simultaneously with the display to demonstrate workings or make annotations.

5.70 Tablet technology allows different learning styles in the classroom. In one particular lesson, some students can read, some can listen to an audio recording, and some can play a game, but the learning outcome is the same.

5.71 Apps are adding further flexibility and creativity to digital learning, especially in enhancing teachers’ capability to plan lessons. Teachers can pre-select a range of activities that deliver a lesson in the form of apps. Students simply logon with their device and internet in real time with the specified content. Student support software also aid whole class interaction and help teachers measure the learning outcomes; pupils can answer on the touch screen, giving every student the opportunity to feel involved and integral to the lesson.

5.72 Samsung believes that the arts have a role in promoting and harnessing the creativity necessary for careers in technology and the creative industries. It is crucial that we harness creativity alongside traditional STEM skills. It is this belief that led us to further develop our relationship with the Royal Albert Hall who we have been partnered with since 2012. This year Samsung opened a digital classroom at the Royal Albert Hall that will teach maths and science through music (see Appendix 2).

5.73 Samsung has been partners with the British Museum since 2009 when we opened the Samsung Digital Discovery Centre. The centre provides a state-of-the-art technological hub.
for children and young people to learn about and interact with the Museum’s collection. It offers the most ambitious and extensive on-site digital learning programme of any UK museum, with eleven different school programmes running throughout the school year, and family programmes operating fifty weekends a year. All activities are free.

5.74 We renewed the partnership for another 5 years last year (see Appendix 3).

How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

5.75 Courses that are provided need to be flexible to keep pace with technological advancements. Our Samsung Digital Academies, referenced earlier in this paper, are designed to provide young people with the skills for the digital economy. We continue to look at new partnerships with colleges and further education institutions to ensure we are delivering the skills the economy needs now and for the future.

5.76 Samsung is also focused on fostering entrepreneurialism amongst our young people as they will be creating the companies of the future. The tech sector uniquely lends itself to start-up businesses.

5.77 We also need to inspire students by making them aware of the opportunities that are available and the vast variety of different companies – both the long established organisations and the many start-ups we are beginning to see. We work with our partners to do this, most recently through an employer engagement event with Newham College. Guests at this event were able to tour the new Samsung Digital Academy facilities; learn about the courses and training on offer; meet students and discuss apprenticeships, work experience and job opportunities; and network with other local technology businesses from Tech City.

Short- and medium-term support to the digital sector

How can the digital sector be supported in the short-and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

5.78 This submission has already set out the role that Samsung is playing as a leading technology company to deliver the skills that we need to succeed in the current and future digital economy.

5.79 There is also a need for industry, Government and academia to work together to ensure the UK is able to maximise the opportunities available in the digital economy. The Information Economy Council, which Samsung plays an active role on, performs this role and acts as the forum that is developing a long-term strategy to drive the growth of the information economy sector. It looks at key areas such as skills, future technologies and infrastructure. This forum allows for a joined up approach that allows Government and industry to focus on priority growth areas as well as tackle challenges in a coordinated way.

5.80 If industry is going to maximise the growth opportunities from future technologies there needs to be further cooperation to address the challenges that the sector faces as a whole. The recently established Tech Partnership, supported by e-skills, is a good example of how this can work. The Tech Partnership, founded by employers, has taken responsibility for digital skills as the Industrial Partner for the Information Economy. The Tech Partnership
is supported by, and taking forward, the work of e-skills UK. It has recently been successful in bidding into the Government’s Employer Ownership of Skills Pilot fund (EOP). The pilot is combining money from business and the Government to help employers invest in the skills and training they need for growth. This will help to scale up the various skills initiatives that are being undertaken by companies and bring together common skills needs and delivery throughout the UK.

**Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?**

5.81 Samsung feels passionately about equality of access and opportunity, in allowing our young people to thrive and take advantage of the opportunities provided by technology. We are able to do this by working with charities such as Kids Company and the Prince’s Trust who work with disadvantaged young people at risk of exclusion.

5.82 We have found through research with our digital classrooms that technology in the classroom, delivering cross curriculum subjects, has had a positive impact on SEN pupils. Differentiated learning allows pupils to learn at their appropriate level making lessons more inclusive.

5.83 SEN pupils are more confident at showing their work to the class; being able to embed multimedia into work makes the finished output more attractive than previously, which has boosted SEN pupils’ confidence.

5.84 There are also specialised apps that are aimed at pupil needs which improve their learning for example reading apps for dyslexia and the repetition in the times table game, which has played a central role at improving SEN pupils ability to do times tables and accelerated their progress, compared with traditional methods.

5.85 We also recognise that there is a need to engage more with women and encourage women to take careers in the tech sector. This is why we are supporting the Government’s Your Life campaign. Your Life is a three-year campaign to inspire young people to study maths and physics as a gateway to exciting and wide-ranging careers; and by helping employers recruit and retain talent, particularly women. We are supporting this by sponsoring 1 post-doctoral researcher to take up teaching at an underprivileged school to develop exciting STEM teaching resources.

**6. Conclusion**

6.1 Personal computers, tablets, smartphones, operating systems, web browsers, fixed and wireless broadband, social networks, cloud computing, 3D Printing, Big Data and the Internet of Things have already transformed much of how we communicate, create, share, consume, learn, work and play.

6.2 The UK’s future success in leveraging these opportunities depends on public trust with regards to the security and confidentiality of their data and how it is used and by whom. It is imperative that the Government and Industry work together to address these concerns by developing a robust internet of things framework.
6.3 We need to create the digital skills and a skills system that keeps pace with these technological developments and changing consumer demand.

**Appendix 1**

**Samsung Citizenship Programmes**

**Overview**

Our target over the next decade is to use our expertise and knowledge to strengthen our communities and make a difference in people’s lives. Key to achieving this is creating opportunities for the next generation through greater access to technology. We are delivering this in two key ways: Digital Classrooms and Digital Academies.

**Digital Classrooms: Under 16s**

A Samsung Digital Classroom offers an engaging and collaborative educational environment for nurturing future talent. A suite of Samsung technology is provided along with teacher training, connectivity and maintenance support to the schools. This allows not only for creative teacher-led learning but also for increased peer-to-peer interaction through device mobility.

**Digital Academies: Over 16s**

Samsung Digital Academies provide vocational training courses on the most cutting edge smart technologies using Samsung’s latest devices. The programmes have been developed
to help young people gain technical knowledge and nationally recognised qualifications as well as essential employability skills necessary for a future in the technology industry.

**Future Skills Development**

We believe ensuring young people get the opportunity to learn how to learn digital skills at an early age, and inspiring them to pursue careers as programmers and computer scientists is critical for the UK’s economy. We are both passionate believers in the additional benefits of learning to code- strengthening problem solving skills and logical thinking - supporting learning of key academic subjects including STEM. It’s not just enough for children to know how to use technology. They should know how it works too.

**Appendix 2**

**Samsung and the Royal Albert Hall: Discovering Music and Maths through Music**

In partnership with the Royal Albert Hall we are running 16 sessions each term split over two programmes, Discover Music and Maths with Samsung and Discover Music and Science with Samsung. The Music and Maths programme is for Key Stage 2 children aged 7 – 11 and the Music and Science programme is for Key Stage 3 children aged between 12-14. Each session
lasts for approximately 2 hours and the pupils will complete each session having created a music piece.

**Discover Music & Maths** - Using mathematical principles to create and record a piece of music from scratch. This will cover fractions, probability and graphs.

**Discover Music & Science** - Look at scientific principles from a musical perspective. This will cover sound waves, Oscilloscope demonstrations, wavelengths and frequencies, Speed of Light vs speed of Sound, and the Doppler Effect.

**Appendix 3: Samsung Digital Discovery Centre at the British Museum**

The Samsung Digital Discovery Centre School programme currently reaches more than 5000 students annually, almost 20% of the total number of school students taught in the Museum each year. The partnership aims to double the number of schoolchildren using the Centre in the next five years.

Due to our partnership, the Museum has been able to offer more Augmented Reality (AR) learning than any other UK museum, offering a range of different styles of AR mobile activities for phones and tablets. The AR mobile program Passport to the Afterlife, which runs on Samsung Galaxy Nexus phones in the ancient Egypt galleries, has been cited in academic dissertations and presented at major conferences in the US and UK. The partnership has also enabled some unusual collaborations, including with well-known UK fashion designers such as Tatty Devine and Fred Butler to create a series of dynamic workshops for 13-18 year olds.

The recently renewed partnership will enable the Museum to develop a range of longer and more in-depth programmes and will contribute to the new English National Curriculum. This will include the use of Samsung mobiles throughout the galleries for self-led learning activities. The first in these new app-based programmes uses the latest in image-recognition and AR technology to engage school students with the sculptures of the Parthenon – ‘a gift for Athena’.

The Centre’s growing portfolio of projects with secondary schools provides clear evidence of the distinctive contribution that digital technologies can make to students’ learning. The increasing use of digital technologies in the field of Art & Design offers a valuable opportunity to develop this audience over the next phase and a new programme of digital art workshops and projects will be developed for this age group.

Alongside its work with students, the Museum will also expand its programme of work with teachers, both through events and through building additional links with university teacher-training departments. Meanwhile activities for families will take advantage of new technologies to provide innovative in-depth activities including touch tables, 3-D printing, and 3-D animation.

It is also doing video conferencing to reach remote schools.

*10 September 2014*
Science Council – Written evidence (DSC0096)

1. The Science Council

1.1. The Science Council is an umbrella organisation of learned societies and professional bodies, and currently has 41 member organisations drawn from across science and its applications: a list of current member bodies is attached. Collectively member bodies represent almost 500,000 individual members, including scientists, teachers and senior executives in industry, academia and the public sector. The Science Council awards the professional qualifications of Chartered Scientist (CSci), Registered Scientist (RSci) and Registered Science Technician (RSciTech).

1.2. In addition to providing a mechanism for the sector to work collectively, the Science Council develops and leads collaborative projects working with member bodies and the wider scientific community: examples include the Future Morph website473 designed to provide young people with information about careers opportunities, LMI analysis of the UK Science Workforce474 and the Diversity, Equality and Inclusion Strategy Group.475

1.3. The Science Council is the leading UK voice on the skills and professionalism of scientists. Its strength comes from its ability to be multi and inter-disciplinary in its approach to identify the changing nature of science skills needs and challenges facing society.

2. Future demand for digital skills

2.1. Modern science is a global activity. The scale and immediacy of the issues the world faces, such as climate change, global population growth, and global resource and food security, together with the pace of change in science and technology demands increasing interaction and cooperation between countries and scientists working in international multi-disciplinary teams. Digital infrastructure and new digital technologies will enable this process, for example creating the ability to model and monitor weather patterns, or to enable efficient management and use of global resources. Other examples of digital innovation will:

- Assist governments and international bodies to make evidence-based policy decisions. Scientists will increasingly need to be confident and adept at accurately collecting, handling, analysing and utilising large-scale data sets. Recent Science Council research found that the ICT workforce is projected to increase by 39% by the year 2030.476 Research has also found that over the next five years UK employers’ demand for ‘big data’ specialists will rise by 243%.477 This will require the future science workforce to possess high-level digital skills.

473 www.futuremorph.org
474 The current and future UK science workforce TBR, Sept. 2011 http://www.sciencecouncil.org/content/science-workforce
475 http://www.sciencecouncil.org/content/diversity-equality-and-inclusion
477 http://www.e-skills.com/research/research-publications/big-data-analytics/#November
Science Council – Written evidence (DSC0096)

- Enable more efficiently monitoring and regulation across a range of activities. It is now the case that complex data submissions to regulatory authorities are done electronically using the electronic Common Technical Document for specially developed web portals. Regulatory specialists are now increasingly required to understand how to operate digital platforms. Some regulatory scientists have chosen to move into document management software development, which has produced a separate sub-specialism of regulatory affairs called ‘regulatory operations’.
- Help ensure safe and efficient transport of people and goods across the world.
- Help ensure online privacy and cyber security.
- Develop new wealth creators in the UK in the areas of telecommunications and digital media platforms as well as in the application of digital technologies in service and public sectors.

2.2. In other economic sectors, the use and application of digital skills will become increasingly prevalent. Future demand for digital skills will not just be for specialist developers, but also for scientists across disciplines and economic sectors looking to maximise incremental advances in technology and services by applying digital technologies to enhance existing procedures and practices. The demand for scientists with cross-disciplinary skills is already high; recent Science Council research has highlighted the strong demand for secondary scientists in the UK workforce. Secondary scientists work in occupations that are science related but also require a mixed application of scientific knowledge and skills alongside other skill sets, which are often of greater importance to executing the role effectively. For example:

- The European Union has designated that any software packages used in the health profession are to be considered ‘medical devices’. The application of these devices has meant the need for regulations to be developed alongside to cope with rapid technological development. Moving forward it will require software developers, doctors, scientists and lawyers specialising in regulation to develop a high-level understanding of digital technologies and their applications in order to develop appropriate laws, assessment criteria, and guidance for the safe use of such products.

2.3. The application of digital skills and use of digital platforms will not be confined to specialists and high-end users. As people move, organise and manage more aspects of their lives onto digital platforms, such as online shopping, paying bills and online communication, it is important that people become ‘Digital Citizens’.

- However, for those without regular and easy access to a computer or the internet, the ‘digitisation’ of these services can be demanding. As government and businesses gradually transfer access to and information about services and products online, there will be an increasing need for Government to invest in education for all citizens to successfully handle this change.

3. Digital skills in the national curriculum

3.1. It is essential that all young people have the opportunity to access digital skills teaching and learning in schools and colleges so that they become confident users of digital technologies regardless of the subjects they study or their future career.

3.2. Research shows that the growing ‘computerisation’ of the labour market is likely to lead to more routine-intensive occupations such as those in Accounting, Insurance and across manufacturing, becoming automated\textsuperscript{480}. Without long-term planning across education and the economy, the future labour market will therefore become polarised between high-skilled, high-income jobs and low-skilled, low income jobs. To ensure meaningful and productive employment opportunities for young people and ensure that the labour market has the supply of the skills it requires, young people will need to acquire non-routine skills such as problem-solving and creative skills which they can combine with computing and digital skills to create new knowledge, products, services and technologies.

3.3. Within the national curriculum there may be value in examining the merit of a ‘twin track’ approach to the teaching of digital skills in schools and colleges, both at GCSE and A-level. At A-level for example, young people studying subjects with a low demand for high-level digital skills, such as English and modern languages, might have the option to study ‘core’ digital skills learning to develop beyond the basic and intermediary digital literacy to become ‘Digital Citizens’. It may also encourage them to use these skills in innovative ways in other areas of study that have not hitherto been considered.

- The application of digital technology in the humanities is currently being adopted by University College London’s Centre for Digital Humanities and the London Metropolitan Archives to digitally restore previously damaged historical documents\textsuperscript{481}. Conservation of such documents will enable historians and the general public to study and access previously unreadable documents of great cultural value.

3.4. Those studying subjects where high-quality digital skills are in great demand, such as science and mathematics subjects could receive greater, in-depth learning to develop the skills needed to become ‘Digital Workers’ or ‘Digital Creators’. It will be essential that digital skills are embedded and taught within and across those curricula rather than in isolation.

- It would be worth exploring the potential for subjects such as geography to embed the teaching of high-level digital skills in their curricula. This already occurs in the United States where the National Council for Geographical Education has designed a skills map for teaching 21\textsuperscript{st} Century Geography in schools\textsuperscript{482}. The map provides schools and teachers with guidance on how to integrate digital technologies across many facets of the Geography curriculum.
- Increasingly cross-disciplinary subjects that utilise both natural and social sciences are applying high-level digital technologies and applications to traditional research and investigative methods to digitally map landscapes, urban and rural environments and as yet uncharted parts of the globe. The Government’s recent investment in a new polar

\textsuperscript{480} http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf
\textsuperscript{481} http://www.engineering.ucl.ac.uk/blog/news/ucl-london-metropolitan-archives-digitisation-great-parchment-book-wins-award/
\textsuperscript{482} http://www.p21.org/storage/documents/21stcskillsmap_geog.pdf
ship that will use digital and remote technologies to map underwater polar environments is one example of this.

3.5. The Science Council would not wish to see digital skills taught predominantly within the mathematics curriculum where we consider the curriculum to be already crowded. There would be a danger in undoing the progress achieved in recent years in developing increased interest in mathematics post-16. As an essential element of many future science roles, digital skills need to be embedded and taught in a way that supports all science and mathematics curricula.

3.6. One of the challenges of introducing the new computing curriculum that will develop and foster the digital skills of a future workforce is ensuring that there is an adequately trained teaching workforce, but there is a significant shortage of qualified IT teachers. A recent Royal Society report highlighted the shortage in teachers able to teach above basic digital literacy, with approximately only one third of the 18,000 IT teachers in secondary schools possessing a qualification directly relating to IT. It is important that young people have the opportunity to be taught by qualified teachers with appropriate subject knowledge in their discipline at each education level, especially post-16. Therefore the challenge remains how to ensure that existing qualified IT teachers have the right skills and knowledge to teach the new curriculum. Higher education has an important role for the next generation of IT teachers to provide them with the necessary skills, qualifications and expertise they will need to teach the new national curriculum and its future incarnations.

3.7. An additional concern across the science community is that teaching salaries for IT graduates disincentivises potential teachers, as the profession cannot compete with the salaries of IT jobs in other sectors of the economy. More highly qualified teachers are needed to enter the profession to meet the expected future economic demand for science and mathematics qualifications. A number of Science Council member bodies already offer attractive scholarships for prospective teachers in their respective subjects. Government and the teaching profession must look to employ further incentives that attract more IT graduates into the profession, such as appropriate training and progression routes, financial incentives and mechanisms to attract and retain new graduates, returners and those changing career.

4. Access to digital skills learning and teaching beyond the national curriculum

4.1. Digital skills teaching and learning should also be available to all young people outside the classroom. This has occurred to some extent through the proliferation of Massive Open Online Courses (MOOCs), enabling more young people to access wider teaching and knowledge. Although evidence shows that less than 7% of people finish a course, they have the potential to revolutionise how and where people learn and acquire knowledge. However, MOOCs and other online learning tools are only available to those with ready

486 http://www.iop.org/education/teach/itts/page_52632.html
487 file:///C:/Users/oliver/Downloads/SSRN-id2381263.pdf
access to a computer and the internet. This is a particular challenge to young people from less advantaged backgrounds and those living in more rural areas, who may not have the same access as their counterparts from more advantaged backgrounds and those living in urban areas.

4.2. In many parts of Wales and Scotland, and some regions of England for example, access to reliable broadband internet ranges from 0% to 30%. The lack of reliable internet connection in these areas also affects the ability to develop and operate a digital business. It is critical that the Government accelerates its plan to provide adequate broadband connection to the whole of the UK and there is a need to consider additional support to enable schools and colleges in areas of poor broadband availability to support access to the internet for their students and other learners.

- The Department for Education’s Home Access programme, which provided more than 270,000 low-income families with access to a computer and the internet, closed in June 2010. An evaluation of the programme in 2010 stated that it had been an effective and sound investment which had led to enhanced use of home access for education and improved ICT skills and confidence. The Department must look at the business case for establishing similar programmes.
- Public libraries are increasingly used by those without access to online services at home and are therefore a valuable access point for many people to participate in the digital economy and develop their digital skills. The closure of public libraries could have a significant effect on many communities access to online services and training, particularly those with low ‘digital capital’.

4.3. With the pace of technological advancement outpacing the UK’s ability to develop a workforce that could take advantage of that advancement and the increasing demand for high-level digital skills across the economy, it is important for digital skills to be embedded across higher education programmes, particularly at the undergraduate level. Providing opportunities to develop appropriate knowledge and skills in digital technologies across many areas of rapidly changing science will enable the next generation of students to specialise for particular sectors of the economy, for specific roles and careers, and develop new and innovative solutions to large and small-scale challenges.

5. The role of careers information and guidance

5.1. Careers information, advice and guidance for young people remains poor, particularly with regard to subject and qualification choice where ill informed choices mean career pathways are often closed. At a time when young people are expected to make an increasing financial contribution towards their education and training, it is crucial that they are able to access accurate information, advice and guidance to inform their choices, and that they fully
understand both the importance of digital skills to STEM-based careers in general, and the opportunities that exist in the digital economy.

5.2. All stakeholders, including employers, Government, education and training providers, and professional bodies will need to clearly articulate to young people the importance of digital skills in STEM-based careers. They will need to collaborate to provide high-quality accurate information and messages about the qualifications, skills needs and range of career opportunities and environments for young people to work both within the digital sector and beyond it.

6. **Supporting and providing growth opportunities across the UK**

6.1. Digital technologies enable businesses, especially SMEs and micro-enterprises in both urban and rural economies across the UK to operate in the global market place, trading with and selling high-value products or services anywhere in the world, especially to fast growing and emerging economies. These businesses provide growth and jobs to their localities and throughout the UK’s supply chains. The use of high-level digital skills in rural economies can provide the catalyst for greater application and use of innovative farming and agriculture methods, enabling the UK in the long-run to become more food secure as new technologies and innovation enable greater crop yields to be harvested.

6.2. In order to grow an economy that enables all citizens to fully benefit from new and existing digital technologies, reliable, fast and widely accessible digital tools and infrastructure will be required on a grand scale. However, Governments’ track record for delivering large-scale projects is not impressive and Sir John Armitt’s recent review of infrastructure planning cited successive Governments’ lack of long-term strategic planning around infrastructure projects.

6.3. A long-term digital infrastructure strategy must take into account that national and local investment priorities can inhibit other local and regional opportunities. For example, some regions of the UK already have responsive local governments, ready access to a highly skilled and educated workforce, good transport links and broadband infrastructure, and an economy with an established infrastructure of schools, centres of culture, and leisure facilities that attract significant inward investment. Other regions have fewer resources of this kind and as a result communities in these areas can be inhibited from delivering digital education and enabling active participation in the digital economy. For example, many coastal and seaside towns do not have the capacity to nurture and sustain their own digital skills ecosystem because of poor infrastructure, low performing schools and colleges, and the lack of local university or large research or innovation-driven employers.

6.4. Local governments should take the opportunity to make greater use of digital technologies to provide local services and amenities, and be more creative in their procurement policies. However, to be effective across all regions of the UK, all local governments will need the authority and capacity to make effective decisions across infrastructure, education, transport and in other policy areas. These decisions will need to

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include provision for increasing the ‘digital capital’ of entire communities so that everyone can access and maximise benefit from new and enhanced services.

6.5. Local Enterprise Partnerships have the potential to play a key role in developing visionary and appropriate digital skills and infrastructure strategies at the regional and local level. These will need to be in partnership with local employers, schools, colleges, and where possible regional universities and employers to ensure joined-up policy delivery across regions. Without ensuring opportunities at the local and regional as well as the national and international level, there is a significant risk that a two-tier innovation, education, training and skills environment will develop.

6.6. The Science Council recommends the establishment of an independent National Science Skills advisory group to provide advice, leadership and guidance to the Secretary of State on a national science education and skills strategy. Digital skills are an essential part of a long-term science and innovation strategy. Such an advisory group must have expertise in digital skills and technologies to inform the advice it provides to government.

7. **Raising the importance of digital skills among policy-makers**

7.1. The business case for increased Government investment in digital infrastructure and skills across the UK, which lead to jobs and growth within their constituencies and to the wider UK economy, must be strongly made by employers, education institutions and professional bodies to Parliamentarians.

7.2. High-level digital skills are required across all Government departments and their sectors of responsibility and Government needs to ensure that policies relating to digital skills are joined-up across all departments. The alignment of a digital strategy and related policies across education, skills and training, workforce development and regional investment would achieve greater coherence, collaboration and productivity and maximise the potential long-term benefit to society.

7.3. The Science Council was pleased that a Minister of State for the Digital Economy was appointed in July 2014. However it is unfortunate that the Minister’s role is shared between only two Government departments, BIS and DfE. All Government departments are to publish their own digital strategies in due course but as a consequence of not appointing a cross-Government Minister to oversee departments’ strategy formulation, implementation and delivery it is not clear how the Government can deliver a coherent and joined-up cross-Government digital skills strategy.

7.4. To ensure greater coordination and a joined-up approach across Government the Science Council recommends the appointment of a cross-Government department Minister with responsibilities for digital skills and technology reporting to the Cabinet Office. The Minister would need to work closely with Departmental Chief Scientific Advisors and the Government’s Chief Scientific Advisor to ensure civil servants’ continued professional development in digital skills.

12 September 2014
The Definition of Digital
Digital is one of the most fashionable words today. The definition "relating to the use of computer technology" means it can embrace many things. Start-up tech companies can be anything from an online store to a highly sophisticated app. The skill sets required for different types of digital enterprises therefore vary enormously from highly technical skills to more mundane marketing, design or people skills. I might be stating the obvious but many people are scared by words like "digital" "tech" and "code". The way most people react to code is the way some people react to a foreign language (or even an accent) They slam down the phone, without even trying to understand!

Job and wealth creation
The biggest concerns when we talk about digital today seem to be:

"How can we create the right conditions to attract or breed mega companies like Google, Facebook, Ebay and Amazon which create thousands of jobs and wealth?"

Attracting and creating global tech giants in the UK
Boris Johnstone hoped to attract new corporate tech giants to London by launching the £1m start up in 2013 but had to discreetly withdraw his award because of the lack of suitable entries. None of them had the potential to make a "Big Boy"


Yet by 2014 a survey showed that there were 34,000 tech start ups in London (up from 1382 recorded in 2011). Even though, (to get back to the problem of defining technology) a director of a start-up said "I think they are including everybody with a computer"!, London has definitely become very tech friendly in the last year.

As a former economist I think it's unreasonable to expect the UK to rival Silicon Valley and to start producing huge tech start ups. We don't have the enormous domestic market with no cultural barriers which the US has, which makes it relatively simple to launch a new concept without looking "overseas". The UK is better placed to excel at producing "niche" digital products, as it is in producing niche products in many other sectors. If we content our ambitions with this, there is still a huge potential for the creation of successful companies and all the jobs and wealth that goes with it.

The US still has some other advantages in terms of less red tape for creating and funding new companies and/or for IPOs (initial public offerings). And yes, there is still scope to make life for digital companies easier and cheaper in the UK, in this domain.

Digital and tech skills
It also common to talk about "digital" when referring to the lack of people with IT/engineering/development skills. We should certainly be encouraging more people to
pursue studies in STEM disciplines, especially women. Statistics show that if there were as many woman studying these subjects as men there would not be the shortage in IT and development skills that we have in the UK today. There is an interesting article on the subject here


Nevertheless a successful start up depends on a combination of skills starting with an entrepreneur who can put those skills and the right people together. The entrepreneur is rarely a developer, but simply the person who find the right developer(s) to produce the product, the right marketing people and skills to market it and the right people and financial skills to fund it.

Lessons learned from founding the Techpreneur's Awards

When marketing the Techpreneurs Awards, I was impressed by interaction and support for internet start ups, in the UK, especially in London. There is an abundance of events and associations in London which give techpreneurs and would-be techpreneurs the chance to get together, to exchange information, get inspiration and find the people they need to get their project off the ground, (including investors). Most of the events are free and so easily accessible.

With the help of these events and associations and the social media, we succeeded (with no budget) in getting over 60 entries from Women Techpreneurs, both in the Veteran class (established companies) or the Conceptual class (companies not yet trading), with 32 going into the final round.

We also had a good response from universities, mostly outside London. There are a growing number of UK universities which have poles to support entrepreneurs and techpreneurs and cash grants. This is a recent development and a very positive one.

The most striking "problem" with the entries submitted to the Techpreneur Awards, was neither a digital nor a technical problem, it was more a lack of financial data and the ability to supply it. Most of the companies/founders who didn't make it to the final round were rejected because they couldn't provide even basic financials.

If the "entrepreneur poles" which can now be found in a growing number of universities could be set up in schools too, this, to me, would be the most impressive way of breeding a new generation of entrepreneurs, techpreneurs and young people who could connect and would get the correct image of a digital world, which is rewarding and exciting. We would then have a strong growth of people pursuing studies and careers in the digital world.

3 September 2014
Scottish Government – Written evidence (DSC0128)

Scottish Government – Written evidence (DSC0128)

The Scottish Government has set out a comprehensive digital strategy which recognises the need for action to develop digital infrastructure, promote digital participation, stimulate the digital economy and promote the use of digital public services. Digital Skills are critical to the success of this strategy and I hope that this submission provides a valuable contribution to the work of the Select Committee.

Annex A: Submission to the Select Committee on Digital Skills

Digital Strategy

1. The Scottish Government’s digital strategy, published in 2011 describes a series of actions designed to ensure that Scotland is well positioned to take advantage of the opportunities of the digital age. It sets out an integrated approach including action to develop digital infrastructure, promote digital participation, stimulate the digital economy and promote the use of digital public services.

2. Reports on the progress made in implementing this strategy are published annually. The latest progress report is expected to be published shortly.

3. In 2013, Scottish Government published findings of work designed to support the development of a world class digital economy in Scotland. This describes Scotland’s existing strengths in sectors such as digital health and care, big data, smart mobility, smart sensor and sensor systems and the smart built environment. It also outlines a series of recommendations designed to stimulate partnerships between the private, public and the third sector in order to ensure that our computing and informatics skills continue to lead the world, support further innovation and ensure that digital businesses, of all types, are encouraged to develop and grow in our country.

4. The 2013 report uses the term “digital” to refer to those activities that involve internet and web technologies, including digital infrastructure, digital platforms and digital content. The “digital economy” is therefore taken to comprise both the “demand side”; namely the use of digital technologies to conduct business and support growth across the economy as a whole; and the “supply side”; namely the specific businesses and sectors that develop, deliver and support the use of those technologies in both domestic and international markets. The digital skills agenda is critical to the success of both sides.

Scotland’s Digital Economy and Digital Skills

5. It is now estimated that the ICT and Digital Technologies sector contributes £3bn GVA to the Scottish economy. This represents about 3% of the economy as a whole. From 2010-13, the number of businesses operating in the sector (software development; telecoms; and ICT services) increased by 3.6% to 6,500.

496 http://www.scotland.gov.uk/Publications/2011/03/04162416/3
497 http://www.scotland.gov.uk/topics/economy/digital
498 http://www.scotland.gov.uk/Topics/Economy/digital/digitaleconomy
6. The sector employs 73,000 people. This is forecast to increase to 84,000 by 2020. A majority of these roles are of high value, with the sector offering median full time earnings of £38,500 compared to the Scottish average of £25,500. Almost three quarters of employees in the sector have attained a higher education or equivalent qualification.

7. Despite the growing demand for skills, the number of young people within the sector has dropped from 29% to 14% in recent years. There is also an increasing gender imbalance, with the proportion of women within the sector having decreased from 30% in 2001 to 17% in 2011.

**Short and Medium Term Support to the Digital Sector**

8. Skills Development Scotland, the national body that supports the people and businesses of Scotland to develop and apply their skills, published a Skills Investment Plan (SIP) for the Digital /ICT sector on 11 March 2014. The plan, which was developed in conjunction with the Digital industry, was accompanied by an additional £6.6 million of funding from Scottish Government in order to support its implementation.

9. The SIP outlined a series of actions under 4 headings:

- Responding to the immediate need for ICT and digital technology Skills
- Broadening the future talent pipeline for ICT and digital technology skills
- Working together to make the education system more responsive to the needs of employers
- Raising the profile of the ICT and digital technology sector and careers

10. Action to address the short term needs of the industry includes the development of an industry – led talent academy designed to provide transitional training for individuals with related skills and improve the access they enjoy to the jobs market. The fundamental principle of the Digital Skills Academy is that it will be “industry led”, with industry leading both the operation of the academy and the development and delivery of the courses offered. The current business case describes a curriculum focussed initially on web and mobile computing, with courses, developed in conjunction with employers, to deliver intense learning in *Java, Ruby, Python* and other web engineering tools in a collaborative environment. At present, it is proposed that the Academy will launch in summer 2015 and offer 6 month – 12 month courses at postgraduate, rather than undergraduate, level.

11. Other actions to address immediate skills needs are:

- Support for Continuing Professional Development and workforce development as a means of up-skilling the current workforce,
- Assisting businesses to widen their talent pool by supporting talent attraction strategies including the recruitment of overseas talent and action to attract more women to enter and return to the profession

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499 [http://www.skillsdevelopmentscotland.co.uk/media/987939/ict__digital_technologies_sector_skills_investment_plan.pdf](http://www.skillsdevelopmentscotland.co.uk/media/987939/ict__digital_technologies_sector_skills_investment_plan.pdf)
• Developing a targeted marketing campaign to raise awareness of skills shortages within the sector with the aim of attracting people into the industry in Scotland.

12. As part of this effort, Skills Development Scotland delivered a “Making Young People Your Business” campaign that successfully promoted the benefits of employing young people and raising awareness of the opportunities offered by Modern Apprenticeships and placement schemes in the digital sector.

Future Talent Pipeline
13. In addition to immediate action to address short term skills gaps, action is required to broaden the future talent pipeline for ICT and digital skills. The Skills investment Plan includes commitments to:

• Map ICT / technology initiatives to the Curriculum for Excellence which aims to provide a coherent, more flexible and enriched curriculum from ages 3 to 18
• Improve access to extracurricular digital activities such as coding clubs
• Work with schools and partners to develop work based career pathways to support young people to progress into Digital /ICT modern apprenticeships, training opportunities or employment
• Deliver a promotional campaign to encourage further take up of Information Technology Modern Apprenticeships and establish new advanced level modern apprenticeship frameworks for ICT/digital technologies in response to industry need.

14. The Scottish Government recently received a report from the Commission for Developing Scotland’s Young Workforce which, amongst other things, examined opportunities to bring employers closer into the delivery of education. One recommendation in this report was that transitions into work would be helped if students in their final year at school were able begin to access high quality vocational qualifications and workplace placements and modern apprenticeships.

Computing Science in Curriculum for Excellence
15. The Scottish Government sees learning in science and technology subjects as important for young people, and for the economy, helping them to develop skills for learning, life and work. CfE provides opportunities for all young people to develop their understanding and skills in computing. The curriculum framework makes the distinction between learning in ICT and in computing science – the use of ICT will be applied and reinforced by all teachers across the curriculum, and pupils will also have opportunities to develop their knowledge of hardware and how software can be developed and applied.

16. Scottish Government and Education Scotland are undertaking work to ensure that computing science is supported in our schools. We are providing BCS, the Chartered Institute for IT, with funding to support professional learning for secondary school teachers of computing science through its PLAN C project. This will help ensure that learning incorporates new programming languages and current thinking on teaching approaches, as well as building professional learning communities within local authorities. We are also supporting NESTA to deliver its “More and Better” Learning programme in Scotland, to develop and test models of digital learning and teaching, and provide associated learning opportunities for teachers.
17. Education Scotland has published a range of support materials for the Computing Science National qualifications and has established a working group to consider the learning and teaching resources that are suitable for the Higher standard. Education Scotland will also publish a *Technologies 3-18 Curriculum Impact Review* which will help gauge the impact of a changing curriculum on learners’ experiences and achievements, and evaluate current practice. The Technologies Review will look at all subjects within that curriculum area, including computing, and the broader use of ICT across the curriculum.

18. The Royal Society of Edinburgh and the BCS Academy of Computing have supported a project to produce exemplification materials for secondary teachers. Education Scotland provided financial support for the work, as part of their support for the CfE qualifications. The materials will help teachers develop computational thinking skills, providing examples of how up-to-date and stimulating environments, such as Scratch programming and mobile apps, can be used as learning contexts within CfE.

**Apprenticeships**

19. Modern Apprenticeships form a significant part of the Scottish Government’s pledge to support youth employment and earlier this year we announced that we will increase the number of places available year on year from 25,000 to 30,000 by 2020. There are Digital related Modern Apprenticeship Frameworks available at Level 2 (SCQF Level 5) and Level 3 (SCQF Level 6/7). There are also Digital related Technical Apprenticeship Frameworks available at SCQF Level 8 (equivalent to a Diploma of Higher Education). These frameworks have been developed by E-Skills, the Sector Skills Council for the ICT and Digital Technology sector in consultation with industry and have been designed to meet employer demand for specific job roles.

20. It is too early to assess the long term success of these technical apprenticeships. The digital industry has traditionally recruited from the graduate pool and it is anticipated that there will be a period of adjustment as employers test and the make the most of this new route. Early signs are however encouraging.

**Action to promote Digital Competitiveness**

21. The report in 2013 established a Digital Scotland Business Excellence Partnership which brings together policy makers with representatives from the digital / ICT sector and Scotland’s enterprise and Skills agencies. This partnership oversees two programmes of work: The skills programme highlighted above, and a Business Support Programme which is hosted by Scottish Enterprise. The Partnership itself is founded on the recognition that the digital economy is extremely fast moving in the sense that company requirements and growth potential can change rapidly and that this requires an integrated response from all those agencies that support economic growth in the sector.

22. The Business Support programme is supported by an additional £7 million from Scottish Government. This has already enabled it to support a digital voucher scheme that supports small and medium sized enterprises to invest in digital technology and a supplier development programme which, amongst other things, seeks to use the requirement to trade electronically with the public sector, as an opportunity to help these businesses to develop their digital skills and understanding. Future plans include a comprehensive programme of digital business support delivered at local level by Business Gateway and its
partners and a programme to promote the uptake of digital technology by Scotland’s tourism industry.

23. Scottish Enterprise dedicates a significant proportion of its Specialist Adviser support to international ecommerce and digital marketing projects with growth companies. Working with Scottish Development International (SDI) and ScotlandIS, the trade body for Scotland’s ICT sector, it has also developed and launched the national ecommerce Scotland Programme that provides master classes, leadership briefings, events and competitions to support international e-commerce. SDI complements this activity with their own standalone international ecommerce workshops targeted at entry-level exporter businesses, whilst sector specific programmes include the “Pixels and Pies” event series aimed at raising awareness of the international ecommerce opportunity within Scotland’s Food & Drink sector.

**Recruitment to Scottish Government**

24. The Scottish Government, in common with many public sector organisations, has experienced difficulties in attracting the digital/ICT talent it now requires. This has led to an increased reliance on short-term contracting staff to provide complex digital skills, particularly in the areas of digital infrastructure and the development of user-focus digital public services. This is not necessarily sustainable in the long term because of the costs involved and the fact that such skills are required over a longer term period than the short term contracting facilities are designed to support.

25. There are training programmes at all levels for Government staff, whilst our support for the Digital Participation Charter described below includes a commitment that all civil servants have the opportunity to develop at least a basic level of digital skills. Cross-departmental and cross-Government training programmes are also in place to raise awareness of digital across the leaders of Government agencies.

**Infrastructure**

26. The Scottish Government’s next generation fibre broadband programme will provide over 95% of premises with access to fibre broadband by end 2017. This is being delivered through two contracts with BT, one covering the Highlands and Islands, the other covering the “Rest of Scotland”. Community Broadband Scotland has been established by Scottish Government within Highlands and Islands Enterprise to provide advice and financial support for communities that lie outside the anticipated footprint of the fibre broadband programme in order to enable them to develop sustainable, community based, connectivity solutions.

27. The current broadband programmes are based on a gap funded model, in which public sector investment is used to make infrastructure investment viable in areas that would not be served by the market alone. Scottish Government recognises that alternative financing models are likely to be required in order to deliver its longer term vision of a world class digital infrastructure that delivers connectivity anywhere, anytime and through any device. Work to identify future investment priorities and financial models to deliver this vision is therefore being taken forward by Scottish Futures Trust, an organisation established to increase the efficiency and effectiveness of different forms of infrastructure investment in Scotland.
Digital Divide

28. The Scottish Government published its digital participation strategy in April 2014. This identifies the need for a national movement for change supported by partnership working across all sectors of the Scottish economy. The Scottish Government has appointed the Scottish Council for Voluntary Organisations to take forward much of its work in this area because it recognises that digital inclusion overlaps with other forms of inequality and that skills development is often most effective if it is delivered at a local level by organisations that already enjoy a position of trust amongst those that they are seeking to support.

Initiatives within this programme of work include:

- A Digital Participation Charter which aims to “match-make” between community needs and organisations / people that wish to support digital participation for corporate social responsibility and other reasons
- A community fund which supports local digital participation initiatives and enables community groups to put their content online and provide a positive reason for people to go only for the first time
- Online training courses to promote basic digital skills
- A database of centres that offer access to these courses and other forms of support
- Support for the provision of free WI-Fi in some public buildings
- Projects with Housing Associations to enhance access and skills training for tenants

29. Work in this area is guided at the highest level by a Ministerial Advisory Committee on Digital Participation chaired by the Cabinet Secretary for Culture, Europe and External Affairs.

3 February 2015

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500 [http://www.scotland.gov.uk/Publications/2014/04/6821](http://www.scotland.gov.uk/Publications/2014/04/6821)
Siemens, City & Guilds and Skills Funding Agency – Oral evidence (QQ 232-249)

Transcript to be found under City & Guilds
Skills Funding Agency, City & Guilds and Siemens – Oral evidence (QQ 232-249)

Transcript to be found under City & Guilds
1. Introduction

The Social Security Advisory Committee (SSAC) is pleased to respond to the Call for Evidence by the House of Lords Digital Skills Select Committee. The SSAC has a particular interest in the actions taken by Government and others to promote digital inclusion for recipients of Social Security, including raising the level of digital skills among this population.

We understand that the primary focus of the Select Committee’s consultation is on the digital skills needed to support the competitiveness of the UK economy. The Social Security system makes a contribution to developing general digital skills in the workforce, for example through provision of skills programmes for the unemployed, however we also wish to highlight the importance of digital skills in enabling those in need of support to access Social Security.

This short paper therefore outlines our views under two main headings:

- Digital inclusion for those accessing Social Security
- Developing digital skills through the Social Security system

2. Digital Inclusion for those accessing Social Security

Digital skills in the Social Security claimant population

There are high levels of digital activity in the general population, with 82% of people found to be online (defined as regular or occasional internet use) in research carried out during 2012. However the same research indicates that the DWP’s customer profile is different, for example:

- 72% of disabled people were found to be online.
- Only 59% of over 65s were online.

Also, accessing benefits online is a relatively complex activity requiring a higher level of digital skills than, for example, simply browsing the internet for information or using email.

There are, in fact, significant concerns over the ability of more vulnerable claimants to access digital services. Research by Citizens Advice Scotland showed that in a survey of over 1100 clients presenting with benefit issues:

- Only 54% had an internet connection at home.
- 36% never used the internet, and a further 11% reported hardly ever using it.

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501 The Social Security Advisory Committee (SSAC) is an independent statutory advisory body of the DWP that provides impartial advice on social security and related matters.
502 Digital Landscape Research (Cabinet Office, November 2012)
503 Offline and Left Behind – Digital exclusion among Scotland’s CAB clients (Citizens Advice Scotland, 2013)
• 76% said they would struggle to claim a benefit online.
• 72% said they would struggle to apply for a job online.

Nonetheless, the rate of internet usage in the general population continues to rise, and the relatively new digital service for claiming Jobseeker’s Allowance online is achieving high levels of usage, with 88.3% of applications made online in June 2014.

As the digital landscape continues to evolve, with new services, devices and channels emerging, so the skills of those currently at risk of digital exclusion will also evolve. We therefore encourage government to continue to invest in monitoring levels of digital exclusion, in particular among the more vulnerable segments of society.

2.1 Support for Social Security claimants with limited digital skills

The Government Digital Strategy\textsuperscript{505} sets out how the government intends to become “digital by default”, both to save money and improve access to government services. Consistent with this approach, the DWP’s Digital Strategy\textsuperscript{506} seeks to increase the use of digital services by claimants, and for example anticipates that by 2017 over 80% of claims for Universal Credit will be made online.

Both of these strategies recognise that there is a need for alternative provision, known as “Assisted Digital”, for those who lack the skills or for other reasons are unable to access digital services. There are also legal requirements affecting the provision of alternative means of access to government services\textsuperscript{507}.

The DWP is in the early stages of developing its approach to Assisted Digital, currently working with other government departments and carrying out investigative projects\textsuperscript{508}, and has the aim of agreeing an Assisted Digital approach for its digital exemplar services (including Universal Credit) during 2014\textsuperscript{509}.

Early indications are that the DWP approach to Assisted Digital will place emphasis on use of third parties to deliver skill development and other support to claimants who are not online:

• The DWP Digital Strategy suggests that, in the longer term, provision of residual non-digital services for those who cannot interact online “may well require the DWP to work through others, better placed to engage with those who need this support”.
• For Universal Credit, the Local Support Services Framework\textsuperscript{510} sets out an approach to delivering support to those not currently online by working in partnership with local authorities, third sector organisations and others.

\textsuperscript{504} DWP Business Plan Transparency Measures (DWP, Updated August 2014)
\textsuperscript{505} Government Digital Strategy (Cabinet Office, December 2013)
\textsuperscript{506} DWP Digital Strategy (DWP, December 2012)
\textsuperscript{507} Bishop Electrical et al v HMRC Tax Commissioners (September 2013)
\textsuperscript{508} For example the Digital Deal which provided funding for internet services and training to social housing tenants.
\textsuperscript{509} Action 9 of the DWP’s response to the Government Digital Strategy (DWP, December 2013)
\textsuperscript{510} Universal Credit local support services framework (DWP, February 2013)
While we recognise the benefits of local provision tailored to local needs, we are concerned that this emerging approach could lead to a diminished level of DWP accountability for ensuring that claimants who do not have the skills to access digital services, or are digitally excluded for other reasons, receive the support they need. This is particularly important given the current financial pressures on local authorities and third sector organisations. We therefore believe it is essential that the DWP remains fully accountable for funding and ensuring the quality of support to claimants who would otherwise suffer from digital exclusion.

Other digital inclusion issues affecting Social Security claimants

A number of other aspects of digital inclusion affect claimants, in addition to lack of skills. While these are not directly related to the subject of this consultation, we briefly include some significant ones here in order to provide a more complete picture of the subject:

(a) As referenced above, a significant percentage of claimants may not have access to a computer or internet connection at home.

(b) Where an internet connection is available, it may not have the speed/capacity to support complex digital services (e.g. in rural areas).

(c) Claimants may have disabilities or health conditions which impact their ability to use digital services, and may not have access to assistive technologies where these exist (e.g. screen readers for the visually impaired).

(d) Where a telephone-based alternative to a digital service is provided, the cost of calls may be prohibitive, especially where a claimant depends on a mobile phone.

We believe it is important that the DWP’s emerging approach to assisted digital addresses issues such as these in addition to providing support for skills development.

Further, it is important that Government overall continues to ensure investment is made in the public infrastructure needed to provide access to digital services, in particular provision of high speed network connections to rural areas and of public access points (e.g. libraries).

3. Developing digital skills through the Social Security system

3.1 Helping claimants to develop digital skills

It can be argued that providing high quality government digital services which are widely used may of itself encourage people to develop their digital skills, although whether this has a significant impact compared to the availability of social media and other online activities is unclear. However, in delivering Social Security and supporting the unemployed, the DWP has a number of important opportunities to help claimants develop their digital skills:

- Jobcentres can currently access funding to provide digital skills training for unemployed claimants in their area (using programmes such as UKOnline, Online Basics and e-skills UK).
Organisations delivering the Work Programme for those at risk of becoming long-term unemployed can provide similar digital skills training for the claimants they are supporting.

Jobcentre Plus work coaches can support individual claimants with online tasks such as preparing a CV, searching for vacancies and preparing job applications.

As referenced above, the Universal Credit local support services framework envisages local partnerships providing digital skills training for claimants not currently online.

We believe these programmes can offer an important way for those with very limited digital skills, and often on the fringes of the employment market, to start building the general digital skills needed for the future workplace. We therefore encourage government to continue to fund these programmes, and to monitor outcomes in order to maximise their effectiveness.

4 September 2014
Solace and Leeds City Council – Written evidence (DSC0124)

Submitted as a joint response between SOLACE and Leeds City Council, Health Partnerships

This is a response to outline the proposed work of the Solace network in local government, with inclusion of some examples from Leeds as a case study of how digital leadership and skills is being encouraged by partnership working in local authorities.

The content is relevant to the following questions asked by the committee:

Short- and medium-term support to the digital sector

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

Infrastructure

15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

PART 1: SOLACE

ABOUT SOLACE

Solace is the representative body for over 1300 Chief Executives and senior strategic managers working in the public sector in the UK. We are committed to promoting public sector excellence. We provide our members with opportunities for personal and professional development, and seek to influence debate around the future of public services to ensure that policy and legislation are informed by the experience and expertise of our members. Whilst the vast majority of Solace members work in local government we also have members in senior positions in health authorities, police and fire authorities and central government.

Solace has recently appointed 10 new spokespeople and deputy spokespeople on key policy issues for local public services, supported by virtual policy networks. ‘Digital Leadership’ is one of these key policy areas, and Solace has drafted an initial set of priorities around digital leadership for local authority workforces and places. Since the new spokespeople were appointed in October 2014, the following provides a view of the commitment and enthusiasm amongst local authority leaders to find progress on the themes identified by the Select Committee:
Priority Area 1: Digital as enabler of economic growth, prosperity and liveability in our places

Encouraging and promoting the growing ‘digital sector’ of the economy

- Is our education system (formal and informal) preparing people to make the most of the new jobs and opportunities being unlocked? In particular, is the compulsory school system fostering the necessary skills and excitement in young people?
- Do our authorities’ take the same care to build relationships with, support and encourage the ‘digital’ sector in the local economy as they do other sectors? Don’t want to smother and bureaucratise innovation but do want to support where possible and have ‘on side’.
- Do our own organisations ‘model’ that openness and encouragement? What about our commissioning/procurement systems for example?

Digital as a tool to promote civic connections and participation

- What does ‘placemaking’ look like in non-physical spaces? We spend significant time in planning and economic development thinking about how the physical environment can shape lives. What would ‘digital planning’ look like?
- Where can we make realistic, strategic interventions to promoting thriving digital social spaces? Again, not about bureaucratised or ‘controlling’ approaches – about trying to facilitate connections and bring partners together
- What role can digital spaces play in combating social isolation and loneliness – a new mechanism for fostering and building social contacts (and challenging the lazy equation of digital with ‘anti-social’)

Infrastructure and access

- What would it look like if we were serious about catching up with the best in the world (i.e. South Korea) with regard to digital infrastructure? Super-fast broadband, widely available public Wi-Fi etc.
- What role can we play in making this happen? Widespread infrastructural change a 10 year goal, how can we model this and drive it ‘from the ground up’?
- How can we ensure we model this behaviour? Do all council buildings have public Wi-Fi and spaces to meet and work?

Managing economic disruption

- How can we support our communities through the almost inevitable disruption to many industries which are likely to continue and become more rapid? (education, social support etc)
- How can we foster resilience and adaptability in our places and ensure there isn’t over-reliance on any one industry or sector (no matter how strong it might look).
- About moving from a model with sudden, large-scale employment disruptions (e.g. factory closures) to more systematic, regular shifts

Priority Area 4: Digital leadership skills, capacity and capability for the future

Reframing the Leadership challenge

The questions or hunches we are testing and starting from are:
1. Reframing the purpose of local government and our measures will help deliver digital / social change and financial savings

2. Demonstrating good digital leadership is simply good leadership

**Developing and growing digital leadership skills and capacity**

The questions or hunches we are testing and starting from:

1. Providing new skills and experiences around change / service design / social innovation for staff at all levels will support the radical redesign of local services

2. Removing digital ignorance at the top table (including political top table) in councils will reinforce and introduce new behaviours and ways of working (networked, open, collaborative etc.)

**Developing and strengthening digital capability**

The questions or hunches we are testing and starting from are:

1. Investing in and aligning resources around digital demand and capability will support the transformation of local services

2. Working beyond traditional boundaries and developing new collaborations and partnerships with agile suppliers “digital / service change experts” will help reduce and mitigate the risk of failure

**PART 2: LEEDS CITY COUNCIL, HEALTH PARTNERSHIPS**

1. Leeds City Region

2. Leeds Innovation Health Hub

1. **Leeds City Region**

The city region has identified Creative & Digital as one of its key industries in which it has distinctive and world-leading capabilities, and where there are real opportunities for rapid, sustained growth. The following are some examples of work in this area, although not an exhaustive list:

**A. Digital Infrastructure**

Enhancing digital infrastructure is critical to supporting economic growth and competitiveness in the city region, enabling business to exploit the opportunities that improved connectivity will bring to increase productivity, reduce overheads and travel costs, and access new markets, products and suppliers.

The Leeds City Region Digital Infrastructure Plan was published in Spring 2012, setting out the long term strategy for enhancing the City Region’s digital infrastructure and promoting and exploiting its use by business and residents. Outcomes planned or already delivered include:

- Supporting York to deliver its successful Super Connected Cities programme;
- infrastructure roll-out programmes to complete superfast broadband access coverage;
• wireless networking extended to all towns and city centres and the remotest of rural areas throughout LCR;
• a demand stimulation campaign to encourage significantly greater take-up of newly available superfast broadband capacity to residents and businesses.

http://www.leeds.gov.uk/docs/LEH%2003%20Leeds%20City%20Region.pdf

b. New Opportunities for Growth

Business growth in our digital and creative industries has outstripped that of other UK core city regions. Supported by a dynamic cultural scene, employment in digital and creative industries is higher here than Manchester or Bristol.

Growth in business numbers has been particularly strong in software, computer games and electronic publishing (an increase of 78% between 2005 and 2009) and radio and TV (a 66% increase).

And this growth is set to continue, thanks to our proximity to Media City in Salford – just 40 miles from Leeds – which offers lucrative new business opportunities.

The sector is supported by vibrant industry networks, university excellence and various creative business hubs, including dedicated media centers in Leeds, Huddersfield and Barnsley.

c. Key industry clusters:

Digital electronics

The Airedale Digital Corridor has a combined turnover equal to that of Cambridge. It is home to a significant cluster of market-leading digital and electronic firms including Pace, Filtronic, Echostar Europe, Radio Design, Teledyne Defence and Bradford Technology.

The Advanced Digital Institute supports innovation in this sector by providing expertise in digital TV, smartphone technology, telehealth and telecomms infrastructure

Gaming

Leeds City Region is home to a significant gaming industry and global players including Team 17, Rockstar, Dubit and Four Door Lemon. Well-known games developed in Leeds City Region include Max Payne and several installments of the best-selling Grand Theft Auto franchise. The sector is supported by industry-led games network, Game Republic.

Developing Digital Skills

The Leeds City Region LEP has recently secured £100,000 of funding for SMEs to develop digital skills http://business.leedscityregion.gov.uk/news/superfast-boost-for-leeds-city-region-small-busine/
2. Leeds Innovation Health Hub

The City has developed a Leeds Innovation Health Hub, which uses some of the city’s unique assets to develop work and attract inward investment in health, innovation and associated digital technologies. The aims of LIHH are:

- To achieve improved health and social care outcomes for the population of Leeds
- To maintain and further enhance the international reputation for Leeds as a centre of excellence for innovation in health and medical technology
- To attract inward investment and encourage local enterprise and business opportunities through innovation in health and medical technology

The core assets in the city include:

- National health organisations
- 3 universities
- Thriving private businesses from the health sector
- Patients, families and communities
- Coordinated partnership working across health and social care in a large UK city

The core areas of focus for delivery from the hub are:

- Medical Technologies
- Health Informatics
- Engaging Communities

There is significant work with the academic institutions in Leeds on the digital agenda and beyond, particularly in relation to health. The University of Leeds has contributed to the development of the Leeds Care Record, lead the establishment of the Leeds Institute for Quality Healthcare and plays a key part in the local digital economy. The University, together with partners, has recently submitted a bid to play a crucial role in the Leeds City Region and nationally. It aims to address important challenge areas, especially in relation to sustainability, citizenship, wellbeing and digital infrastructure. There are close links to Leeds Beckett University with a joint appointment in health, and work across the city to link up the agendas of academic institutions and civic organisations. This is not just limited to knowledge sharing, as much joint planning and consultation happens with a number of projects to proactively work together. For example, the Leeds Academic Collaborations with the Third Sector (LeedsACTS!) network has recently started the development of a Third Sector Informatics strategy to better utilise the digital assets that exist in the Third Sector.

12 December 2014
Sunderland Software City – Written evidence (DSC0063)

1. Background and Organisational Relevance

1.1 Sunderland Software City (SSC) is an organisation established in 2008 to support the growth of the software industry in the North East of England. It works with a community of circa 1,350 software companies in the region and delivers business support to new and established businesses using European Regional Development Fund (ERDF) and local authority funding.

1.2 The skills requirements of the software companies we work with has become increasingly important, so much so that in a recent survey as part of our evaluation “recruiting staff with the right skills” ranked as the greatest barrier to growth (see figure 1).

![Figure 1 - Barriers to Growth](image)

1.3 Since 2012 SSC has delivered career guidance to young people in order to increase awareness and perceptions of the industry at a local and national level. In 2014 SSC was awarded a Local Enterprise Partnership (LEP) and Skills Funding Agency (SFA) Local Response Fund (LRF) project to deliver skills training in the workplace. Specifically this will deliver leadership, management and sales training to those requiring upskilling.

2. Response Overview

2.1 This response is based on interaction with businesses in the course of SSC’s ongoing daily activity. It represents collective learning from our business support activities and skills delivery.

2.2 SSC is responding to only a limited number of questions laid out by the committee. The questions answered are the ones which we feel we can add relevant value to.
3. **Response to Questions 3**

3.1 Figure 2 provides a forecast of growth in the North East’s software sector. This sector is narrow in definition and is defined using SIC code analysis\(^{511}\). Even in this specifically narrow definition there is a requirement for circa 5,000 extra employees in the sector.

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<tbody>
<tr>
<td>Net Number of New Businesses for the Period</td>
<td>N/A</td>
<td>59</td>
<td>146</td>
<td>210</td>
<td>308</td>
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</tr>
<tr>
<td>Total Number of Software Business in the Region (end of period)</td>
<td>1,074</td>
<td>1,133</td>
<td>1,279</td>
<td>1,490</td>
<td>1,798</td>
<td>724</td>
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<tr>
<td>Annual Sector Revenue in the Region (end of period). £m</td>
<td>£450</td>
<td>£491</td>
<td>£580</td>
<td>£716</td>
<td>£918</td>
<td>£468</td>
</tr>
<tr>
<td>Net Number of New Employees over the Period</td>
<td>N/A</td>
<td>404</td>
<td>1,007</td>
<td>1,456</td>
<td>2,123</td>
<td></td>
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<tr>
<td>Total Software Sector Employees in the Region (end of period)</td>
<td>7,412</td>
<td>7,816</td>
<td>8,823</td>
<td>10,279</td>
<td>12,402</td>
<td>4,991</td>
</tr>
</tbody>
</table>

![Figure 2 - North East Software Sector Growth](image)

4. **Response to Questions 5**

4.1 Through activities delivered in schools with teachers, students and parents we have discovered the software industry suffers from lack of awareness and poor image. It is difficult to fully understand the rationale behind this however we have observed the perpetual reiteration of five myths around the industry:

- All software jobs are moving off-shore
- You must have at least one degree to work in the software industry
- All jobs in the software sector are for ‘techie’s’
- The opportunities for developers focuses mainly around the games industry
- No girls work in the software sector

\(^{511}\) Sunderland Software City Strategy can be found at: [http://issuu.com/pacreative/docs/ssc_strategy_doc_no_crops/2?e=3780039/1900816](http://issuu.com/pacreative/docs/ssc_strategy_doc_no_crops/2?e=3780039/1900816)
4.2 SSC activity has been aimed at dispelling these myths thus preventing self-deselection of young people entering the industry or even the education path to enter the industry.

5. **Response to Question 8**

5.1 Perhaps more so than any industry, the digital industry requires ‘t-shaped’ people. Such people not only have core competencies – the vertical of the ‘T’, but also have an understanding and appreciation of wider business functions – the horizontal bar of the ‘T’.

5.2 At present there is little appreciation of such a requirement, for example ensuring those who learn coding skills also have an appreciation of customer interaction or business processes. All post-16 providers will teach the broad array of competencies required but many fail to expose students to cross-curricular learning. Even on a non-accredited basis exposure of basic principles of wider functions will make students more employable and better equipped for a successful career.

6. **Response to Question 9**

6.1 From both an intermediary perspective (such as SSC) and an industry perspective (the companies with which we work) there is a lack of clarity of provision. Who is responsible for what? Why is one provision different from another? How should businesses engage?

6.2 For the short and medium term delivery plans, there needs to be clarity of provision made to industry, in doing so requirements from industry will flow. More commentary is made on the role for intermediaries, such as SSC, in our response to question 12.

7. **Response to Question 10**

7.1 In the short term, high-skilled immigration from EU countries should be explored. It should be explored as a solution to the immediate, short-term requirement for skilled and experienced technical staff within the digital industry.

7.2 In exploring immigration, there is the possibility to curb the use of outsourced software development in favour of development locally that benefits in-work training.

7.3 By having a programme of talent attraction to the UK emphasis can be placed on finding experienced employees who can both complete the work but also add value to in-work training provision. Such an approach perpetuates the next generation of indigenous talent.

7.4 Any such talent attraction programmes such take into consideration demand requirements from across the UK, not just London.

8. **Response to Question 12**

8.1 We propose there is not a market failure in the supply side of skills provision – FE, HE and private provision all have the ability to teach required content. The market failure exists in the messaging between the demand side (industry) and the supply side.

8.2 SSC has positioned itself between the skills demand and supply side of the digital industry to act as an aggregator of demand. Such aggregation of demand enables the supply
side to offer provision that matches demand. Such a role requires only a small amount of investment in order to have a significant impact. This ‘gearing’ effect is a role which local government should continue to fund.

8.3 If no such intermediary exists – one with a strong industry relationship – Local Enterprise Partnerships should look to take on this role.

9. Response to Question 13

9.1 As suggested in paragraph 1.2 of this response the most significant barrier to growth for SMEs is the availability of skills. As the question shifts to ‘why does current provision not work’ the response to question 12 in this submission comes to the fore.

9.2 Observed activity in the digital sector regarding the current ‘on-boarding’ of new staff, either as new graduates or apprentices, suggested supporting new workers causes the largest barriers.

9.3 SMEs have limited capacity – a symptom of lack of employee supply – this is compound by the requirement to support new entrants over a period of months, in doing so more capacity is lost.

9.4 One solution is the short terms provision of skilled workers, in the form of freelance staff, to backfill posts as more senior staff support the induction of new team members.

5 September 2014
Tablets for Schools has pleasure in submitting a summary of our research to the Digital Skills Committee. We believe this summary will help to inform questions 4-8: Future Workforce.

This paper summaries key findings and key facts to emerge from 14 research studies carried out between 2011-14 by Family Kids and Youth on behalf of Tablets for Schools. Following a short management summary, the research findings are briefly summarised in date order. The last page provides information about Tablets for Schools and Family Kids and Youth.

**Tablets for Schools Research – Management Summary**

- One-to-one mobile devices in schools are perceived by teacher leaders to have the advantage of offering pupils immediate access to the internet to provide information, learning material and communication.
- Schools wish to engage with mobile devices, including Tablets, as part of their pedagogical model because acquiring digital skills is seen as essential to equip pupils for further study and work in the 21st Century.
- 9% of UK schools interviewed have introduced one-to-one Tablet devices; 49% of schools are considering doing so.
- 93% of schools introducing one-to-one Tablets have done so to prepare pupils for working and living in a digital age.
- Teachers view the use of Tablets as a means to enhance their ability to provide individual tuition, benefiting both those with SEN and gifted and talented pupils.
- 87% of pupils using one-to-one devices claim to find learning easier because of their Tablet. 69% believe they are more motivated to work because of their Tablet, and 68% of pupils believe that having a Tablet will benefit their school grades.
- Adoption of one-to-one devices is best managed within the school through a collective agreement on the principles of the pedagogical changes that are likely to occur, e.g. collaborative learning, independent learning and enhanced teacher-pupil relationship.
- This calls for an objective within the school to ensure that parental, staff and governor engagement is established at an early stage.
- Teachers can lack confidence in using digital devices in teaching and there is currently little guidance available within teacher training establishments.
- Comprehensive management of the school’s infrastructure, including sufficient Wi-Fi provision, technical support, provision for repair and insurance, is essential.
- Sufficient Wi-Fi provision is a major barrier to schools, particularly in rural areas, along with a lack of knowledge about insurance and provision of technical support.
- There is some distraction which occurs with pupils admitting to using social media in class but notably pupils using one-to-one devices become adept at self-regulation and have firm views about how devices should be used safely both at school and at home.
- Allowing enough time and training for staff to become familiar with the devices, and a clear policy on usage including apps, other content, communication tools and firm boundaries with, if necessary, the installation of firewalls, appears to drive successful adoption.
• Leadership, as well as teachers, need strong support in the form of clear guidelines at the point of introducing individual mobile devices. Learning from other schools that have already adopted one-to-one devices is immensely valuable.

**Tablets for Schools Research – Key Findings**

1. **February 2012: One-to-one Tablets in Secondary Schools: An Evaluation Study - Stage 1**

This summarises findings from an evaluation study that looked at the feasibility of giving pupils in secondary schools one-to-one tablets. Research was carried out between September 2011 and July 2012 and included a literature review, a review of global evaluation studies, and an evaluation of three secondary schools that had chosen to give pupils one-to-one tablets in September 2011. The three schools were in Belfast, Kent and Essex, with the main focus of the research on the Essex school, and included a nearby ‘control school’ that did not have one-to-one tablets, plus two feeder primary schools. Interviews with school leadership were carried out in all schools, plus observation of tablet learning in the three Tablet schools across a range of subjects. In addition eighteen focus groups were carried out with pupils, parents and teachers. Results suggest several benefits to learning including an increased motivation to learn; increased parental engagement; more efficient monitoring of progress between pupil and teacher; greater collaboration between teacher and pupil and between pupil and pupil. It appears that one-to-one Tablets offer a sense of inclusion that allow children, irrespective of socio-economic status or level of attainment, an opportunity to thrive through a new pedagogical model of pupil-led learning.

2. **May 2012: Tablet Use in School - Pupil Research**

Honeywood was one of our original research schools and introduced one-to-one Tablets in September 2011. FK&Y interviewed pupils at Honeywood School about their use of their Tablets over 1 week in May 2012. Pupils in Years 7 – 10 were sent a questionnaire each day (Monday to Friday) and asked a different set of questions about the way they used their Tablet that day, and their attitude towards having their own Tablet in school.

**Impact on Learning:** 87% - “I find learning easier because of my iPad”; 72% - “I think my work has improved because of my iPad”.

**Impact on Creativity:** 90% - “It is easy to make presentations of my work on my iPad”; 61% of pupils using Tablets would like to design their own apps.

**Academic Achievement:** 68% - “I think having a Tablet will benefit my school grades”; 61% - “I think I will do better in exams because of my iPad”.

**Working Collaboratively:** 92% - “I can share my work with others in my learning session”.

**Independent Learning:** 100% - “I can use my Tablet to help me do research for schoolwork”; 88% - “I can work at my own pace and it doesn’t matter if others are working slower or faster than me in lessons”.

**Motivation to Learn:** 92% - “having my own Tablet in school is a good idea”; 69% - “I am more motivated to work because of my iPad”; 41% - “using iPads is a good reason to come to school”.

**Distraction:** 18% - “I am sometimes tempted to play games in lessons”; 24% - “I get distracted in class because I’m often sent messages or games by my friends”.

964
3. June 2013: Teacher Leader Research

In June 2013, FK&Y sent a questionnaire to Teacher Leaders at 21 of our research schools. These are schools that have adopted 1-2-1 Tablets. In-depth Case Studies of each school can be read here. Main findings include:

Adoption of Tablets: Schools adopted 1-2-1 Tablets between 2010 and 2013. Nine schools were planning full adoption in school year 2013-14. The time taken from first consideration to deployment averaged 11 months. However, for the majority the time was between 1-2 years. Schools needed considerable help and support before they introduced 1-2-1 Tablets.

Reasons to adopt Tablets: 93% to prepare pupils for working and living in a digital age; 90% to support self-led research and problem solving; 53% to ensure equality of access to the internet; 43% to achieve potential cost savings (admin, printing, books, computers suites etc).

Challenges: Insurance and breakages: 71% insist on a specific protective cover / case for the Tablet to prevent breakages; 68% required help with insurance; 53% required external help with choosing protective cases; 25% found insurance very or quite difficult.

Challenges: IT & Wi-Fi Concerns: 80% had additional IT costs, including: IT staff, upgrading wireless access parts, storage and charging facility, mobile device management system. Improving Wi-Fi alone cost between £25 – £250k, with an average of £83k; 53% felt they required external help with Wi-Fi; 45% of schools have had to introduce additional broadband; 27% found obtaining external help with Wi-Fi difficult.

Challenges: Financial: 38% used a ‘blended’ approach, that is they used different ways to finance the scheme; 24% were school-funded only; 19% were parental contributions only; 19% were gifted to Year 7’s by Microsoft / Google / Acer / Sony as part of the T4S research; 17% found getting help on financial issues difficult.

Computer Suites: 95% previously had a computer suite before the introduction of Tablets; 81% still have a computer suite.

Attitude towards teacher engagement: 95% offered their teachers professional development during the period of adopting 1-2-1 Tablets; 90% offered their teachers professional development before Tablets were introduced; 89% have offered their teachers professional development since the introduction of Tablets; 81% provided teachers with their own Tablet computer.


Research for this stage was carried out between September 2012 and April 2013. The research included an evaluation of four secondary schools that had chosen to give pupils one-to-one Tablets in September 2011, two schools that had introduced Tablets in autumn 2012, and three schools that were given Tablets by Tablets for Schools for Year 7s between 2012 and 2013. Methodology included qualitative and quantitative research. Results suggest that long-term use of the Tablet has a profound effect on pedagogy, and that pupils benefit from having access to content both at school and at home. Pupils appear to have greater engagement with learning, collaboration with peers increases, and teachers can monitor individual progress effectively. There are some concerns about pupil distraction and managing time effectively. It is clear that schools need time to adjust to the introduction of one-to-one devices, and that the functions of the Tablet device need to be understood by teachers, together with the changes to pedagogy that are brought about by an increase in
independent learning. Strong leadership helps this process. Infrastructure, insurance or self-insuring, and protection for the devices need to be considered before introduction takes place, and access to appropriate content is key to using the devices effectively. For schools considering the introduction of one-to-one Tablets, learning from schools that have undergone this journey is highly beneficial.


This updates the global picture first outlined for Tablets for Schools by Family Kids and Youth in Stage 1. Inevitably this is a fast and constantly moving market, and one that Tablets for Schools continues to monitor regularly. Nearly one year on it is notable that spending on ICT is increasing and the majority of this appears to be going towards one-to-one schemes. According to a recent survey by European Schoolnet an average of 8% of students in Europe have access to a personal laptop or Tablet, but there are large differences between countries. For example, in Year 9 or Grade 8 (13-14 years olds) 40% of Spanish pupils have access to a one-to-one device, whereas in Finland, Lithuania, Estonia and Slovenia hardly any pupils at the same age have access. In Year 13 or Grade 11 (16-17 years old) almost 90% of Norwegian students have access to a one-to-one device, but in countries such as Austria, Turkey, Italy, Lithuania and France access to computers is currently far less common.

The survey also shows that especially in Denmark, Norway and Portugal BYOD schemes are popular and over 50% of students in these countries are allowed to bring their own smartphones, tablets or laptops to school.


This summarises findings from research carried out between April and September 2013. The method included questionnaires from face-to-face interviews and ethnographic observation carried out in 21 schools. The research assesses and compares staff, pupil and parental attitudes before and after Tablets were introduced to Year 7s in three schools. The findings indicate that the adoption of one-to-one Tablet use is best managed within the schools through a collective agreement on the principles of the pedagogical changes that are likely to be brought about, and an objective to ensure parental and staff engagement at an early stage. Comprehensive management of the school’s infrastructure, including sufficient Wi-Fi provision, technical support, provision for repair and insurance, is essential. Allowing enough time and training for staff to become familiar with the devices, and a clear policy on usage including apps, other content, communication tools, and firm boundaries with, if necessary, the installation of firewalls, appear to drive successful adoption. Preparing pupils for life and work in the 21st century is the common objective of these schools, and learning how to manage time and the possibility of distraction through one-to-one Tablet use is an important part of this preparation.

7. January 2014: Pupil Research

In January 2014, FK&Y sent questionnaires to every pupil at nine of our long-term one-to-one Tablet using schools to find out their experience of using Tablets at school and at home. Responses were received from 3,558 pupils aged 11 to 17.
Online safety: 90% say their school talks to them about staying safe online; 85% of pupils said their school blocks access to some websites and apps such as social media and games; 82% know how to change their privacy settings; 71% agree that most people their age know how to use the internet safely; 70% are concerned about keeping personal details private online.

Concerns over time spent online: One in four 11-17 years olds think they are sometimes addicted to using the internet; Boys admit to using the internet compulsively for gaming (26%) and girls for socialising (42%); A correlation exists between those who take their device to bed and feeling addicted – rising from 41% to 50%; Two thirds are taking an internet enabled device to bed with them at night; Of these, two-thirds are talking to friends on social media or watching films and videos; 31% are doing their homework.

Tablets for Schools Pupil Charter: As a result of the research, young people from the research put together their own charter:

1. **Switch Off and Sleep** – Don’t take your device to bed! Power down 30 minutes before bed. Get a real alarm clock!

2. **Set Time Limits** – Don’t waste time watching hours of content. Do you really need to check your profile again?

3. **Find New Boredom Busters** – Interests and passions that you can enjoy and dedicate time to offline.

4. **Unplug** – Dedicate certain times in the week or day to being unplugged and encourage your family to join you.

5. **Protect Study Time** – When studying, switch your device or social media alerts off to avoid distraction.

8. February 2014: Introduction of Coding Research

In February 2014, FK&Y sent questionnaires to 40 Tablets for Schools research schools to ask about the introduction of coding into the curriculum in September 2014. Results found: 75% of school heads think teaching coding is relevant to their pupils; 67% of schools are already teaching coding; 33% do not feel confident about introducing coding to the curriculum; ‘It is the most common concern voiced by senior teachers about the new national curriculum’.

9. April 2014: Nexus Tablet Research

To support Tablets for Schools, Google offered 7,300 Nexus 7 Tablets and 18 schools were selected to receive them in July 2013. The Tablets were gradually introduced into the schools during 2013-14. In April 2014 FK&Y sent the 18 schools a survey to find out how they found the experience. Despite receiving support from Tablets for Schools, 9ine and Google, the research found that the process was not an easy one, and schools still required additional external help and guidance.

Top line findings: 56% need external help / guidance on receiving Wi-Fi / broadband; 44% need external guidance or help on changes to teaching and learning; 44% need help with insurance; 41% of schools need help with financial issues.
10. April 2014: One-to-one Tablets - A Literature Review
The interest in this area has continued to grow amongst academic researchers. An increasing number of publications have debated the effects these devices have on teachers and pupils in educational contexts ranging from nurseries to universities. Tablets for Schools assesses what, if anything, distinguishes Tablets from other technologies that have previously been introduced in

11. August 2014: Advice to others:
Young people using one-to-one devices were interviewed about staying safe online. They had this advice for other young people:

1. ‘Stranger Danger’ – Stay away from people unknown to you. People can lie about themselves. Don’t accept friend requests from unknown people and certainly never meet them. Accepting unknown friends gives a stranger access to photos, details and friend lists putting you and others in danger. Block anyone suspicious.

2. Don’t share personal information – Keep privacy settings ON (82% of these savvy teens know how to change privacy settings) and don’t give away personal info, where you are going, where you live.

3. Think before you post – Be kind. If you would not say it face to face, don’t say it online. Don’t post something that you would not be happy shouting in a public place or would not want your parents to see, especially photos. Pictures posted can be photo-shopped and used to bully. Remember once posted, everyone will see it and it may be hard to take down completely. Future employers look at profiles.

4. Avoid unfamiliar, inaccurate or inappropriate content – Don’t click on pop ups and virus check everything you download. “Listen to your Mother, she knows best!!!” Tell your parents, tell CEOP, tell a teacher, but report it. If you don’t, the bully will keep bullying.

5. Report it – “Listen to your Mother, she knows best!!!” Tell your parents, tell CEOP, tell a teacher, but report it. If you don’t, the bully will keep bullying.

12. August 2014: Attitudes to Gaming
Games such as World of Warcraft, Call of Duty and Grand Theft Auto are among the most popular games amongst young people aged 11-17. There is considerable disquiet amongst adults about children playing games with violent or inappropriate content and a fear that it will influence or harm them. Age ratings have been introduced in an effort to prevent young people from playing these games. In this survey of over 3,500 young people between 11-17 years, seven out of ten said they were ‘not bothered’ about young people playing games that were intended for older people.

The most common reason young people were ‘not bothered’ by underage play was a perception that these were ‘only games’, not real and that young people would therefore not be influenced by their content. This was followed by a belief that these games were ‘just fun’ and that young people are mature enough to deal with the content. However the most common reason why young people were opposed to children playing these games was a
belief that the ratings were there for a reason and should be respected. Others argued that these games contain inappropriate content and that this could negatively impact thinking and behaviour.

13. October 2014: Revisiting Coding
This research revisited the schools which took part in the Coding research in February 2014, before the introduction of Coding into the curriculum. Nearly 9 out of 10 schools (87%) now feel that the teaching of coding is relevant to their pupils, compared to three-quarters (75%) in February. Over a fifth (22%) feel that it is ‘very relevant’ (compared to 36% in the February survey) and nearly two-thirds (65%) believe it is ‘quite relevant’ (compared to 39% in the February survey). Only 9% of schools do not feel that the teaching of coding/computer programming is relevant providing ratings of ‘not very relevant’ (compared to 12% in the February survey).

Schools in the research express a belief that the teaching of coding prepares pupils with the skills needed for a growing employment sector and therefore equipping and preparing them well for a potential future career. Schools also believe teaching coding equips pupils with logical thinking, analytical and problem-solving skills.

Schools are now far more confident about the introduction of coding/programming than they were earlier in the year with nearly 8 out of 10 (78%) now feeling confident about its introduction, compared to under half (47%) in February.

14. November 2014: The Use of one-to-one Tablets in Schools – Stage 4
671 schools across the UK took part in the research. The research found that a lack of funding prevents many schools from introducing Tablets on a larger scale. In most schools Tablets are a shared resource. 69% of schools are currently using Tablets in teaching and learning. Of these, 9% are using one-to-one Tablets. 17% of secondary schools are using one-to-one Tablets but only 5% of primary schools. 34% of schools use Tablets in some lessons only; 15% have introduced Tablets for teacher use; 14% use Tablets in some years only; 12% of schools use in some classes only. 49% of schools claim to be considering the introduction of one-to-one Tablets or other mobile devices and 42% say they might be considering the introduction of Tablets. While teacher leaders believe that introducing one-to-one mobile devices will help prepare pupils for higher education and career training, concern about teacher training and ways teachers can be supported to use digital technology in teaching and learning is a major factor, indicating that there is a clear need to support schools on the journey of introducing mobile devices.

Background
This evidence is submitted by the charity Tablets for Schools and research company Family Kids and Youth (FK&Y).

Tablets for Schools
Tablets for Schools is a registered charity passionate about the transformative effect of technology in the classroom and beyond. It brings together teachers, industry leaders and academics, using robust and independent research on how tablets and mobile technology can impact learning and attainment. In the last 3 years Tablets for Schools, in collaboration
with research company FK&Y, has carried out extensive research looking at the use of Tablets in education. This has included three literature reviews and primary quantitative research with over 4,000 young people using 1-2-1 Tablets in schools; teacher leaders at 40 schools using 1-2-1 Tablets; teacher leaders at 671 UK schools about their Tablet use; over 50 face-to-face focus groups with parents, teacher leaders, governors, teachers and students in schools using one-to-one Tablets.

Tablets for Schools is led by Director Mary Palmer. Mary is passionate about the way in which one-to-one mobile devices can be used to foster the democratisation of education by allowing each child in school access to the internet and the best learning resources to prepare them for life in the twenty-first century.

http://www.tabletsforschools.org.uk/

Family Kids and Youth
Established in 2002, FK&Y has recently worked on research projects with children and young people for the BBC, Unilever, IKEA, The Prudential, The University of Cambridge, The Department of Health and The Department for Education. It is the main consultant and supplier to IKEA on family and children’s research and author of The Play Report, the largest study ever carried out in 25 countries on parenting and play. FK&Y is the long-term evaluator for Youth United looking at the notion of behaviour change in childhood and adolescence through young people’s involvement in community activity. FK&Y’s report on digital advertising and marketing to children on behalf of CAP and the ASA will be published in December 2014.

FK&Y is a Company Partner of the Market Research Society (MRS), and holds membership with the British Educational Research Association (BERA), ESOMAR and the British Psychology Society (BPS), abiding by the codes of conduct of these organizations, including those guidelines involving research with children. FK&Y works closely with the Faculty of Education, Cambridge and the Department of Education, Sussex, and its advisors are Professor David Buckingham, University of Loughborough and Professor Colleen McLaughlin, University of Sussex. This year it has been appointed onto the new UK SBS government research roster as a supplier of research with children and young people. All members of staff have DBS clearance.

http://www.kidsandyouth.com/

1 December 2014
As one of the leading industry voices on digital inclusion, TalkTalk welcomes the creation of the Digital Skills Committee and the opportunity to submit written evidence.

About TalkTalk
At TalkTalk we’re committed to making Britain better off. Since entering the market with free broadband in 2006, we have consistently provided the country’s best value-for-money TV, broadband, mobile and home phone. With a customer base of over 4 million, we sell to consumers through the TalkTalk and AOL brands and to businesses via TalkTalk Business.

We have helped drive down the average price of broadband dramatically, benefitting not only our 4 million customers, but allowing consumers today to pay nearly half of what they did then, whilst also getting more for their money. TalkTalk continues to offer Britain’s lowest priced packages and is the only UK broadband provider that offers totally unlimited broadband for all packages.

Having launched our popular TV service in 2012 we reached one million TV customers in May 2014. This rapid growth makes us Britain’s fastest growing TV service.

We also continue to lead in industry innovation, particularly in keeping our customers safe online. We led the way for the industry with the launch of HomeSafe™, our free groundbreaking whole home security and safety service, now active in more than 1.2 million homes. In May 2014 we came together in a world first with our competitors to launch Internet Matters, a not-for-profit organisation to help parents protect their children online.

Supporting charities and social initiatives using technology for good has always been important to us and we are co-founding partners of Go ON UK. We’ve been running the TalkTalk Digital Heroes Awards for seven years and have helped over 78 unique charitable causes that benefit their local community through technology with funding of nearly £500,000.

The Digital Skills Challenge

Digital skills are critical to Britain’s ability to compete and prosper economically. Already the computing and telecoms, software and data, broadcast and publishing industries together contribute over £100 billion to the economy. At a time of slowed growth in other sectors, the internet economy in the UK is growing at 10% a year and will account for 10% of GDP by 2016. Booz and Co identified a potential £63 billion uplift in GDP if Britain maximises the digital potential.

We are concerned however, that a skills deficit risks compromising the digital dividend in three areas:

1. **Economic:** Britain risks failing to maximise the economic uplift possible, jeopardising its hard-won status as a global digital leader. 9.5 million UK adults lack the basic digital skills to get online, undermining Britain’s ability to compete for high-skilled digital jobs that might otherwise be lost to emerging economies. Only half of UK businesses have a website, and of those who do, only one in five use it to sell products and services.

2. **Social:** Britain risks excluding some social groups from the digital dividend, exacerbating existing social and economic divides. For instance, just under a third of those with disabilities do not use the internet and over half of those without basic digital skills are over 65. As digital skills become increasingly essential in the workplace, those without them risk being excluded from the jobs market, or confined to low-paid sectors.

3. **Regional:** Britain can be proud of London’s position as one of the world’s leading digital cities. Throughout 2009 and 2012, 83,000 new technology, digital and media jobs were created in London, while the number of technology and digital companies grew by 76 per cent. The risk, however, is that Britain’s digital skills base becomes narrowly clustered on London at the expense of other regions, jeopardising attempts to rebalance Britain’s economy and attract investment beyond the south east.

Recent research by TalkTalk shows widespread public concern about a digital skills deficit, and strong support for Government action to address it. A Populus poll of over 2,000 adults for TalkTalk showed a third of people (34%) felt they didn’t have the digital skills needed to do everything they wanted to online, rising to nearly half (44%) of over 44s. Nearly two thirds of adults (62%) backed Government-funded training for those without the skills to get online.

**TalkTalk’s Contribution**

TalkTalk is a passionate champion of promoting digital skills and reducing digital exclusion. We want to help make Britain the most digitally skilled nation in the world where every home and business is online, and to make the communities we work in better off. Last year, we launched the TalkTalk Digital Heroes Foundation to unite all our activity. Examples of our commitment include:

- **Go ON UK** – TalkTalk is a founding partner of Go ON UK, the digital skills charity. We are signatories to the UK Digital Skills Charter, and are working closely with Go ON to support the regional rollout of activity designed to ensure all UK adults have the skills they need to get online.

- **Digital Champions** – To support the rollout of Go ON North West, we’re encouraging all of our employees to become Digital Champions, delivering training in UK online centres. Our target is to train half of our staff in the North West as Digital Champions during the Go ON North West rollout.

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515 http://www.go-on.co.uk/about/
516 http://www.go-on.co.uk/opportunity/
517 P4, Digital Skills for Tomorrow’s World, UK Digital Skills Taskforce
519 * The TalkTalk Digital Heroes Foundation is established under the Charities Aid Foundation (registered charity number 268369) (CAF), for the benefit of the charity or charities selected by TalkTalk and approved by CAF
• **Digital Seniors** – Launching a pilot community scheme focused on tackling digital exclusion amongst elderly citizens. Recognising that elderly citizens often require support both with the skills and costs of getting online, the scheme combines training by TalkTalk digital ambassadors with a discounted offer on devices and broadband services. This ground-breaking new pilot is anticipated to launch in the North West in October. Examples of other device discounts targeting excluded groups include a deal with Microsoft, where customers receive a free repurposed computer when they purchase TalkTalk’s Simply Broadband package for £1.75 per month.

• **Coding** – Sponsoring Young Rewired State’s Festival of Code, a week-long event bringing together over 2000 under-18 self-taught coders and challenging them to build a mobile or web application using open data. Children as young as 8 spent a week in TalkTalk’s offices, developing their coding skills, learning from experts and showcasing their talents. TalkTalk is also a supporter of Apps for Good.

• **Digital Hero Awards** - TalkTalk runs an annual Digital Heroes Awards where we give funding and support to groups and individuals who are using technology to improve their communities. The Awards are in their 7th year and to date we’ve helped 78 projects, giving away nearly half a million pounds. Previous winners include The Cybersmile Foundation, the UK’s first dedicated cyber bullying charity and Code Club, a nationwide network of volunteer-led after-school coding clubs for children aged 9-11.

**Policy Suggestions**

Addressing the digital skills challenge, like many public policy issues, requires industry, Government and the third sector to all make a contribution. There is much already being done by the third sector and industry (though we think industry can and should continue to do more). When it comes to Government policy, TalkTalk would recommend the following to encourage digital skills development:

• **Rebalance political priorities** – There is a welcome political focus on the digital economy, however it is disproportionately focussed on infrastructure. Building a superfast broadband (SFBB) network alone will not deliver a digital dividend. Around three quarters of the UK population have access to SFBB, but take-up stands at just 9%. Britain need to rebalance the political debate, recognising that infrastructure is meaningless unless people have the skills to use it.

• **Pro-competition regulation that supports lower broadband prices** – The current high prices of fibre broadband are a barrier to take-up, with one quarter of offline adults in the UK citing cost as a reason they don’t use the internet. Ofcom’s robust regulation of the copper broadband market has succeeded in stimulating competition, with high levels of consumer choice and some of the lowest copper prices in Europe. A similarly robust regulatory framework does not exist for fibre, where BT is exploiting its position as the sole network provider to overcharge at a wholesale level and squeeze competition. This artificially inflates prices for consumers and SMEs at a time when they can least afford it and risks making fibre a luxury product. Ofcom recognises this risk and is proposing to introduce a margin squeeze test to create a level playing field in the fibre

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520 Page 286, Ofcom Communications Market, 2013
market. Such a step is essential to guaranteeing competition and ensuring next generation networks are not priced beyond the means of families and businesses.

- **Rebalance digital skills funding** – Review the Adult Skills Budget (just over £2 billion in 2015-16) to embed Basic Online Skills across all courses it funds. Greater weight should be given to short courses and flexible working. These are more accessible than longer, formal courses which attract existing digital enthusiasts, rather than those at risk of being digitally excluded. Longer, more formal courses are also not suitable for many businesses, especially smaller businesses and present a real barrier to further education.

- **Increase funding for UK online centres** – Supporting UK online centres to expand their services. Currently UK online centres receive a small amount of funding from central Government (c.£10m) in comparison to the total amount being committed to broadband infrastructure.

- **Establish specialist SME coaching in UK online centres** – UK online centres have to date focussed almost exclusively on consumers. With the additional funding outlined above, they could address the skills needs of start-ups and SMEs. For instance, they could run short courses and drop-in sessions focussed on coding, online marketing and promoting businesses through social media.

- **Support UK online centres to establish business / school partnerships** - matching businesses looking to expand their digital offering with school leavers with relevant computing / digital media skills. UK online centres could run specific training courses for teenagers looking to translate their social media skills into a professional tool. This would include coding, helping to embed digital skills in the workplace.

- **Utilise university estates as community clusters for digital skills** – Universities are often clusters of digital expertise and facilities, but the benefits are not always extended to the local community. Universities could be encouraged to allow start-ups and SMEs greater access to their digital facilities, allowing for greater collaboration between academics, students and local businesses in campus technology hubs.

- **Establish a Digital Skills Council** – To bring together ministers, charities, universities and employers to identify how coding and digital skills can be strengthened in the national curriculum. This would move beyond standalone IT lessons, anchoring technology across the curriculum. IT and technology skills should be considered comparable to maths and English, an essential tool that underpins other subjects and almost all jobs.

- **Embed digital skills in existing programmes.** For example ensuring all Jobseekers have digital skills and incentivising Work Programme providers to deliver digital skills to the long-term unemployed, as well as ensuring that Government departments themselves also invest in building digital skills, amongst both their employees and end users.

- **Redundancy training packages** - Government should consider a commitment to train all public sector workers leaving the public sector with at a very minimum Basic Digital Skills, if not offering them more advanced training as part of a redundancy package to help employees adjust to the skills needs of modern employers.

*15 September 2014*
Overview
Tata Consultancy Services (TCS) welcomes the establishment of the Lords Digital Skills Committee and its inquiry into digital skills in the UK. As services and products become increasingly digitised, the UK’s ability to draw on a digitally skilled workforce will determine the economic success of the country. Recognition of the importance of these skills and attempts to build an understanding of where we most need to concentrate efforts is extremely welcome.

About TCS
TCS is one of the top 10 technology firms in the world. Since 1975 we have worked hard to build our business in UK and Ireland. We are now the 7th largest IT services supplier in the UK and have over 150 customers including British Airways, Marks & Spencer, Boots and Aviva. We employ over 11,000 people across the UK, from Edinburgh to London and beyond.

Over the past few years we have also been delivering a number of technology-enabled transformation programmes for the public sector, including NEST (National Employment Savings Trust), the Disclosure and Barring Service and the Child Maintenance and Enforcement Commission. Our continuing investment and commitment to UK growth and skills and the way we do business makes us a trusted partner for government, businesses and the community.

The global digital economy
The world is going through a Digital Revolution and, like the Industrial Revolution before it, the relevance of the workforce’s skills will determine a country’s ability to remain relevant in global markets. Whilst the UK is more skilled and better placed than many other countries to lead in developing the skills needed to succeed in this economy, there are many countries ahead of it. The UK is competing in a global digital economy. In order for it to win the ‘skills race’ and succeed in this economy, the UK needs to be able to develop its skills base and home grown talent.

TCS agrees with TechUK’s Deputy CEO Anthony Walker who recently gave oral evidence to the committee (29 July) that the UK needs to aim for more digital makers who are driving future growth. The UK Digital Skills Taskforce interim report outlined that over 90% of UK jobs require basic digital literacy, over 50% jobs require ‘digital workers’ and over 10% jobs are ‘digital makers’ who are building and driving digital technology. We agree with TechUK that as a country we should be aiming for 20% digital makers. This will be key for the UK to be a net producer rather than a net consumer of digital technology in a global marketplace.

What Government and Business can do
In order for the UK to win the digital skills race and succeed in the digital economy, it is important for industry and government to work together to develop the UK’s skills base and home grown talent. Specifically, we believe there are three main areas industry and government should be focussing:
1. **Raise profile of STEM** – particularly the importance of technology and ICT professions in particular

- TCS is a funding donor of the Queen Elizabeth Prize for Engineering – an engineering equivalent of the Nobel Prize

2. **Ensure curriculum appropriate** – away from programme usage towards creation

- TCS is pleased by Government’s move to include computer coding in the revised National Curriculum but is concerned at the lack of resource given to implementing the new curriculum in schools across the UK
- TCS’s IT Futures programme works across numerous secondary schools and universities in the UK and Ireland, aiming to reconnect young people who may be disassociated or disenfranchised from technology creation. TCS works alongside specialist charities and social enterprises, seeking to personalise the creation of technology. TCS are working with: Teach First, Stemnet, Apps for Good, Mykindacrowd, Three hands.
- TCS is working with leading universities (Imperial College London, Durham University and Nottingham University) and helping to shape MSc and MBA courses that are relevant to ICT industry. TCS’s Academic Interface Programme (AIP) integrates TCS projects within the syllabus.

3. **Employers must create opportunities** to bring young people into the workplace that helps to provide and develop skills e.g. internships, apprenticeships and graduate programmes

- TCS is developing an effective graduate programme that delivers appropriately skilled staff to our business and flexible skillsets to support career longevity.
- TCS has partnered with the National Apprentice Board and eSkills UK to support a national push to make apprenticeships a career option for young people.

**Ensuring talent remains in the UK**

TCS are committed to encouraging home grown skills and apprenticeship programmes are contributing towards a long term solution to the UK’s skills shortfall. However, we need to ensure that there are the right conditions available to enable the UK to become a global hub for technology talent. A smart migration policy is crucial, and the industry is in alignment on the closure of the Post-Study Work Visa that has essentially resulted in a situation where higher education leaders are now “worried that we are training our competitors to out-compete us”.

We should also not forget mechanisms to share and transfer skills from/with the global economy. TCS employs 11,000 UK based staff, but has the same again of global staff working temporarily in the UK for fixed two year periods. Working in partnership with our clients, TCS consultants implant specialist knowledge with the local workforce and vice versa, benefitting the UK and our overall skillsets

*19 September 2014*
Tech City UK, Humber Local Enterprise Partnership and Manchester City Council – Oral evidence (QQ 192-204)

Transcript to be found under Humber Local Enterprise Partnership
Very many thanks again for the invitation to give evidence to your committee on 28 October, and the opportunity to explain Tech City UK’s role, remit and ambitions.

I said that I would write regarding research councils in the UK, but I also wanted to add two more points to your questioning on digital inclusion.

Of course it’s vital to ensure access to broadband and to skills and hardware, but I think we should also remember that the digital revolution may well offer substantive improvements in inclusion and services provided to individuals and businesses.

Secondly, one of the reasons that Tech City UK is launching the Digital Business Academy is precisely because of the need to ensure that access to skills right across the country. As I mentioned before your committee, the entrance requirements are very broad with no academic barriers. The courses are all free to anyone living in the UK, with practical experience built into them, and offer incentives and further opportunities along the way. For example, participants may be placed directly into the final round of interviews for internships, placements or jobs; or they might receive start-up funds, free co-working space or other business support.

Regarding research councils, we ourselves do not work closely with them, partly because we too are publicly funded, but mostly because the nature of our role is such that we do not engage in research of the type that they fund. However, given your question, it’s certainly something that we will look at for the future, as the research councils absolutely are key institutions in funding innovation and research in the UK.

Finally, it’s possible that members of our Cluster Alliance or other partners do work with one or other of the seven councils as part of their business, but that is not information that I have access to.

11 November 2014
Tech Partnership, UK Digital Skills Taskforce and TeenTech CIC and Go ON UK – Oral evidence (QQ 113-128)

Transcript to be found under Go ON UK
techUK, Coalition for a Digital Economy and Federation of Small Businesses – Oral evidence (QQ 53-65)

Transcript to be found under Coalition for a Digital Economy
Transcript to be found under Professor Patrick Barwise
Who we are

Tinder Foundation is a not-for-profit social enterprise that makes good things happen with digital technology. Established as a staff-owned mutual, our 30-strong team supports a network of 5,000 independent local community partners through the UK online centres network and works with hundreds of national organisations in order to make good things happen with local technology.

Tinder Foundation is funded through a mixture of private, public and third sector funding.

The problem

There are still 9.5 million people in the UK who lack basic digital skills. Of these 49% are disabled, 63% are over 75 and 60% have no formal qualifications. There isn’t any one group of people who are not online, and it is not just older people or unemployed people who lack digital skills. In November last year we published an infographic highlighting the key stats and the main sources of research around digital inclusion. You can see a copy of it here.

As a nation, we need to develop high-level and bottom-level skills; supporting people to gain basic online skills is as important to the economy, and to society, as teaching people to code.

Our network of UK online centres, based in the heart of local communities, has helped over 1.25 million people get online in the last 4 years. We have centres based in public libraries, community organisations, churches, mosques, cafes, restaurants, prisons et al. Our success is based on the networked approach which we take; by embedding digital skills delivery into local communities, and ensuring it is delivered by local people, we have been able to reach people who often wouldn’t engage with traditional learning. Tinder Foundation coordinates this networked approach.

We have developed a learning platform, Learn My Way, which contains free online learning content on basic digital skills, to support centres with their local activity and ensure consistency of learning. We have proven that this model is scalable, and because we use digital technology to deliver the training we can reflect quickly to changes in digital world in new online content which is then used by tens of thousands of local volunteers and staff.

We are not a membership organisation - more like a club of thousands of people with a shared vision. We provide coordination, support, services and leadership, and our centres provide people in need with the opportunity to learn.

Increased investment would ensure that no one is left behind. Government works in silos - we need Departments to work together to recognise what financial commitments they need to make, and may be already making, in order to get 100% of people with basic online skills.

521 Media Literacy: Understanding Digital Capabilities Follow Up, BBC & Ipsos Mori, March 2014
522 Cultures of the Internet: the Internet in Britain, OxIS, October 2013
523 Internet Access quarterly update, Q1 2014, ONS, May 2014
524 Cultures of the Internet: the Internet in Britain, OxIS, October 2013
Tinder Foundation – Written evidence (DSC0077)

Trend analysis shows that by continually investing as we do now, there will still be 6.2 million people without basic online skills by 2020. We need to see a public investment of £50 million a year for the period of the next government to get as close to 100% online as possible. This was highlighted in more detail in a report we commissioned along with Go ON UK in February this year\(^{525}\).

**Benefits to having basic digital skills**

**Individuals**

A recent report commissioned by BT\(^{526}\) in June 2014 shows that the social value of the internet for someone with low levels of digital skills is £1,064 per year arising from increased confidence, job seeking, financial savings and reduced social isolation.

Internet users gain work more easily and earn more\(^{527}\), they stay healthy online\(^{528}\) and they use public services online\(^{529}\).

**Government**

We have measured the impact of “channel shifting” (people moving their contact with government from face-to-face or telephone to online). Tinder Foundation measures the benefits of the people we have helped each year; this results in savings of c.£50 million a year.

We are a digital inclusion programme, not an unemployment programme, however in the last 4 years we have helped more than 80,000 people to gain employment, saving the government more than £678 million in benefit payments per year.

**Measuring Success**

- We put a strong emphasis on measuring our impact, and use a variety of data capture mechanisms and research methods. We use this on a national level to demonstrate impact, while local centres can manage individual learning progressions, oversee their centre activity, and prove their impact on a local level.
- Learning data is collected through Learn My Way. This data is automated and can be viewed at individual, centre and national level.
- Surveys provide us with details of learner demographics, progression to learning and employment and use of government websites.
- Further impact evidence allows us to apply volumetrics to economic impact, showing the financial benefit to Government for each person who gets online.

5 September 2014

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\(^{525}\) A leading digital nation by 2020: calculating the cost of delivering online skills for all, Catherine McDonald, February 2014

\(^{526}\) Better future report 2014, BT, June 2014

\(^{527}\) Champion for digital inclusion - the economic case for digital inclusion, PwC, Oct 2009

\(^{528}\) NHS Choices annual report 2011

\(^{529}\) Adults’ Media Use and Attitudes Report, Ofcom, April 2014
Trustworthy Software Initiative – Written evidence (DSC0024)

1. The Digital Skills Committee of the House of Lords, chaired by Baroness Morgan of Huyton, is conducting an inquiry into digital skills in the UK. The Committee has invited interested individuals and organisations to submit evidence to this inquiry. The terms of reference for the inquiry are “to consider information and communications technology, competitiveness and skills in the United Kingdom” and to report by 5 March 2015.

2. The information identified below has been provided by Stephen Newman BA (Hons), DMS, MSc, CEng, FIET in his role as a Technical Vice President of the Trustworthy Software Initiative (TSI). The UK Governments National Cyber Security Programme is sponsoring the TSI to provide tools, techniques and guidance in training both the future and current workforce in the production, supply and procurement of Trustworthy software with the objective of ‘Making Software Better’. Stephen’s background is in Telecommunications and he spent over 25 years in the BT Research and Development Department where he had responsibility for driving R&D innovation into the business community.

3. The Changing Technological Landscape

3.1 **Question 2**: What are the main challenges for economic growth as the UK transitions to a knowledge driven economy? - the growth and prosperity of economies around the world are driven by ICT and organisations and individuals need to have trust in the systems they use and the software that runs on them to benefit from all that ICT and the Internet have to offer. The biggest challenge is to ensure the Trustworthiness of the software that drives this growth and the aim should be to improve cyber trustworthiness by making software more secure, dependable and reliable, and to educate on why Trustworthiness is important. Robust and reliable software is a vital tool for modern day businesses, enabling them to operate efficiently while protecting them from growing cyber threats.

3.2 **Question 3**: What is the employment impact on the UK’s labour market? - As cyberspace becomes more all pervasive in society and the Internet of Things increases the connectivity of networks and systems and blurs the line between work and social interactions so the need for digital skills increases. There is an ever increasing demand for skilled engineers but, according to the Institution for Engineering and Technology (IET) Annual Skills & Demand in Industry Survey, more than half of employers are having difficulty recruiting the staff they need for their business to expand. Other findings from this report include: 59% of companies indicated that a shortage of engineers would be a threat to their business; 44% of engineering, IT and technical recruits do not meet the employers expected levels of skills; and 52% of organizations anticipate employing more apprentices in 4 to 5 years time. Demand for engineers in the UK remains high and will continue to increase as we become more interconnected and technology advances, and research from Engineering UK suggests that we need to find 87,000 new engineers each year for the next decade.

4. Future Workforce

4.1 **Question 4**: What skills do future workers need in order for the UK to be globally competitive? - as cyberspace expand into an all pervasive interactive domain made up of digital networks that are used to store, modify and communicate information we need a
skilled workforce which understands how to design, develop, deliver, support and maintain these systems. These domains not only include the Internet but also other information systems that support businesses, infrastructure and services. Digital networks already underpin the supply of electricity and water to our homes, help organise the delivery of food and other goods to shops, and act as essential tools for businesses, and their reach is increasing as we connect our TV’s, games consoles and even domestic appliances. As a first step in providing the necessary skills to sustain these systems a future workforce needs to be able to design, develop, produce and maintain Trustworthy Software, software that is: available (the ability to deliver services when requested); reliable (the ability to deliver services as/when requested); resilient (the ability to transform, renew and recover in a timely response to events); safe (the ability to operate without entering harmful states); and secure (the ability to remain protected against accidental or deliberate attacks).

4.2 Question 5: How are we teaching students in a way to inspire and prepare them for careers in the future workforce in occupations that may not yet exist? - the UK Governments National Cyber Security Programme is sponsoring The Trustworthy Software Initiative (TSI) to provide tools, techniques and guidance in training both the future and current workforce in the production, supply and procurement of Trustworthy software with the objective of ‘Making Software Better’. Guidance for this initiative is provided by the Department for Business Innovations and Skills (BIS), the Centre for the Protection of the National Infrastructure (CPNI) and private sector organizations via a Stakeholder Advisory Board. The TSI has captured and collated the body of existing guidance, relevant standards and best practice as its Trustworthy Software Framework(TSF) and is working with professional bodies, particularly the Institution of Engineering and Technology (IET), the British Computer Society (BCS) and the Institution of Analysts and Programmers (IAP) to provide education and training needs for trustworthy systems to flourish. This ‘experience’ has been used to produce an initial undergraduate training module, being led at the Cyber Security Centre Warwick Manufacturing Group at the University of Warwick, which has been trialed by several Universities in the UK and plans are currently in place to increase the scope of the modules and for a wider roll-out to an increased number of Universities. The training, education and awareness objectives are: to raise awareness among Science, Technology, Engineering and Mathematics (STEM) undergraduates of the concept of trustworthy software; to provide pre-packaged content that can be used in face-to-face and on-line teaching to provide students with an understanding of the principles and techniques required to deliver trustworthy software; and to provide content suitable for use by individuals and organisations for continuing professional development purposes.

4.3 Question 8: How does the current post-16 system inspire and equip students to pursue careers in the future workspace in occupations that may not yet exist? How can they be improved? - it is intuitively obvious that we need to improve the UK’s digital skills and encourage more people to work in the engineering fields concerned with cyberspace and the interactive domains enabled by the advances in digital technologies. In a recent poll of IET members 99% of those surveyed agreed that engineering skills are vital to the UK economy but 72% felt that the UK does not place enough value on engineering skills. These results suggest that engineering is not perceived as a good career choice which is probably caused by non-engineers not having an up-to-date understanding of how engineering has evolved in the last two decades. I believe some of these issues can be overcome by; educating the public about engineering to give them a better understanding of the engineering profession;
increase activities in schools/colleges/Universities; and increase remuneration packages for engineers.

5. Short and Medium-Term Support to the Digital Sector

5.1 **Question 9**: How can the digital sector be supported in the short- and medium-term. What is the role for higher and vocational education, national colleges, industry and industrial policy? - the TSI has been responsible for launching a Publically Available Specification (PAS754:2014 Software Trustworthiness - Governance and Management - Specification) which has been used as the basis for developing undergraduate courses. The Minister of State for Universities and Science stated in June 2014 that ‘...the Trustworthy Software Initiative will help UK companies select the most secure, dependable and reliable software for their needs as well as providing them with the skills to use it effectively...’. This information can also be used to develop on-line module courses to support Continual Professional Development (CPD) with major organisations and also professional bodies. For example: when applying for Chartered Engineer status the Professional Competences required by the Engineering Council should include an appreciation of Trustworthiness when applied to networks and systems. This Competence could be obtained via on-line courses being made available on the Professional Organisations web sites. In addition to this the module could be integrated into all relevant apprenticeships and training CPD courses made available within large organizations. This will stimulate the current workforce to gain an appreciation of Trustworthy issues and develop skills to overcome potential problems.

5.2 **Question 12**: What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector? - one of the TSI’s roles is to coordinate, on behalf of the National Cyber Security Programme (NCSP), a selection of measures to help UK organizations specify, realise and use appropriately trustworthy software and to develop those skills needed in both the current and future workforce. The approach being adopted is to provide learning pathways for Training, Education and Awareness (TEA) and a roadmap has been developed which identifies 6 major themes of delivery, or 'swim-lanes', covering the future workforce through to senior managers. This model has swim-lanes for: Future School Leavers who would receive Basic Instruction in Trustworthy Software (BITS); New Technical Practitioners would receive BITS as well as Comprehensive Instruction in Trustworthy Software (CITS) and have access to Domain Instruction for Trustworthy Software (DITS) and Refresher Instruction for Trustworthy Software (RITS); Existing Technical Practitioners would receive Intermediate Instructions for Trustworthy Software (IITS) and have access to DITS and RITS as well as Advanced Instruction for Trustworthy Software (AITS); Academic Experts would receive AITS; Aligned Practitioners (non engineers) would progress through BITS, IITS, DITS, and RITS on a needs basis; and Senior Managers who would receive BITS. A swim-lane representation of this skills delivery model is shown in Fig 1 below.
Fig 1 - Swim-Lane Skills Delivery Model

One of the ambitions of the TSI is to work with Local Government and LEPs to make education institutions and local/national enterprises aware of the training modules identified in the above swim-lanes and work with them to deliver the training, education and awareness in the most appropriate way.

### 6. Industry

#### Question 13

What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are the best overcome? When considering the issue of trustworthy software in the digital economy, two major barriers need to be considered - understanding and cost. The majority of organisations in the UK are not aware of the ‘problems and issues’ with defining/procuring/using software that is not trustworthy. There are numerous examples of cyber security incidents arising from poorly designed or implemented software or applications where the root causes are well known and have featured on the publicly available list for many years. The 2014 Trustwave Global Security Report identified that: 96% of applications scanned by Trustwave harbored one or more serious security vulnerabilities; the medium number of vulnerabilities per application was 14; 100% of mobile applications tested contained at least one vulnerability; and 71% of compromised victims did not detect the breach themselves. Many of these incidents could be overcome if organisations understood the issues of trustworthiness. To gain this understanding/education would involve two major costs: the costs of gaining the understanding; and the cost of implementing remedial actions. To overcome these barriers there needs to be an approach which, having developed appropriate education and training material, then makes them available via a communications/advertising campaign aimed at stressing the benefits of having a highly skilled workforce in a knowledge-driven economy. To encourage the take-up of these skills there has to be an incentive either in status or financial terms - only organisations with accreditation can bid for certain contracts or a tax refund incentive for gaining the skills required. In addition to this, guidance needs to be provided for organisations to procure against which ensures the trustworthiness of the software they intend to procure. The TSI, in conjunction with the British Standards Institute (BSI), has been responsible for producing a Publically Available Specification (PAS754:2014 Software
Trustworthiness - Governance and Management - Specification) which can be used as the basis for an accreditation scheme. In time it should become the ‘norm’ for those procuring software to be able to specify the need for trustworthiness (using PAS754) and for suppliers to be able to achieve market edge over their competitors by being able to demonstrate their ability to supply trustworthy software by achieving accreditation to PAS754 through a recognised accreditation scheme.

6.2 **Question 14**: How can businesses help equip the workforce with new skills in a rapidly changing environment? - the responsibility for providing these skills rests not only with businesses but also the professional bodies. These should not only include the ‘technical’ bodies such as the IET, BCS and IAP but also the management bodies such as the Institution of Directors (IoD), the Chartered Institute of Marketing (CIM), the Chartered Management Institute (CMI) and the Chartered Institute of Project Management (CIPM). All of these organisations should be encouraging CPD and should have relevant modules/courses available on their web sites to up-skill their members in new and emerging technologies; and their requirements for membership should be updated to reflect these advances in technology and management techniques. These CPD modules should also be made available to business for them to use within their organisations, even if the members of the workforce have no intention of joining the professional bodies.

31 August 2014
“I think it’s a really important issue affecting the British economy, and indeed wider British society, and I think what we’re hoping to do is first of all establish just how fundamental the shift is that’s happening now around us with technology and to try and determine whether that is indeed more significant than similar changes in the past, or as significant, or less significant because there’s a lot of different information around, and we first of all want to pinpoint that particular issue”.

Baroness Morgan of Huyton, Chair of Committee on Digital Skills (Transcript of Interview on YouTube)

In this note, we comment on the question: How fundamental are the changes that we are experiencing due to digital technologies? Our Comments are directed to the point made by Baroness Morgan above and are relevant to issue number 1 in the committee’s Call for Evidence. We argue that the rise and rise of the digital world is a profound phenomenon. To fully exploit this digital world economically, socially and politically, the UK must drive change in education, skills and life-long learning. We note the role of digital data in this phenomenon.

1. The digitisation of professional and private life

1.1 Hardly any area of professional or private life has been neglected by web-based technologies. At work, we rely on email services, video conferencing, office information systems, professional networking tools, ...; at home, we use retail services, gaming networks, social networking sites; 3D virtual worlds and communities, ...; as citizens, we communicate with public bodies and government agencies through the Web; as private individuals, we support our lives with all manner of apps and wearable technologies customised to our particular interests and needs, such as sport and entertainment. Mobile devices, such as smart phones and tablets, make the Web constantly accessible. One is struck by the diversity, scale and depth of digital services embedded in our daily lives, and by the acute sense of how indispensable these technologies are.

1.2 This digital world has been built from thousands of technological innovations and developments, which have been deployed in millions of applications around the world. All of these technologies are made from software; and software is designed to process data. In particular, what makes data digital is its representation in systems of symbols.

1.3 Reflecting on a timeline for these technological innovations and developments – say, since the commercialisation of the Web in the early 1990s – one is struck by the speed and degree of change. The progress of processor speed, memory capacity, bandwidth, mobility, etc., whilst important, should not overshadow the progress of the more abstract science of algorithms, programming and software development, i.e., Computer Science. Nor should

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530 Issue 1: What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?
progress in hardware and software overshadow the appeal of software systems to governments, organisations, companies and individuals. The scale of this success attests to a wide spread approval and appetite for digital objects and services.

1.4 The phenomenon of a few decades’ worth of technological and social transformation should be seen as an extra-ordinary pioneering period – a period of exploration that is coming to an end. The ambitious task of consolidating, maturing and securing ‘Digital Britain’ is at hand. Such a view could widen and deepen the evidence and recommendations of the Committee about the fundamental importance of digital skills for the future of the country.

1.5 We note some arguments in support of the view that (i) the world is re-constructing itself in digital data; (ii) this is a profound transformation that should drive a national mobilization of digital talents, skills and resources, and a rise in public awareness and co-operation; and (iii) the transformation is consistent with long term sociological trends that characterise the modern world.

2. On phatic technologies

2.1 Taking up the point made in 1.1, let us consider one of the most striking changes of recent years: the rise of social software, for example, Sims Online (2002), Second Life (2003), Facebook (2004), Flicker (2004), YouTube (2005), Twitter (2006), ... Social networking systems have transformed many individuals’ personal experience and social lives. More importantly, the take up of these technologies has completed a comprehensive embedding and habituation of the Web in contemporary life.

2.2 In our study of social software and its sociological and technical origins, we conceptualise it as a primary example of what we call phatic technologies (Wang, Tucker & Rihll, 2011). A technology is phatic if its primary purpose or use is to establish, develop and maintain human relationships. The users of the technology have personal interactive goals. The goals that are commonly found among the users form the social basis of a community, which is made of relationships enabled by software.

2.3 Phatic technologies are not new. All phatic technologies are communications technologies. The development of telephony, starting in 1875, yields technologies of phatic use. Like the telephone, a phatic technology may become so deeply embedded in its users’ daily lives that not using it may be regarded as odd or even deviant. One might say that in certain social groups, not using Facebook is strange. Phatic technologies depend on videos, photographs, links, status messages, avatars, etc. generated by users to create a social community. The Internet is the primary source of phatic technologies which, of course, are not confined to personal life. Establishing, building and maintaining relationships are central to commercial transaction or civic interaction.

3. The rise of abstract systems

3.1 Communications and interactions via social software are faceless. Why is faceless social software so surprisingly successful in generating human relations? One of the key features of modern social life is the reliance on what Lord Giddens calls abstract systems. In The Consequences of Modernity (1990), Giddens argues that: whilst in traditional societies, social life is dominated by face-to-face localised activities, modern societies foster relations between people that are far removed from these face-to-face interactions. Abstract systems
are the means by which our public and professional lives are disembedded from their immediate locales and re-embedded across an abstract and vast time-space.

3.2 The concept of abstract system plays a dominant role in understanding modernity and, as we argued in Wang, Tucker & Haines (2012), is enormously fruitful in understanding the role that phatic technologies play in modern societies. Actually the disembedding of social life is one of the fundamental reasons behind the increasing social influence of phatic technologies. These technologies, characterised by their social purposes, are able to facilitate the reembedding of personal and contextual intimacy and reduce alienation. This reembedding may be at the heart of the appeal of cybercommunities and virtual worlds.

4. Implications

4.1 By drawing attention to the extraordinary impact of phatic technologies and suggesting an explanation for their sociological significance, we are making the case that the rise and rise of the digital world is a profound phenomenon. It needs a fundamental shift in current social and political thinking, including paradigms for education, skills and life-long learning. One area that is widely recognised as a force for change is data.

4.2 Any system, or environment, organisation or community can be observed or monitored; the act of observing produces data – quantitative or qualitative – that pictures or represents the behaviour of the system or environment, which is examined for various attributes. Data is collected in different ways: intentionally gathered via surveillance technologies, or unintentionally volunteered in various phatic technologies. Any system or environment supported by software is automatically monitored. The ubiquitous deployment of software fuels the ubiquitous rise of data.

4.3 Cyber security is essential to the safety of the nation and the UK Government’s 2010 National Security Strategy rated cyber attacks as a ‘Tier 1’ threat. Having cross-cutting knowledge, skills and capability to strengthen all our security objectives was stated in the strategy as one of the four objectives in the next five years. This means that individuals would need to be taught how to protect themselves online; and businesses and organisations would need to be aware of the vulnerabilities in their systems and the threats that they face. More importantly, the UK as a nation needs to confront the threat head on and to identify opportunities (in the midst of vulnerabilities and risks) to grow its international competitiveness in cyber security. Indeed, the UK needs to catch up as its national human resources in cyber security are modest. Purchasing foreign software and technical talent cannot be a long term solution to the problems of the cyber security of the UK.

4.4 The growth of digital data is connected with evidence-based policy making and management practices, which aim to replace or reduce ideological bias with independent investigation and data. Whilst it seems reasonable to collect data and statistics to inform decision making, not unexpectedly, when fashion gives an idea momentum, we find the collection of data can become a magic bullet for management and strategy, or even an end in itself. The rise and rise of monitoring in everyday life, at work and at home, generates vast amount of data much of which is a waste product, rather than a valuable commodity. Furthermore, the process of monitoring workers and organisations can influence behaviour and dismantle their mission and culture.
4.5 With cyber security threats, evidence-based addictions, and the abundance of monitoring technologies (amongst other things), our fascination with data is destined to grow and grow. Certainly, this growth is in the face of a continuous debate about the lack of effectiveness, financial cost, and more importantly social cost of these technologies. How do we achieve the balance between security and privacy? To the individual, the question ‘How secure is your digital life?’ means to a large extent ‘How private is your life?’.

4.6 People at all levels of society need to be equipped with digital skills that are not merely relevant to their occupations and their daily lives; rather they need awareness of the nature of the new digital world and their digital presence in personal, communal, societal, national, and even international contexts. For example, people must be better able to manage their digital identities.

4.7 Besides an increasing awareness, people involved with software professionally need to increase their depth of understanding and reflection of the origins, uses, intended applications and unintended consequences of their data.

4.8 In a response to this Digital Skills Call, the UK Computing Research Committee (UKCRC) has offered a convenient and pragmatic classification of digital skills, which may be used to develop concrete ideas about standards and actions for the UK. UKCRC proposes five levels: (1) basic domestic skills; (2) operational skills in the work place; (3) skills in digital infrastructures; (4) skills for application builders in specific domains; and (5) skills for developers of new technologies.

4.9 The UK has a first-rate track record in scientific and technological developments. The quality and scale of Computer Science in the UK is a great national resource. Its development has not been without struggles (some of which resulted in government action, e.g., the Alvey Programme 1983-87). However, the achievements of UK computer scientists attest to the importance of unfettered curiosity driven basic research. Virtually, all major scientific discoveries arise from such research as Sir John Cadogan, first director general of the Research Councils, has recently argued (Cadogan, 2014). Breakthroughs cannot be planned.

4.10 A national programme of digital awareness and upskilling should aim to (i) lay the foundations for long term competitiveness across all sectors of the UK economy; (ii) protect the UK’s leadership in many of these sectors; and (iii) establish the UK as a global leader in software and data science.

References
UCanDoIT, Age UK, Code Club and TalkTalk – Oral evidence (QQ 129-142)

Transcript to be found under Age UK
The UK Computing Research Committee (UKCRC), an Expert Panel of the British Computer Society, the Institution of Engineering and Technology and the Council of Professors and Heads of Computing, was formed in November 2000 as a policy committee for computing research in the UK. Its members are leading computing researchers who each have an established international reputation in computing. Our response thus covers UK research in computing, which is internationally strong and vigorous, and a major national asset. This response has been prepared after a widespread consultation amongst the membership of UKCRC.

UKCRC believe that digital skills can be described through a small set of levels or groups:

1. The “basic digital skills” that are required by the general public to use electronic services include web browsing, email, electronic banking and payment, online appointment booking, form filling etc., and also include the management of digital identity, privacy and security, social media, GPS and location services, and telecommunications including e.g., Skype and WiFi. These are a varied set of basic skills that are needed by the “consumers” of digital technology and which are constantly evolving over time. The acquisition and update of these skills constitutes a major societal challenge that contributes to the digital divide.

2. Another level of skill with regard to Information Technology (IT), which does not necessarily include all of the skills listed in the previous set of basic skills, relates to those people who use information technology in the workplace. They will need the skills to use word processors, spreadsheets, databases, and all kinds of transactional systems in support of office work, business processes etc. Many web design activities that use existing software packages also come under this heading, though this activity in general may fall both in this level, and in the one we describe in 3) below. Skills that are needed to operate digital systems in manufacturing, transport, and healthcare using domain specific digital interfaces that can require some level of programming are also included in this level. One might term these people as being the “Operators” of digital technology. Some of these Operators may actually be skilled professionals in their own fields, as with regard to complex and critical medical equipment. Such individuals would “programme” their medical devices or systems, but would not generally know how to take these skills into the core IT areas such as computer programming in general. Thus professional computer programming together with the use of advanced programming and software engineering tools do not come under the headings 1 and 2.

3. At a distinctly more advanced level in their knowledge of IT, are the specialists who know how to install, operate, manage digital technology infrastructure (e.g., networks, server farms, enterprise desktop administration, web services, etc.), and update it when new systems or versions are released. These are the “engineers” who keep the digital infrastructure running, and include experts who have graduate and post-graduate degrees in Computing, Computer Science and Electrical and Electronic Engineering. Obviously, these individuals will have undergone formal training in computer programming, even though many of them may not do a substantial amount of programming in the course of their work.
4. The Applications builders are the domain-skilled programmers who produce software, and may not have all of the skills of the IT specialists of category 3). For instance they may not have the deeper knowledge in operating systems and telecommunications that are required by the IT engineers, but they will have programming skills, and should have software engineering skills. These are the specialists who can build new Applications in support of their business or for business sectors such as banking or retail. This category is critical as more and more business sectors rely on electronic systems and processes. Indeed, every industry/sector needs creative, skilled IT professionals who can keep their business competitive by exploiting IT to the best advantage. Their skills may extend from basic plugging together of packages provided by others through to new technology and application development. Many of these specialists will have graduate or post-graduate degrees in Computer Science or Computing, and some of them may be self-employed as founders of technology start-up companies.

5. Finally we must mention the Technology developers. They will typically work for companies developing new digital technologies, devices and hardware, applications, software tools, etc., or they may be self-employed or involved in start-ups. They are the core “suppliers” of raw digital technology on which all the other activities depend. Such developers will have different levels of qualifications in Computing, Computer Science, Electrical and Electronic Engineering, Mathematics, Physics and other fields, all the way to PhDs and post-doctoral training.

Many of the activities that we have outlined, in particular those at Levels 3), 4) and 5), require that the result of the IT professional’s work must meet certain industry standards, such as ISO 25010 for software quality, including correctness, MIL-STD-498 or ISO 62366 for dependability, ISO 9241 for usability, other standards for security, performance, reliability and dependability, proper documentation, and so on. Thus each of the skill levels will require some form of testing and certification.

In turn, the products that people having such skill levels produce, whether they be hardware or software, or complex devices that include multiple software and hardware components, will require testing and certification, so that there is a tight relationship between IT skills and their certification on the one hand, and IT products and their quality standards on the other.

One significant characteristic of all the levels and areas we have mentioned is the substantial renewal they undergo with respect to their technical content in phases that may last a few years to a decade. Thus, Digital Skills in particular, require that even a well-educated population and workforce will need to access cost-effective opportunities for life-long learning, retraining and knowledge and skill enhancement. Digital Skills are directly derived from prior and continuously ongoing Research and Development efforts that take place around the world and in the UK. A successful, internationally competitive, well-funded, and vibrant UK Research capability in Computer Science, Computing and Electrical and Electronic Engineering is the best guarantee that Digital Skills in the UK will attain and surpass the highest world class capability that can best serve the country’s economy and its strategic interests, since it will allow the timely identification and transfer towards industry and commerce of skill levels as they evolve, and provide the expertise to educate both the professionals and the new generations of experts that are required by the nation.
UK Council for e-Business – Written evidence (DSC0102)

UKCeB Background
Thank you for the opportunity to submit our views to your Select Committee’ Digital Skills investigation. The UK Council for e-Business (UKCeB) is an industry-funded, not-for-profit, organization operating at the information boundary between MOD and its supply chain. Over the last 23 years, the UKCeB has developed a good deal of experience in Information and Knowledge Management and warmly supports the intent behind the House of Lords’ Digital Skills Select Committee to examine whether the UK’s workforce is sufficiently skilled to successfully compete in the global economy.

Leadership
The education gaps and training shortfalls for young people have been documented at length and will not, other than to welcome the progress that is being made in secondary and tertiary sectors, be covered here. For us, a more significant knowledge gap appears amongst senior managers and company leadership whose collective influence will be necessary if the cultural blockers impeding the UK’s cyber performance are to be overcome.

Cyberspace offers unprecedented opportunities to change the way we work by in an increasingly mobile and distributed workforce by allowing connected users to work where and when they may operate most productively. However, this does not fit the conventional command & control workplace model where managers literally oversee their subordinates at work. Such a change would require a different employer-employee trust relationship and, recognizing that it would not be appropriate in all circumstances (perhaps for reasons of security or of collaborative team-dynamics) would need some analysis to determine an optimised working environment for a given organization. More importantly, this change would require buy-in from all executives and a determined resolve from management to achieve.

Delivering a safe and productive technical environment to enable this change is essential if business is to flourish. It requires an informed set of investment choices to be made that will ensure defined benefits match the business priorities in a managed risk climate. This, in turn, requires decision-makers to understand, and to be up-to-date in, technical as well as business threat and counter-threat solutions.

Our experience suggests that many (though by no means all) C-corridor executives - particularly those amongst large, multinational organizations - are increasingly attentive to this aspect of their responsibilities. However, too many middle-managers do not see the cyber component as being their domain and are likely to abrogate these important business-level decisions to the IT department. In the general case, this failure of managers to embrace technical capability is further compounded by the inability of most IT technical staff to fully appreciate the language of business. This two-way failure to communicate adequately is a significant hurdle in the cyber world - and, incidentally, a major cause of failure in IT projects.
Human Factors
We envisage that the UK workforce in, say, 10 years' time will operate digital equipment, services and processes entirely naturally and intuitively; however, until that future state is reached, a competitive advantage for the UK will only be assured if our collective digital capabilities are developed faster - and with greater agility - than comparable economies elsewhere. Accordingly, this need to bring the UK workforce up to a common standard-of-excellence needs to recognize that, in addition to the education and training challenge, not all workers would necessarily thrive in the less structured working environment envisaged for the future.

For reasons of ability, capacity and previous practice, the habits accrued by many in the current workforce over their working life to-date, will lead to a need for managers and employees to develop individual learning strategies to reach the standards necessary for their 'digitized' role. Business risk is also an area where the human dimension may be overlooked:

A 2013 Centre for the Protection of National Infrastructure (CPNI) report on ‘insider acts’ describes a number of characteristics and attributes that had lead to real incidents causing real damage to public- and private-sector organizations. However, other than encouraging greater managerial oversight, the report does not include any guidance on how to deal with these risks – and this despite the same report saying that more than half the ‘insider acts’ found in the study were attributable to managers and executives.

There are technical and non-technical solutions available but appreciating the culture that creates many of these issues is a critical gap. Techniques are available to help responsible managers to measure their working environment and to understand the pressure points that lead to behavioural risks and constrained growth that are based on bespoke, business-defined, success criteria.

Digital Natives
The UKCeB's Digital Native project [see UKCeB website - Projects > Digital Natives' Study into Collaboration across Team Defence] sought to gain an insight into how a group of young professionals - the latest generation of graduates to have grown up knowing nothing other than the connected world - would collaborate using a suite of modern applications. The following quotes are from Stowe Boyd, a commentator on future-of-work and related topics [http://research.gigaom.com/2013/05/the-future-of-work-in-a-social-world-part-2/ ]:

“...The collaborative model of work as the dominant model of work today is based on push communications, business processes as a concept and actual way to structure work, and is slow-and-tight as a result. The cultural ethos is the creation of a collective: a group of people sharing the same principles, goals, and expectations. But we’re seeing the transition to a fast-and-loose model of business, based on pull communication through social networks. These lead to a less restrictive cultural ethos: a connective, where people are cooperating mutualistically, but without the overhead of deep trust.”

“... Some corporate cultures are stuck even farther back in time, and are based on competition. I don’t mean competing with others in the marketplace, like Facebook competing with Twitter. I am talking about a corporate culture based on zero sum
competition among workers, where one person’s advancement is someone else’s demotion. These are cultures strongly based on authority-based decision-making, and really are a holdover from the late modern era: the late industrial era.”

Unconstrained, the Digital Native group collaborated effectively across a wide variety of media and were particularly adept at solving compatibility issues when communicating via disparate systems. That said, other business drivers - such as privacy and security - might have been occasionally compromised to achieve the intended outcomes.

So, the digital native is likely to be highly effective in maximizing productivity using Information and Communications Technology (ICT), but may not fully appreciate the business risks associated with, in extremis, unconstrained sharing and boundless optimism.

From the 12-strong sample engaged with the Digital Natives project, there was a clear indication that new entrants working in the Defence sector are thoroughly drilled in the consequences and perils of ‘loose action’ with regard to sharing information. Also, now that Government Departments and Industry are making greater use of enterprise social media, these organizations are finding that workplace conversations are useful and secure when contained within the enterprise collaboration tool; this is likely to be an evolving capability with insights to be freely shared across the digital community. We expect that the Digital Natives will continue to make a valuable contribution to other elements of what consultants Gartner describes as the Nexus of Forces: Social, Cloud, Information (Big Data) and Mobile.

Governance

Having identified the technical, managerial and business skills and capabilities needed by the digital workforce in 2014 and beyond, consideration should be given to suitable governance arrangements to ensure that definitions remain meaningful, inclusive and accessible. There are several models in-use in the UK, including those from the Chartered Institute for Librarians and Information Professionals (CILIP) and from Skills for the Information Age (SFIA). However, neither is comprehensive.

Ultimately, the model to be selected should enable users to identify the equivalence of skills and capabilities across all businesses sectors and provide a suitable degree of assurance regarding the competencies of those handling information on behalf of other organizations. Professionalization also requires careful oversight to ensure that appropriate standards are maintained and that the full range of working environments - including technical, commercial, business and academic (in both public- and private-sectors) are represented. The development of experience-based learning is also critical; however, this should not rely on internships over properly resourced apprenticeships, sandwich courses and other work-based learning opportunities.

Conclusion

The UKCeB has been immersed in the business of developing information skills and capability since its inception in 1991 to ensure that barriers to effective collaboration across what - in 2014 - we call 'cyberspace' are minimized wherever achievable.
Enhancements in education and training are likely to lead to meaningful improvements in the UK’s skill-base but still need buy-in from decision-makers to ensure that schemes are adequately resourced.

Executives and senior managers have a pivotal role to play in overcoming the cultural issues that constrain businesses operating in any environment but a particularly important one in ‘cyberspace’ - one that is not yet fully appreciated in many business and employment sectors.

Conventional management structures are not necessarily best-placed to maximize opportunities in the digital business-space; therefore, organizations are likely to benefit from empowering the more digitally savvy - albeit, often relatively junior personnel - to participate in decisions affecting the business’s performance in the digital economy.

Oversight remains important and digital solutions need to be constrained, where necessary, to ensure that appropriate measures of security, privacy, quality and reliability are observed.

A thoroughly considered balance between user-anarchy on the one hand and an oppressive nanny-state on the other will be required to create the optimized freedom of manoeuvre necessary to assure the UK’s position as the ‘best place on the planet’ from which to operate in the digital marketplace. Creating this environment will require a radically different trust relationship between executives, managers, and workers - and between businesses and customers.

Maintaining this position beyond the medium-term, will additionally require meaningful and rigorous governance and must be under-pinned by an appropriately knowledgeable, motivated and empowered workforce.

15 September 2014
What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

1. Technology is changing every aspect of our lives. From health to transport, cyber security to food security, from the world of arts to the world of science. It transforms how we keep in touch with friends and families, how we work, how we consume and how we enjoy ourselves. Unprecedented amounts of information and data are being created and shared across the world. The pace of change can be dizzying, often much faster than our ability to make sense of it. In fact a burgeoning industry is being built on our need to make sense of it.

2. Over the past ten years entire industries have been turned on their heads, increasing demand for innovators with the skills to both create and build new technologies and for those who recognise the potential in emerging technologies and are capable of applying them to existing industries. There is every indication this pace of change will continue. The potential, particularly if effective policies to promote inclusion are implemented to allow all sectors of society the ability to change and shape their experiences, is enormous – personally, socially, economically and politically. A digital nation will be a successful nation.

3. Technological advances offer huge benefits for the economy. Any business, no matter what its size or where it is based, can reach a global customer base. The internet makes it easier for new companies to enter the marketplace and scale.

4. The need for digital skills is only going to grow: the Science Council estimates that the ICT workforce alone will grow by 39% by 2030. A 2013 O2 report, The Future Digital Skills Needs of the UK Economy, estimated that 745,000 additional workers with digital skills would be needed to meet rising demand from employers between 2013 and 2017.

5. Tim Berners-Lee considered that “The web as I envisaged it – we have not seen it yet. The future is still so much bigger than the past.” And Gartner predict that ‘by 2020, more than seven billion people and businesses and at least 30 billion devices will be connected to the internet. With people, businesses and things communicating, transacting and even negotiating with each other, a new world comes into being’

6. Technologies which are fast evolving with the potential (where they are not already so doing) to disrupt include: Virtual reality, Data analytics, Haptics, Robotics, Satellite systems, Cyber Security, E-Textiles, Flexible electronics, Artificial intelligence, Vertical Farming, Nanotechnology, Augmented Reality, Stem Cell treatments, Holography, Food Security, Materials Science, 3D printing. This represents a small selection but indicates the breadth of opportunity.

7. It becomes clear that every business is increasingly a digital business and every job is a digital job.

8. There is no doubt that digital advances are reshaping our economy. As the Department for Business, Innovation and Skills has said BIS: “In the market sector alone, manufacturing and services are blurring, new sectors and economic activities are coming into being, and all are
massively impacted by the unfolding digital revolution.” The Royal Academy of Engineering has argued “computing is integral to all sectors of the economy including defence and aerospace, games and entertainment, retail, healthcare, construction, manufacturing, finance and pharmaceuticals”. The changes extend to the process of scientific discovery: according to the Royal Society, computing is “transforming both how science is done and what science is done”. In 2013 the Nobel Prize for Chemistry was awarded for the development of computer models of how chemicals interact at the molecular level that have now become essential in the development of new drugs. The Nobel Prize Committee said: “Computer models mirroring real life have become crucial for most advances made in chemistry today”. These advances are profoundly exciting.

9. Consequently, jobs involving advanced digital skills are booming, both in the UK and across the world. The highest growth occupation in the EU between 2011 and 2012 was among “software and applications developers and analysts” LinkedIn have analysed the popularity of job titles they have seen across the profiles of over 259 million members to find the most popular job titles which simply did not exist five years ago. Of these, eight were technology related roles such as IOS and Android developers, data scientists, and specialists in both cloud computing and digital marketing. There are many differing future estimates that the demand for employees with advanced digital skills needs is only going to grow. Across Europe, e-Skills for Jobs in Europe estimated that the EU could face a shortage of up to 900,000 ICT professionals by 2020. The Science Council estimate that ICT workforce is likely to increase by 39% by 2030. There are specific new skills needs within certain lines of work. For example, SAS & e-Skills UK have projected that there could be 132,000 job opportunities possible in big data over the next 5 years.

10. The digital sector of the economy is often championed as a sign of its importance to the economy. According to the Government’s Information Economy Strategy, the ICT sector contributed around “8 per cent (£105 billion) to GVA in 2011” and includes 120,000 businesses. However, estimates vary. Research from the National Institute of Economic and Social Research and Growth Intelligence estimated in 2013 that there are almost 270,000 digital companies, 14.4% of all companies in the UK. Depending on how you measure it, the digital economy’s share of employment varies from “around 5% to 11% of jobs. The difficulty is that it is becoming increasingly difficult to silo off companies as digital or not digital. The OECD has noted “there is still no widely accepted methodology or single measure to capture the whole Internet economy. It is becoming increasingly difficult to split organisations into a binary classification of digital or not digital. Instead, it is increasingly a question of to what extent is an organisation digital, not whether they are or not.

What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

11. A more complete understanding of the skills needed and clearer communication about numbers required at different skill and salary levels. We feel there is need for detailed research to map the likely nature of future employment possibilities so they can be communicated more effectively. General statistics abound but we found it extremely hard to drill down into the detail. It is challenging to get evidence on the exact skills required, by how many and at what level. This information is essential so accurate careers advice can be provided to young people and intelligent retraining of existing workforces can take place, if necessary with subsidy as the evidence would show clear ROI.
12. **Perceptions held by students, teachers and parents are often misguided and inaccurate.** Students, teachers and parents fail to understand the opportunities within the digital workplace. All too often stereotypical perceptions prevail. There are various major problems including, but not limited to: out-dated views about what tech jobs might involve; a lack of appreciation of the importance of digital skills to all jobs; and a lack of awareness of just how successful UK digital companies are. Parents and teachers often promote careers they think they understand and which have historically been worthwhile rather than the emerging opportunities which are unfamiliar or completely unknown to them.

13. Crucially, tech roles are far too often seen as jobs for the boys. Most people have heard of Bill Gates and Mark Zuckerberg but struggle to cite a female role model. The gender imbalance in tech is extremely damaging: it is hardly surprising that we have digital skills shortages given that we are failing to make the most of the talents of almost half of the potential workforce.

14. Changing the views of parents and teachers will be especially important if we are to prepare young people for the digital future and to support a knowledge driven economy. These groups are the influencers who guide young people and shape their decisions. Results from 5,500 students surveyed by TeenTech in 2012/3 found that 43% turned to parents for advice on careers, well ahead of other influencers. Despite their importance, too many parents are poorly placed to advise: a recent survey by O2 found that 23% of parents believe digital skills to be irrelevant to their children’s future career success, despite the fact that almost all jobs already require at least a basic level of digital skills. Digital skills are increasingly needed at intermediate and advanced levels across all sectors.

15. There are narrow stereotypes among the young about what it might be like to work in a digital job. The Young Digital Taskforce ran their own informal survey within schools and across social media asking their peers and parents to name people working in the digital industries. Most people were able to name Bill Gates, Steve Jobs and Mark Zuckerberg without any trouble but then got stuck. Not a single woman was mentioned. No one mentioned a role model from black or minority ethnic communities.

16. Asked about the impression of people working in technology, the descriptions offered by the Young Digital Taskforce’s peers swung between geeks bashing away on keyboards or of boring middle-aged men in badly fitting suits doing dull repetitive jobs.

When I asked friends what they thought about people working in tech they said ‘Nerds up in their bedrooms, never seeing the daylight, only coming out to eat pizza, pants up to their chests’, Student, Young Digital Task Force

17. The Young Digital Taskforce commented on the overwhelmingly masculine image of the industry and how they had already had direct experience of this. One Task Force student, Hollie from Oldham College, said when she walked into her first technology class she was asked if she was in the wrong classroom, simply because she was female. We need to change these perceptions

18. Education needs to be properly supported and encouraged to deliver outstanding careers guidance at every age. Too often, it is woeful despite being more important than ever before. Without good careers guidance, the most disadvantaged will continue to be the
ones who lose out. We also need to make it easier for businesses and education to connect so that industry can play a more active role in providing young people the information, advice and guidance that they need.

19. We need to do more to celebrate and promote our successful tech companies from across the UK so that people appreciate that the latest technology is not just built on the West coast of America but in the UK. Here the media has a responsibility to ensure that we champion technology as much as we do physics, maths and science.

20. These were our recommendations to improve perceptions of the technology industry:
   1. Government should coordinate a campaign involving all stakeholders to tackle the gap between the perceptions and the reality of the growing importance of digital skills. This campaign should focus particularly on key influencers such as parents and teachers.
   2. Regional groups should collaborate to establish websites dedicated to connecting education and tech businesses in order help improve careers guidance and facilitate work experience. Local Enterprise Partnerships, local authorities or self-organising collaborations could lead this.
   3. Businesses and professional bodies should collaborate to create a national online Wiki dedicated to digital careers. This should be for people at all stages in their lives.
   4. Employers need to take steps to improve diversity in the tech workplace. They need to go beyond appointing more women to boards to examining the reasons for the low numbers of recruitment and retention of women at all levels.

What is the employment impact on the UK’s labour market? What are the regional differences?

21. After much discussion, the UK Digital Taskforce devised a simple structure to discuss tiers of skills required in a world which is digital by default. : Digital Citizen, Digital Worker, and Digital Maker. This is a helpful way of understanding the likely impact on the labour market.

22. Increasingly we all need basic digital skills to participate in everyday life as a digital citizen, whether it is to communicate, find information or purchase goods/services. These levels of basic digital skills have become an almost universal prerequisite to employment: almost everyone needs to be able to use the internet, process simple word documents and find information online. Lack of such skills can lead to exclusion from society as well as the job market.

At the intermediate level, many people require deeper skills as part of their working lives. We have characterised this as the digital worker. In essence, skills at this level might include (but not necessarily be limited to) using document-formatting tools and building spreadsheets, while at the more complex end these might encapsulate using sophisticated tools directly related to a particular occupation.

Lastly, we had digital maker level. At this level, we are talking about those who have the skills to actually build digital technology. This could range from less advanced tasks such as
writing Excel macros or creating control files for 3D printing to everything from designing the next microprocessor or implementing ground breaking machine learning algorithms.

While these definitions are necessarily broad, we believe that they help to distinguish between the different skill levels needed.

23. In order to assess how important digital skills are to the UK economy, Chris Mairs, the Chief Scientist at Metaswitch Network and the Chair of the UK Forum on Computing Education, used our framework in an assessment of the 361 standard occupation codes used by the government to categorize the occupations of the UK workforce. Adding a digital muggle level for those requiring no digital skills, to whom digital technology may as well be magic, he made an assessment of what level of digital skills might be required across the workforce.

His analysis estimated that the skills requirements across the UK workforce are as follows: 7% Digital Muggle, 17% Digital Citizen, 46% Digital Worker, 10% Digital Maker.

24. This analysis suggests that well over half the workforce requires digital skills that extend beyond the basic skills of digital citizenship and that over 90% of jobs require at least those basic digital literacies.

25. At our regional meetings – held in Plymouth, Doncaster, Newcastle, North Wales, Reading and London, ensuring young people developed digital skills was seen as vital to the region’s economy. It was widely recognised that access to both fast broadband and talent would enable companies in the regions to compete on a global stage.

**How are schools preparing to deliver the new computing curriculum in an innovative way?**

**How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?**

**The Digital Challenge for Schools**

26. It is at schools that we must take steps to improve our digital skills for the long term. Following warnings from Google’s Eric Schmidt, the Royal Society and Computing at School, England has a new computing curriculum starting in September 2014. This represents both an excellent opportunity and a major challenge. If we can teach our young people a balanced curriculum of digital literacy, ICT and computer science, they will be well prepared for a digital future. However, teachers will need considerable help to prepare and retrain for the new curriculum. Only 44.9% of secondary school ICT teacher have a post A-level qualification relevant to ICT and the overwhelming majority of primary school teachers do not have a computing background. A recent survey found that 60% of teachers did not feel confident delivering the new curriculum.

27. We need to give them the support they need. So far, the Government has provided £3.5 million, a sum that is simply not sufficient. The funding is equivalent to £175 per school. By comparison, Jersey is investing around £15,750 per school to make a similar step change to computing. The sum also compares poorly to recent provision for CPD for teachers for maths, physics and global issues.
28. We need to support teachers to acquire new subject knowledge and develop their teaching style for the new computing curriculum. At present, CPD is not enough of a priority across education. In addition, there is an appetite from both teachers and industry for more project based, cross curricular learning which embodies and recognises creativity, problem solving, collaboration, entrepreneurship and self directed learning. However, time for both of these is a major problem. We need to give teachers (and students) the space they need.

29. School leaders need to appreciate the scale of the challenge and take steps to support the transition to computing, both at primary and secondary schools. Schools, colleges, universities and industry need to collaborate to help teachers to make the transition so that our young people get the computing education they need and deserve. In addition, we need to take steps to increase the number of teachers coming into the profession to teach computing, be it from university or from industry.

30. We made the following recommendations in ‘The Digital Challenge for Schools’ chapter of our BETA Digital Skills For Tomorrow’s World.

1. Government should invest at least an additional £20 million by 2020 to help successfully embed the new computing curriculum in schools across England. Government support will likely need to remain in place for the next decade.

2. Schools must provide time and support for computing teachers to deepen their subject knowledge and develop their teaching style. Dedicated time for Continual Professional Development (CPD) is essential for teachers and should be recognised as a core component of being a professional teacher.

3. Government should launch a ‘Digital Challenge’ for schools, modelled on the collaborative approach of the London Challenge to stimulate partnerships between schools, colleges, universities and industry to enhance careers advice and both the curricular and extra-curricular opportunities available to young people.

4. Government should treat computing as a fourth ‘core science’. In addition, there should be a digital component to education and training opportunities for young people up to the age of 19.

5. England, Northern Ireland, Scotland and Wales should all ensure that their school computing curriculum includes a balance of computer science, digital literacy and information technology.

6. The establishment of a network of school governors with expertise in computing. Those working in the digital industries should be encouraged to apply to become school governors.

7. Universities should take urgent steps to address the severe shortage of new computing teachers. Every university should encourage their computer science students to consider teaching by offering the Undergraduate Ambassadors Scheme.

8. Government should provide a route for experienced professionals in the digital industries to enter the teaching profession via a fast track ‘Teach Next’ route, modelled on Teach First.
31. We need to be much more explicit about the range of opportunities on offer, improve the way we describe the skills, broader attributes and experience needed to access those career opportunities. Kate Doodson, Business and Operations Manager at Cosmic Ethical IT and an attendee at our Plymouth regional meeting, warned that careers in tech were “so misunderstood”, with people believing that you had to be a complete techie and know it all from day one to work in tech jobs. Instead, she emphasised the importance of the creativity alongside technical skills, a point consistently made by people who we have met. We also need to explain the increasing value of digital skills to all workplaces, not just in roles requiring advanced digital maker skills.

The importance of careers guidance in education

32. Careers guidance within education is especially important to changing perceptions. Young people cannot aspire to be something they do not know exists. Careers advice is pivotal in bridging this gap. In theory, careers information should be transformative, highlighting opportunities or pathways that you may never have considered as well as clarifying those already of interest. Good careers advice not only identifies specific roles and careers which someone can choose, but also analyses preferences, personal characteristics and academic achievements in order to guide them to the most satisfying (and so productive) option. While many find their way despite our current poor approach, it does not work for those who lack those personal connections or for those who are socially disadvantaged. Helping students to understand the variety of opportunities and how they are open to all, regardless of background and gender, is particularly important. A fast changing, incredibly diverse digital jobs market is making careers advice more important than ever.

33. Careers advice should be an ongoing process from primary school right through to those already in work who may be seeking alternative career paths. It must begin early in education, not only once students are looking to the future at 16. Views are formed at an early age before children have often been given a chance to reflect widely on what they might do. In the absence of careers guidance, young people develop views which are difficult to change later on in their lives. By the time students are in secondary education, they may not know what they want to do as a career, but they have begun to rule out certain areas, including entire education pathways.

34. We need information advice and guidance on all future options on an ongoing basis. A once a year talk is not enough. This is simply not the case at present: in only 12 out of 60 schools visited by Ofsted for a survey of careers service provision was it the case the schools had “ensured that all students received sufficient information to consider a wide breadth of career possibilities”. (4) Many attending our regional meetings felt that current careers advice was at best “patchy” and for the most part “woeful”. Careers guidance is all too often seen as an unimportant extra, with schools lacking both the funding and incentives to actually deliver this well.

35. It is not just a problem of knowledge. Teachers sometimes seem so driven to focus on exam results that they lack appreciation of how local employment changes can be important to their students: at one event in East London where a speaker talked about 7,500 new technology jobs being created locally, a Design and Technology teacher remarked that she couldn’t really see how any of this was relevant to her.
36. School leaders and governors are especially important to target in relation to making sure careers guidance is a priority.

37. It should also be appreciated that students are shrewd customers. One teenager who responded to our online survey said “I find that whichever teacher or person is giving you careers advice do (sic) not give balanced arguments and try to convince you to do their job, I find this very frustrating”. Student Leicestershire

38. One of the most obvious weaknesses seems to be alerting students to the choices they have post 16 and post 18. Many students are given little or no information about apprenticeships, let alone about digital apprenticeships. This needs to change. A survey of 5,500 teenagers (aged 12-13) was conducted at a series of TeenTech events during 2012/13, which revealed that 74% said they intended to go to university, 9% were thinking about apprenticeships, 9% wanted to go straight into a job while the remainder didn’t know.

39. University can be an excellent option but it will not work for all. Careers guidance should also highlight the option of setting up your own business. If we want our young people to set up the digital companies of the future as well as work in them, information, advice and guidance on entrepreneurship should form one important part of a rounded careers guidance provision.

**Subject Choices**

40. Careers guidance is also extremely important in the context of subject choices made at the age of 14. One of the issues routinely raised at regional meetings was the age at which teenagers have to choose and narrow the number of subjects they study. Young people have to make decisions that will affect potential career choices before they have any idea what their career choice might be. Ute Gojrzewski from Intel said at our Reading regional meeting that she felt “we are forcing young people too early to make too specific decisions about a career without giving them the information that they need to make that a qualified decision.” Instead, she thought we either had to either allow them to study a broader range of subjects for longer or make sure they understood much more about opportunities earlier. We believe that government should address this issue, possibly by adopting something more akin to Baccalaureate style approach through to the end of secondary education. Such a transition was recently advocated by the Royal Society.

41. Students should be helped to understand the subjects that are springboards to many different careers and, perhaps more importantly, students should be warned of the potential for closing off entry into various careers that require digital skills before they give up on that subject. Students should be made aware of the potential consequences of simply choosing subjects that they consider the ‘path of least resistance’

**How can the education system develop creativity and social skills more effectively?**

42. There is real appetite from students, teachers and industry for more project based, cross curricular learning which embodies and recognises creativity, critical thinking, problem solving, collaboration, entrepreneurship and self directed learning. There is a need to recognise these skills, which are valuable in the workplace and important for those who wish to create their own business.
Students and teachers should be encouraged to reach beyond and across subject ‘silos’ to better understand the role of digital skills in art or music, how divisions between the arts and the sciences are artificial ones. This would help students understand how ‘being creative’ did not preclude them from a career in technology.

43. Schools who do build time for such activities which for a great part run outside or alongside rather than within the curriculum, report not only a growth in confidence on the part of learners but enthusiasm for subjects which become more meaningful and relevant. Lisa Wilde and Russell Bramhill from The Hayfield School in Doncaster told us about the effect of participating in TeenTech and running the TeenTech project based Award scheme in their school, saying ‘it has had a transformational effect on our Design and Technology department. Not only were participating students inspired but the effect was contagious with entire year groups and teachers wanting to join in. You can spot the students who’ve taken part in the TeenTech Awards, their approach to GCSE Design and Technology is in another gear’.

44. The Awards encourage students to use science and technology to make life ‘better, simpler or easier’. When we surveyed teachers to ask what students had gained from the experience, 93% said students had enjoyed the opportunity to work on their own ideas and 90% said it had been valuable for developing teamwork. Students working on their own projects which are relevant to learning but over which they have ownership clearly derive benefit in a number of ways.

‘This TeenTech Challenge has been one of the best things we have ever done at school and even outside of school. We learnt we could solve problems (and there were lots because we had never done anything like this before) When we solve our own problems we get an amazing feeling and sense of accomplishment’ Students, Birkdale School

‘In the end it came down to team dedication, to finish what we started. Like any other start–up we made mistakes but we learnt from those mistakes” Student, Devenport High School,

During the TeenTech classes we have had to make a few hard decisions and we’ve had a few minor arguments, all of which have been swiftly sorted out by a civilized vote. Coping with the arguments has actually helped us bond as we can be nicer to other people as we have learnt social skills. We learnt a lot about teamwork, communication skills and creativity (thinking outside the box). We think that these are all important life skills that we wouldn’t have learnt if we hadn’t been involved with the Teen Tech scheme. Students, Park House School

We have learnt a large amount of skills from TeenTech, for example we have learnt business skills through market research and advertising.

Students, Mulberry School for Girls

As a result of the TeenTech Awards we’ve learnt designing isn’t a quick process of coming up with an idea and turning it into a reality but it’s also about research and prototypes and perhaps completely changing your idea if it doesn’t work. We have both been inspired by this process and want to develop our skills in this area and maybe even become engineers or experts in related professions in the future. Students, The Holt School
45. However, finding time for projects like these can be difficult and relies heavily on the dedication and enthusiasm of teachers as well as students. We need to give teachers (and students) the space they need.

46. One member of our taskforce talked in an early meeting about the ‘axis of evil’ – the way curriculums, examination systems and inspections sometimes conspired in a pincer movement to frustrate rather than encourage the best possible outcome. Another member spoke of being penalised in a school inspection because she’d been encouraging students to work out how to do something in a computer science lesson rather than simply telling them.

**What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?**

47. Our top level analysis of the labour market (see 22, 23 and 24) shows well over half the workforce requires digital skills that extend beyond the basic skills of digital citizenship and that over 90% of jobs require at least those basic digital literacies.

48. The significance of advanced digital skills in major projects is often underappreciated. Digital skills are a golden thread running through all the leading construction projects of the century from the Olympic Park to CrossRail. While we often focus on the needs of tech companies, many companies across all sectors increasingly need advanced digital maker skills. *The Guardian* says they now regard themselves as a news company that thinks like a tech company. They employ over 150 people in their tech team but often struggle to find applicants with the skills they need for jobs such as: product management roles with high-end technical skills; data scientists, engineers and analytics; client side developers; mobile and android developers; software engineers and software architects. As Sian John, Director of Security Strategy at Symantec, put it at our Reading regional meeting, “people just don’t realise how great and varied a career there is technology or in digital, how much you need digital skills to work in any industry now.”

49. However some companies including Network Rail were keen to point out that for their IT departments above all they needed clever and agile thinkers with high level communication skills and that they were as likely to employ graduates with a degree in philosophy as one in computer science. One woman from an IT company grabbed my arm at an Awards evening and told me I had to make sure our report didn’t portray their needs as only for ‘pointy headed programmers’. Many we have spoken to want people to understand that technology is a people focused, not a keyboard focused business which seeks out people with personality, passion and dedication.

50. Whether companies were seeking high level technical or high level communication and leadership skills, they were united in reporting difficulties with recruitment.

**How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?**

51. Our research indicated a strong focus on University as the preferred route by parents, teachers and students themselves. Apprenticeships can, and increasingly do, offer an alternative route into digital jobs that can benefit businesses and young people alike. Many
companies of all sizes are really enthusiastic about the benefits of apprentices. However, we need to take major steps to improve the system so that more young people and businesses seize these opportunities. There is too much snobbery in relation to apprenticeships; at the moment they are all too often seen as a second class route for the less able. Policy pushes schools to prioritise progression to university irrespective of whether that is the best route for the young person. Teachers do not have the knowledge or understanding to recommend apprenticeship routes. The consequence is that far too many young people struggle to discover about them: one O2 apprentice we met only found out about the opportunity when looking at his mobile phone plan.

52. A major problem with the apprenticeship system is that it is just too complicated. From SMEs to multinationals, far too many find it too opaque and time-consuming. The problems range from the complexity of the system to a poor National Apprenticeship Service website. As Andrew Corbett of the UK IT Association puts it, “the current apprenticeship system does not work for small IT companies.” We also heard similar complaints from large, multinational employers. For apprentices to work for digital SMEs, we need a simpler, clearer system. In particular, we need to champion models which allow companies to either take apprentices on for the short-term or share apprenticeship training. Larger employers can have a role to play in assisting smaller companies here.

53. Our recommendations in ‘Apprenticeships for a Digital Economy’ for improving the perception and uptake of apprenticeships, particularly amongst SMEs are:

1. Progression onto apprenticeships should be recognised as a good outcome for school students. At present, the system focuses overwhelmingly on university, irrespective of whether that route necessarily suits the student. Additionally, there is a need to educate the educators and the influencers about apprenticeships, helping teachers and parents to understand the benefits of apprenticeships.

2. Government should radically simplify the apprenticeship system to ensure that more digital businesses, especially SMEs, invest in apprentices. The process remains too opaque for businesses of all sizes.

3. Government must champion models that allow microbusinesses and SMEs to either share digital apprentices or to collaborate with other businesses in digital apprenticeship training.

4. All employers should ensure that their training providers are developing their apprentices’ digital skills. Also, all apprentices should be offered remedial digital skills training if they have limited digital skills.

How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

54. Britain is blessed with a strong, diverse, higher education sector that makes our country well-placed to compete in the global knowledge economy of the 21st century. However, it is increasingly important that graduates leaving universities are equipped with the digital skills needed for a range of roles across the modern economy. Current graduates will require skills above those acquired at school under the old curriculum. It is important for universities to offer opportunities to students to develop these skills.
55. The UK needs professionals who can invent new digital technologies, create software applications and keep our online economy safe and secure. Although other graduates also become digital makers in the workforce, computer science graduates are a major source of the high level skills our businesses need. While most computer science graduates go on to well-paid, professional jobs, too many find themselves unemployed. This is concentrated among black and minority ethnic students, who tend to achieve lower grades at university and are then more likely to be unemployed. This cannot be excused and is an urgent issue that universities must address.

56. Industry experience can help students to further their education and develop the technical skills needed for the world of work. Taking a student on a placement also offers considerable benefits to businesses of all sizes. However, too often it is difficult for SMEs to find students. We need to make it easier for students and businesses to connect. While full year sandwich placements might suit some, there are many other types of work placement that we need to encourage. For higher education to ensure that they produce the high level skills needed by industry, we need to ensure they have the connections that make this possible.

57. Postgraduate level study is extremely important for equipping the UK with the high level skills needed in an information economy. However, far too few computer science graduates progress onto postgraduate study. Access to postgraduate education is determined by ability to pay rather than ability to benefit. We need to take steps to support more students to go on to postgraduate level computer science qualifications and reverse recent drops.

Our recommendations in the Digital By Degree Chapter are:

1. Universities should ensure widening participation funding is used to both improve academic attainment and reduce unemployment levels amongst ethnic minority computer science graduates.

2. Government should fund the National Centre for Universities and Business (NCUB) to work with other sector bodies to establish a matching website to connect students with tech businesses across the UK.

3. Government should work with universities and industry to expand the number of tech sandwich years and summer placements undertaken by computer science students.

4. Universities should offer students of all disciplines the opportunity to develop their digital skills outside of their core subject through employability awards and other schemes.

5. University computer science departments should have active Industrial Advisory Boards to help keep them updated with industry developments.
Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

Diversity of the workforce

58. At the moment the technology workforce is not a diverse workforce and this has direct and indirect impacts on economic growth. We are not using all the potential talent available to us at every level.

59. A personal experience four years ago was telling. The HR team of a major IT company invited me to watch their new corporate video. After 5 mins I began to wait for the token woman/non-white face to make an appearance. But no - the 7 min vid was a sea of white, middle aged men. When I pointed out I felt there was something missing the HR person said, Yes it does lack the Wow factor doesn't it? When I clarified my comment she was shocked - not at what I said but because she hadn't noticed herself. Nor had the very lovely CTO who was with us. They both said that because they were indeed surrounded by a sea of white middle aged faces, so it had of course seemed all very normal.

60. We believe companies have a responsibility to ensure that they take measures to improve diversity in the workplace. There are major challenges resulting from the limited number of young women who study computing at school, college and university. However, employers can and should do more to address the low numbers of women in tech jobs. This must go beyond simply focussing on recruiting more women to the board and addressing the imbalance at senior management level. In particular, we need more sponsors prepared to actively promote opportunities rather than simply mentor at all ages. Whilst there have been improvements in the number of female non-executive directors, the number of women in executive directorships remains low as does the number of women in senior management positions. While the figures are low across the sector certain companies do better. For example, 28% of IT roles are women at Network Rail. Network Rail identified two factors which have helped them reach this level. Firstly, the number of senior role models within the department: not only do they have a female CIO but also half of the senior leadership team are women. Secondly, there are also a large number of women working in senior leadership positions across the business outside of IT.

61. We would encourage large organisations to report the number of women in IT roles. In particular, we would encourage the Government to make this obligatory for all government departments and Quangos. If one cannot measure it one cannot manage it.

62. Much emphasis is placed on mentors. However, some consider that it is not just mentors which help but sponsors. That is, people who can more actively support women who may not have the networks or social capital to take advantage of opportunities. Someone prepared to advocate on your behalf when you are not in the room, to make introductions, to act as referee, to alert you to openings. This applies not just to the teenager seeking work experience but right through to the woman looking for an executive directorship.

63. A perennial issue flagged up by all we have consulted are the problems of returning to work after a career break, typically following maternity/paternity care. To help ensure women can have a route back into tech roles, we would encourage companies to experiment with returnships. Returnships are schemes which offer the opportunity to return
to a position in the workplace in a paid capacity for a set period of time with the possibility of a job at the end of it. It allows both the employer and employee to test whether the match is correct without making either commit when the fit might not be correct. We would encourage more employers to ensure that they offer pathways back into tech roles as one way to address the gender imbalance.

64. Employers should also make sure that they review their employment and recruitment policies to ensure that women have are supported. For example, we would encourage universities to sign up to the principles of the Athena SWAN charter. The Charter was developed to encourage and recognise commitment to combating underrepresentation and women in science, technology, engineering, maths and medicine employment in higher education and research. It helps to promote inclusive working practices and allows universities to join part of a national and regional peer support and practice-sharing network of members.

65. Altering recruitment processes have helped the BBC to tackle their gender imbalance. 40% of those on the BBC’s MSc Technology Trainee Scheme are women. To redress the gender imbalance during their recruitment process, they have had: female-only panels at recruitment events; gender neutral language and photos of female engineers in their promotional material; and changed their entry requirement from maths and physics to maths and another science on account of the fact that women tend to favour biology over physics.

66. Employers also need to do more to actively encourage and assist young people from all socio-economic and ethnic backgrounds to take advantage of opportunities. One contributor to our research told how she specifically developed outreach for inner city schools as her employer (a global company) had previously focussed their recruitment activity on ‘schools in leafy middle class suburbs’. The activity was successful and continues.

67. Digital skills stretch from the most advanced to the basic ones increasingly required to participate in society. Basic online skills can help connect people with friends and family, find cheaper deals and locate information more easily. However, there is a major digital divide between the 73% of adults who use the internet on a daily basis and the 13% who have never even been online. This is an issue of economic efficiency and social justice.

68. Extending basic digital skills to all would offer considerable benefits for the most marginalised sections of society, helping to connect the elderly, the disabled and the isolated. If Government is to go digital by default then we must do more to ensure all gain basic digital skills or we risk excluding large sections of society. Getting everyone online will involve a large investment. However, the cost of inaction would be far higher. The Coalition Government’s Digital Inclusion Strategy aims to get “everyone who can be digitally capable” online by 2020. It estimates that between 3.5 million and 4 million, or 6.8% to 7.9% of the adult population, will never have basic digital capabilities. We must aim for as few to be excluded as possible and ensure that the next Government makes a major focus. Research for the Tinder Foundation and Go On UK estimated that the cost of equipping 100% of the UK adult population with basic digital skills would be £875 million. The possible benefits to the Government, to businesses and to our society are so considerable that we must make this investment. The analysis noted that were that to be split Government, the private sector
and the voluntary and community sector, each group would need to make a £292 million investment. However, for business to make its equal contribution, we would need “a step change in private sector behaviour” (19). A combination of a corporate social responsibility drive and experimentation with matched funding schemes might help to increase the business contribution to this task.

69. It is important to note that this digital exclusion is not just about skills. It can also be about the motivation. Here, both local and national government have a responsibility to make sure that their websites are clear, easy to use and accessible for all. Council websites, for example, might be one of the first websites someone who is digitally excluded might visit. All too often, they can be difficult to negotiate and put people off at the first hurdle. Why would someone use a government website if they find making a phone call easier?

Gareth Ford Williams, Head of Accessibility, User Experience & Design, at BBC Future Media in his submission to us emphasised the importance of good web design to ensure that the internet is open to all, a challenge to those in education, saying that all client user facing experiences and the code used to develop them has the potential to be inclusive.

70. Gareth Ford Williams at length in our report as he makes a very important point about Universality being a core principle of the Standards that define best practice in Web Development. ‘However through conscious and often unconscious choices, Standards and best practices are not adhered to or applied incorrectly and therefore inaccessibility is designed and engineered in, resulting in discriminatory experiences. The issue underlying this is that the skills to enable this to be done correctly are not taught from the outset, which is why most Designers and Developers only learn about Accessibility outside of the education system. There are exceptions to this, University of Dundee’s School of Computing being one of only a handful of examples.’

‘The problem is compounded further by Accessibility being taught as something used to ‘fix code’ or ‘add value’ and is treated as a ‘nice to have’, rather than it simply being a way experiences are designed and code is developed from scratch. This is where the myth that Accessibility is an expensive afterthought originates from. This is like thinking that a building with steps up into it is cheaper to build than a building whose entrance is at street level.

There is also a second myth that accessibility comes with unacceptable compromises to product design. This is simply not true and the; BBC iPlayer, Apple iPad/iPhone, YouView and the YouGov website are just a few examples that prove that baking accessibility in from the start creates a better technology product overall.’

71. Digital Skills for Tomorrow’s World made recommendations around the education of the next generation, examining schools, apprenticeships and higher education but also emphasised how vital it was that we ensure that digital skills are being improved across the whole of our population so that all of our society benefits from technological advances. We need to target those who are unemployed. A lack of basic digital skills is common among NEETs and those on job seeker’s allowance. We need to help equip these people with the skills they need to get back into the workplace.

72. Retraining workers with improved digital skills is a responsibility that employers cannot shirk: the Government alone cannot foot the bill for keeping the workforce’s skills updated.
Companies should work alongside organisations such as unions to help their staff retrain. In addition, online learning through Massive Open Online Courses offers new opportunities for people to retrain and reskill. Too many SMEs and charities lack basic online skills. A lack of appreciation of the benefits and skill limitations keep these organisations from making the most of digital, a problem we need to address.

73. Digital advances compound the importance of lifelong learning in an unprecedented way. If we want to make sure that people can remain in the workforce for longer, they will increasingly need to improve their digital skills at all levels. We need to make sure that the support we offer to lifelong learning is fit for purpose for our digital future.

74. In our Perception and Reality chapter we recommended that
   1. Employers need to take steps to improve diversity in the tech workplace. They need to go beyond appointing more women to boards to examining the reasons for the low numbers of recruitment and retention of women at all levels.

75. In our Digital Skills For Life chapter we recommended that:
   1. Government should make the necessary investment to extend basic digital skills to all of the UK population by 2020, taking steps to share the cost of this transition with businesses and the charitable sector.
   2. Government should ensure job seekers are offered digital skills training to help them back into the workforce.
   3. Businesses ought to take responsibility for ensuring existing members of staff are offered training to keep their digital skills updated.
   4. Government should mount an awareness campaign about the need to improve digital skills among SMEs and charities. This should include piloting of voucher schemes to access digital skills training.
   5. Government should commission a major review of the provision of lifelong learning for digital skills across the UK. Digital advances are making retraining and lifelong learning more important than ever.

What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?

76. One of our key recommendations (Perception and Reality chapter) is for regional groups to collaborate to establish websites dedicated to connecting education and tech businesses in order help improve careers guidance and facilitate work experience. This could be led by local enterprise partnerships, councils or self-organising collaborations.

77. The need for such regional hubs to connect and inform was echoed repeatedly at every regional round table meeting we ran and the responses to our call for evidence. For example, one group at our Plymouth regional meeting advocated a “clearing house system” website which could help to connect students with businesses, suggesting that such an approach could be adopted regionally or sub-regionally. The idea was that it might be a version along the lines of “LinkedIn for people going through education”. Similarly, at our
London regional meeting, we had a fantastic presentation from Juan Guerra, the CEO and Founder of Student Funder on the need for a portal to connect across education and the work of work.

78. The Tech Third Sector
Certain young people will learn digital skills outside the formal curriculum. There are a growing number of organisations, which we describe as the Tech Third Sector, aiming to teach and excite young people about computing beyond the confines of the curriculum. From the local to the international, we must do more to ensure that all young people have the opportunity to enjoy these initiatives.

79. There will always be limits on what teachers can do inside the classroom. The Tech Third Sector can offer a space to develop technical skills alongside the broader attributes such as creativity, problem solving, teamwork, collaborative work and communication. These organisations can help to dispel myths about what a career in tech can involve. In addition, there is scope for these organisations to support formal education. We need to do more to signpost these opportunities both to participants and supporters so as to encourage these organisations to grow.

80. It is worth noting that many after school clubs and weekend clubs which require a level of participation from parents tend to be supported by parents who value skill acquisition. Mozilla pointed out that we need to make sure the Tech Third Sector do not fall into the trap of ‘providing an accelerator programme for the better off ’

Currently, some funders of Tech Third Sector organisations not only gather information from projects but also bring them together to share best practice. The Google RISE Awards winners have the opportunity to attend a Summit which brings together representatives from initiatives across the world currently being funded by the company. The stimulating three day event gives organisations the opportunity to share ideas, benefit from the latest research on outreach and receive quality advice on crowd funding, gathering feedback and scaling to help make their organisations more sustainable. Google actively encourage RISE partners to collaborate to develop and scale their offerings. We think this is a highly intelligent approach.

81. We recommend that:
1. The Tech Third Sector should embrace its potential to act as a ‘petri dish’ for schools, providing the space to experiment with how we teach computing and learn digital skills. Collaborative research across programmes could expand our understanding of the impact of different approaches. This learning could then inform and help teachers within formal education.

2. Tech Third Sector initiatives should be mapped and signposted online to allow students, companies and communities to easily find and get involved with schemes in their local area.

3. Businesses and major trusts and foundations should promote the growth of the Tech Third Sector by providing seed funding to stimulate new initiatives and larger grants to allow successful initiatives to scale up.
4. Efforts to recognise informal learning via online portfolios or digital badges should be encouraged

15 September 2014
UK Digital Skills Taskforce and TeenTech CIC, e-skills UK and Go ON UK – Oral evidence (QQ 113-128)

Transcript to be found under Go ON UK
UK Digital Skills Taskforce and TeenTech CIC – Supplementary written evidence (DSC0111)

How to connect business and schools.

1. Encourage schools to appoint people from tech companies onto the board of governors to help develop school senior management understanding of the importance of digital skills and also to help source strong industry links for the school

2. Currently some schools are brilliant and developing strong links with industry – whether it’s through ex pupils who visit for talks, companies who come into the school to run activities or good opportunities for work experience. However good practice is piecemeal, even within the same school

Regional groups should collaborate to establish websites dedicated to connecting education and tech businesses in order help improve careers guidance and facilitate work experience. This could be led by local enterprise partnerships, councils or self-organising collaborations

I believe these ‘dating websites’ should operate on a local basis to help force links and to create awareness of opportunities – whether it’s a student who wants a work placement, a teacher looking for a strong organization to run an inspiring activity focused on say careers in data security..

The need for a website to match schools and students with employment or work experience opportunities was a recurring theme throughout discussions at our UK Digital Taskforce regional meetings and the responses to our call for evidence. For example, one group at our Plymouth regional meeting advocated a “clearing house system” website which could help to connect students with businesses, suggesting that such an approach could be adopted regionally or sub-regionally. The idea was that it might be a version along the lines of “LinkedIn for people going through education”. Similarly, at our London regional meeting, we had a fantastic presentation from Juan Guerra, the CEO and Founder of Student Funder on the need for a portal to connect across education and the work of work.

3. Appoint a school representative as the point of contact for local and regional businesses and also for STEM initiatives and competitions. It can be frustrating on both sides – companies want to engage but don’t know who to contact. On numerous occasions I’ve had an email from a teacher to say they wished they’d known about one of our events – but the school had been contacted and the message not passed on. Schools should share these details and then the list made available to companies and to third sector organisations, like TeenTech, Code Club and Apps for Good. On our part (and to make the life of that coordinator less of a nightmare) we could have an agreed set of headline information to indicate age group, number of students, in school or out of school activity, likely impact etc

4. Companies should be encouraged to align their outreach to their core activity. I have encountered a number of tech companies who devote time to outreach activities which do very little and in some cases nothing to help students understand more about their work.
5. Companies should be encouraged to look at developing a strategic approach for outreach – which goes beyond one-off interventions.

30 October 2014
UK Forum for Computing Education, Google and Microsoft – Oral evidence (QQ 40-52)

Transcript to be found under Google
Introduction

1. This is the UK Forum for Computing Education (UKForCE) submission to the House of Lords Select committee on Digital Skills Call for evidence.

2. Unlike most activities, at a certain inflection point, technology driven change does not conform to Hofstadter’s Law. We believe this inflection point is upon us for digital technology, and its impacts upon society and business will be faster, more pervasive and more unpredictable than we expect, even after taking this assertion into account. Change will be more rapid than in the previous 15 years in which eCommerce, smart phones and social media have all become massively more embedded in daily life than most people predicted. In such a rapidly changing landscape, it is impossible to predict which specific digital technologies will emerge and/or have most impact. Instead we must equip the workforce to adapt quickly to the changing landscape, purposefully using and innovating upon all elements of digital technology. With such a workforce the UK can be a leader rather than follower, and beneficiary rather than loser, in the global digital revolution.

3. Through these changes, very soon every business will be a digital business. Although some businesses will be more digital than others, **90% of the workforce will require digital skills to do their jobs.** Any consideration of impact or policy in the context of a ‘digital sector’ misses the point. Digital is an attribute of businesses in all sectors and not a sector defining characteristic. To illustrate this point, consider Hassle.com, one of the new breed of digitally enabled businesses emerging from the East London technology hothouse. Hassle is an online marketplace for residential cleaning. The business succeeds because technology enables service discovery, booking, payment and reputation management. But nonetheless, Hassle is disrupting the cleaning services sector, not the digital sector. And it is the digitally savvy micro-businesses within the cleaning services sector (i.e. self-employed cleaners) who will benefit from the disruption by using Hassle to cost effectively acquire, interact with and retain their customers.

4. The new Computing curriculum in English schools is critical to creating a digitally intuitive and digitally agile workforce. High quality, innovative and engaging delivery of this curriculum will provide pupils with a fundamental and underpinning understanding of how technology works and the skill of computational thinking. Together this knowledge and skill form a solid base upon which to master specific digital technology, tools and modus operandi as they materialize in the coming years. Although Scotland started on this journey earlier than England, it is of concern that Wales and Northern Ireland are somewhat lagging.

5. The massive challenge now is to build universal commitment from school leaders to the importance of Computing and in parallel equip teachers for its high quality, engaging delivery. Anecdotal evidence from Scotland is that many head teachers and local authorities do not yet recognise the importance of the Computing curriculum, leading to insufficient teacher CPD and top down emphasis on making a step change happen. Ofsted should undertake a comprehensive survey of implementation throughout schools in England in 2015/16 to understand the status and barriers where intervention is required.
6. It is unrealistic to expect schools to undertake sufficient CPD to equip non-specialist teachers in KS1-KS3 for the new curriculum from current funding. We believe an additional £20M of targeted CPD funding in England would be proportionate and make a material difference. In our detailed answers below we also propose a Digital Apprentices In Schools (DAIS) scheme to mentor and assist non-specialist teachers to most effectively use technology to teach technology.

7. For several years students will be entering university without the benefit of the new Computing curriculum and consequently HEIs should offer Computer Science modules for all (not just STEM) non-CS students.

8. FE colleges and apprenticeships have a major role to play in increasing digital skills and are often overshadowed by consideration of the school curriculum and CS provision in HEIs. Apprenticeships containing a substantial and academically rigorous digital element, in many cases combined with other primary vocational skills ranging from electrician to accountant, are the most appropriate way for many students to become digitally intuitive. A fundamental re-energisation and re-branding of apprenticeships merits a major and urgent government focus.

9. The sections below provide answers to the specific questions posed in the Call for Evidence.

The changing technological landscape

1. What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

10. Over the next 15 years, we believe that technology-driven change will be even faster than the previous 15 years. We are just entering the phase in which the key influencers of change (technology creators, industry leaders and politicians) have themselves grown up in a digital world. Historic evidence from earlier technology-driven revolutions suggests that this is the point where profound innovation and social change occur. It is impossible to predict what technologies will have the most impact.

11. To illustrate this point, consider two technologies that were both reasonably mature 15 years ago, approaching the turn of the millennium – mobile phones and video conferencing. Both had been hailed for many years as potential game changers for business and social behaviour. Low cost webcams and software based encoders/decoders meant video conferencing was no longer the preserve of the boardroom. Increasingly powerful handsets and higher bandwidth telecommunications networks gave mobile phones the potential to offer more than voice calls and basic text messaging.

12. However, for the first 5 years of this millennium, neither technology made a fundamental breakthrough. Then, in 2007, Apple unveiled the iPhone which revolutionized the device in our pockets. In a very short period of time, our phones became the enabler for mobile content consumption, information discovery, eCommerce, and everything else we now take for granted while on the move. In contrast, although many of us regularly place Skype video calls, few would argue that video conferencing has fundamentally changed our behaviour or our economy.
13. With hindsight, some may argue the comparison is flawed, but the relative impacts would not have been predicted by many in the year 2000. There are some technologies we can safely predict will have a major impact over the next 5-10 years. For example (not an exhaustive list):

- order of magnitude reductions in the costs of gene sequencing are likely to profoundly affect health care
- eCommerce (business to business and business to consumer) will become utterly pervasive with consequent changes in behaviour and implications for high street retailers
- wearable technologies will have many applications for lifestyle and telemedicine/eHealth
- education is likely to be massively disrupted by online and blended learning resources and pedagogies.

14. There are other technologies receiving much attention right now where the long term significance is less clear, but may be profound:

- crypto currencies, such as bitcoin may have a major impact on the banking and finance industries
- 3D printing has huge potential but is still in its infancy awaiting an 'iPhone-like' breakthrough
- the so called Internet Of Things (IOT), whereby many billions of smart devices become internet connected seems like a safe bet due to availability of ultra low cost sensors/processors and wireless communications, but it is unclear whether there will be a single 'killer application'
- driverless vehicles and drones could have a major impact on transportation networks and distribution logistics. Fifteen years may be too short a horizon for realisation of such changes but they may well start occurring during this period.

15. Finally, there are various fundamental technologies such as fuel cells and quantum computing where a real breakthrough could have as significant an impact as the advent of the internet itself.

16. In summary, we expect the changes to be astonishingly rapid, extremely broad reaching and in many cases impossible to predict.

2. What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?

17. The potential socio-economic implications for the changes we face are explored well in *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, (Brynjolfsson and McAfee, W. W. Norton & Company, 18 Feb 2014). Rather than trying to summarise that wide ranging exposition, here are some observations on one change that digital technology may drive. Specifically, we may see a shift towards micro production of goods or services, in which economies of scale are enabled by online aggregation platforms, and customer relationships are forged and managed through online marketplaces in a loosely-coupled, dynamic way. This is in contrast to the traditional model in which large
corporations have relatively static employment relationships with their workforce and the acquisition of customers is a costly and time intensive process.

18. Much of this change will be driven by three factors arising from new, better or more pervasive exploitation of the digital technology we already have today, predominantly ubiquitous internet access and powerful, location-aware mobile devices.

19. Firstly, the advent of online marketplaces for all conceivable goods and services empowers digitally savvy self-employed individuals to cost effectively acquire/support customers, transact business and manage their reputation. This is likely to disintermediate traditional agencies or larger employers in various sectors. Hassle.com is a striking example of how this can apply even in traditionally low tech sectors. Hassle is an online marketplace for residential cleaning services. The attraction to self-employed cleaners is a free, easy to use diary management, bookings and contact management system. The attraction to householders is convenient access to a pool of reliable, vetted cleaners with transparent crowd sourced reputation indicators. With Hassle, many of the advantages of scale previously only accruing to larger cleaning agencies simply disappear.

20. Secondly, such online marketplaces also facilitate a peer consumption model in which people borrow/rent items from other individuals rather than purchasing items outright or renting them from a business. Airbnb and Lyft are well established examples for accommodation and ride sharing, but other examples are emerging such as hyper-local rental of power tools/household appliances and rental of parking spaces on residential driveways. This may reduce our total expenditure on certain capital items and may also adversely impact a whole variety of rental businesses. On the other hand, it will lead to additional income for individuals to supplement their primary employment income.

21. Thirdly, the combination of peer consumption, collaborative workspaces, and lower production costs for digital or partially digital goods make it possible for individuals or SMEs to compete more effectively with larger organisations, significantly reducing barriers to entry for new businesses. Loose affiliations are also possible that only persist for the duration of a specific contract or project. For example, thebackscratchers.com is a marketplace in which content publishers, such as the BBC, commission particular items of content, and individual creatives (directors, camera and sound technicians, video editors, etc) come together to form a temporary team. Online relationships, online portfolios, and online reputations are all important elements of such a dynamic model.

22. This shift away from large companies is a challenge for the economy, because some of those companies will inevitably fail to adapt and will consequently fold. Jobs in some medium and large companies will be less secure. Individuals who have traditionally felt most comfortable in a larger organisation may have to become self-employed and/or more entrepreneurial.

3. What is the employment impact on the UK’s labour market? What are the regional differences?

23. The macro effect of digital technology is to remove low skill white collar jobs from the mix as this is the area that computers are currently most able to automate. We should also expect reduction in some areas of manual work, e.g. in warehouses, where robots can
perform repetitive tasks. However, the latter impact is likely to be less severe in the coming years due to two factors:

- the manufacturing sector is not as important to the UK economy as it once was
- significant automation has already occurred in manufacturing over the past 40 years.

24. Demand will be strong for workers in service industries/roles which cannot yet be automated (e.g. health care, transport, customer service), and in high skill white collar jobs where digital skills are at a premium. Although there will continue to be strong demand in construction, agriculture and some other manual sectors, workers will increasingly need digital skills in almost all sectors to be effective in their jobs (see answer to question 4).

25. If the shift to more micro businesses predicted in the previous section occurs, there will be an increased need for 'digitally intuitive' workers as these micro businesses will typically rely on digital technology for many aspects of running the business, and self-employed people will consequently need to be digital Jacks of all trades.

26. There have been various studies estimating the number of new jobs in the digital economy. See *Future Digital Skills Needs of the UK Economy* (Development Economics, commissioned by Telefónica UK (O2), September 2013), *Technology Insights 2012 UK* (e-skills UK, 2012). The consensus is that somewhere in the region 0.5M - 1M such jobs will be created over the next 5 years. However, we believe that these studies underestimate significantly the importance of digital skills to the economy, as they focus on jobs where digital skills are the primary asset (e.g. a software developer or a network technician). Our view is that, for the substantial majority of jobs in almost all sectors of the economy, there is an increasing need for digital skills to facilitate the exercise of a different primary skill (e.g. strong digital skills will be critical for financial analysts, teachers and self-employed plumbers). See the next section for more detailed analysis and quantification.

27. The geographic implications of these changes are likely to be:

- positive for cities where there is a concentration of technology based companies and highly skilled workers (e.g. London, Bristol and Manchester)
- negative for cities where large clerical/administrative centres have sprung up to take advantage of the lower cost base relative to London
- potentially positive for rural areas.

28. The potential positive impact for rural areas arises from greater opportunities for remote and home working. With good high speed broadband communications and some relatively minor changes in working practices, it should be increasingly possible for people to be based at home or in a small remote office. A shift towards more micro businesses may also decrease the need for people to travel into the centre of large cities. Any changes that benefit rural areas may also offset the impacts of lost clerical/administrative opportunities in some urban areas.

**Future workforce**

4. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider
workforce to operate in a digitally competitive environment? Can the current supply chain deliver this?

29. Much analysis of the requirements for digital skills in the UK workforce starts with an analysis of jobs in the IT and telecommunications sectors. We believe this to be a fundamentally flawed starting point in a world where ‘every business is a digital business’ is an increasingly valid mantra. As an alternative starting point, we have considered each of the 361 Standard Occupation Codes (SOCs) for which the government publishes an estimate of the number of full time and part time workers. These SOCs cover the entire c.29M people in the UK currently in employment, ranging from Chief Executives to manual workers such as shelf packers and farm labourers. For each SOC, we have made a judgement, looking forward 2-3 years, as to the fractions of that SOC workforce for whom day-to-day tasks require the following skills:

Digital Muggle: no digital skills required – digital technology may as well be magic

Digital Citizen: the same work skills as are required to be a full digital citizen. This is the ability to use digital technology purposefully and confidently to communicate, find information and purchase goods/services

Digital Worker: substantially more digital skills than those required for full digital citizenship but less than those of a Digital Maker. This includes, at the higher end, the ability to evaluate, configure, and use complex digital systems. Elementary programming skills such as scripting are often required for these tasks

Digital Maker: skills to actually build digital technology (typically software development). The Digital Maker category is interpreted quite broadly to include, at the low end, for example, workers who regularly create complex Excel macros or data files for controlling 3D printers

30. This analysis and the conclusions below are available on the UKForCE website. The headline numbers are as follows:

- Digital Muggle: 2.2M
- Digital Citizen: 10.8M
- Digital Worker: 13.6M
- Digital Maker: 2.9M

31. The clear conclusions from these numbers are that:

- Almost everyone in the workforce will soon need the skills of digital citizenship to do their job, notwithstanding their need for those skills in order to engage more broadly with society and government.
- Well over half the workforce (Digital Workers + Digital Makers) need digital skills significantly beyond those required for digital citizenship.

32. The specific skills needed by Digital Workers and Digital Makers are extremely diverse depending on sector, SOC, and business practices of particular employers. These skills range from financial modelling, content creation and social media analysis through to chip design and big data science. The sheer diversity of these vocational needs makes it impractical and unhelpful to teach specific vocational digital skills at school. Our workforce requires a
foundational understanding of digital technology that can underpin and facilitate the acquisition of many different vocational digital skills, in a world where digital evolution will be extraordinarily fast. Moreover, this evolution will be periodically punctuated by changes that are truly revolutionary rather than evolutionary. It should be remembered that the internet, mobile phones and identification of the human genome have all happened during the working life of very many people still in employment today.

33. For the more expert Digital Makers, the necessary foundational skills will be acquired at A Level and through Computer Science degrees. However, for the majority of Digital Workers and Digital Makers, the high quality teaching of a rigorous Computing curriculum, such as the one being introduced in England in September 2014, is the appropriate way to lay the groundwork for these future careers.

34. A good computing education at school is in many ways akin to the 3 Rs. It is a deep skill which will be necessary to fully exploit the new digital environment as it continues to change at a remarkable speed.

35. Over the coming years we expect a trend toward greater ‘digital self-sufficiency’ in many jobs within an organisation. Historically, organisations used to have typing pools which have been made largely obsolete by other workers preferring the often more timely approach of creating and formatting their own documents. Similarly, many workers now use technology to manage their own diaries, rather than relying on a PA or secretary. Self-sufficiency is facilitated by technology and results in more nimble organisations. Start-up companies, particularly in the tech sector, now commonly have an entire workforce that is completely digitally self-sufficient. That is, everyone has the digital skills necessary to select, install, use and even modify/enhance all the digital tools they require. There is no need for recourse to a central IT function. This trend favours, sometimes to the exclusion of other candidates, those with Digital Maker skills. In other words, across the entire workforce we expect to see a significant increase in the 2.9M Digital Makers. We believe that as many as 25% of the Digital Worker community would already benefit from some Digital Maker skills, improving the overall agility and effectiveness of their employer. This corresponds to more than doubling the 2.9M estimate of the number of people requiring Digital Maker skills to over 6M if this trend toward digital self-sufficiency continues.

5. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?

36. As per the previous section, the key to preparation is the learning of computing concepts as a fundamental subject – i.e. something that underpins and is a necessary pre-requisite for our other learning in the same way as are literacy and numeracy.

37. That means we should be teaching Computing as a rigorous academic subject and not simply be teaching the vocational use of any particular technology. This is precisely the change that lies behind the introduction of the new Computing curriculum in September 2014.
38. The other aspect of this question relates to inspiration rather than preparation. This is indeed critical as students will not engage with the new curriculum or benefit from it if they are not inspired by the content or the potential opportunities flowing from it.

39. Inspiration requires two things:
   - delivery of the curriculum in an imaginative manner providing lots of scope for creativity, experimentation and curious learning
   - enthusiastic presentation to students of the potential career opportunities.

40. See the following section for more thoughts on imaginative delivery of the new curriculum. Exposure to inspirational careers advice at all relevant points in the learning pathway is currently a huge issue. A TeenTech survey of over 5,000 school pupils in 2012 found that parents are their most significant source of advice on possible careers. However, a recent O2 survey found that 23% of parents did not believe digital skills would be important for their child's career.

41. Important elements for improved and more inspirational career guidance include:
   - more exposure of teachers to the roles of digital skills in various sectors through short work placements and shadowing.
   - sessions at schools in which young people in employment, to whom the pupils can relate, talk about their own experiences and how digital skills impact on their careers. STEMNET ambassadors are obvious candidates to help with this activity. However, we must also ensure broad participation from young people whose primary vocation is not an IT role, but who nonetheless use sophisticated digital skills on a day to day basis.
   - good signposting by schools to engaging online resources such as plotr.com, whilst also ensuring that these online resources highlight the importance of specific and more general digital competencies.
   - greater awareness amongst parents and other influencers of the importance of digital skills. This is an area where the BBC and national newspapers can and should play a significant role.
   - encouragement of EngineeringUK, the organiser of The Big Bang Fair, to increase the profile of digital skills within the event as a whole.

6. How are schools preparing to deliver the new computing curriculum in an innovative way?

42. This will always be hugely variable. Our expectation is that the variability will be particularly acute in England for at least the next 2-3 years as schools wrestle with the challenges of upskilling their teachers. A recent survey by NESTA and TES [Teachers unready for computing ambitions, Times Educational Supplement, 11 July 2014] found that ‘just 7 per cent of polled teachers are “very confident” in their ability to teach computing. More than a third (35 per cent) are “not at all confident” and a further 25 per cent are “not very confident”’.

43. In a July 2014 UKForCE survey of 172 Primary and Secondary head teachers, 68% stated they have provided 5 hours or less of CPD to train their teachers on the new Computing curriculum. This was only a small survey, some teachers will already have the necessary
knowledge and some will be very comfortable picking it up 'on the fly', or taking personal responsibility for their CPD in their own time. Nonetheless, we believe the overall lack of preparatory school-funded CPD to be a significant concern. We suspect this inadequate CPD provision is due to school leaders with already highly constrained budgets not recognising the true importance of digital skills and not prioritizing Computing highly enough.

44. It is hard to see how this misalignment can be addressed within schools’ existing very modest CPD budgets. We therefore urge government to provide extra funding over the next 5-10 years to up skill the existing teacher workforce. We believe an additional £20M would be proportionate and make a material difference, spread over the period in which government realistically expects the new curriculum to be fully adopted. This would be around £1,000 per school, which is still a very modest amount to fuel such a step change.

45. Although Scotland embarked on a new Computing curriculum several years ago there is anecdotal evidence that many head teachers and local authorities are not giving this the necessary priority to make a substantial impact. Wales and Northern Ireland have not yet reformed their ICT curricula and although recommendations have been made, other more wide reaching total curriculum reforms, particularly in Wales, may mean that the new ICT curriculum is not introduced until post 2016.

46. Therefore we have some concern that pupils in Wales and Northern Ireland, and potentially even Scotland, may be disadvantaged due to less immediate and intense focus than in England.

47. Alongside a well-funded CPD programme, we recommend that DfE and BIS jointly consider a Digital Apprentices in Schools (DAIS) programme. The objective of the DAIS programme is twofold:

- provide apprenticeships for school leavers combining paid employment with ongoing education in Computing theory and practice
- place these apprentices in schools to work alongside qualified non-specialist teachers to help deliver the KS1 - KS3 Computing curriculum, making best use of online resources and blended learning techniques to provide a high quality, engaging learning experience for the KS1-KS3 pupils.

48. The premise is that many school leavers will be much more comfortable with digital technologies than a large segment of the current teacher workforce, who did not grow up in a digital world, and in the majority of cases were never taught any significant Computing or ICT skills themselves.

49. While we feel that DAIS is a particularly interesting avenue to pursue for helping non-specialist teachers to most effectively use technology to teach technology, there may also be a role for STEMNET, volunteers from industry or graduates from courses such as the joint Birkbeck/ Institute of Education MSc in Learning Technologies.

50. Some schools are already operating a somewhat similar, although less radical, scheme in which more senior pupils provide IT assistance to teachers, either in their own school, or through a modest allocation of time for secondary pupils to spend at affiliated primary
schools. These schemes are quite ad hoc and patchy, and would potentially benefit from wider promotion including structure, case studies and best practice guidance.

51. For the medium term we need a strong immediate focus on bringing more specialist Computing teachers through Initial Teacher Training (ITT). The £25k tax free Computing Teacher Training Scholarships managed by BCS and the funding of Computing bursaries on a par with other shortage subjects is very welcome. The main ITT challenges now are:

- convincing students with highly employable and well remunerated Computing degrees that teaching is a desirable and worthwhile career. Teach First may have a role to play in this regard
- increasing the number of ITT trainers who are themselves computing specialists.

52. Continuity from KS2 to KS3 is a significant challenge. One very promising model is the Digital Schoolhouse initiative being rolled out in 10 London secondary schools, funded by the Mayor of London and delivered by video games trade body Ukie. Each of the 10 Digital Schoolhouses will establish a dedicated Computing suite in a secondary school, to be visited by local primary schools over the course of the year. They will then grow and support a network of primary teachers to deliver creative and cross-curricular lessons with Computing at its heart with a target of over 100 schools participating in year one. The extra contribution of the video games industry will be to link educators with creative industries to create exciting new lessons – using games and unplugged resources – mapped to the new curriculum.

53. As an example of the role that local authorities can play, all 43 Camden primary schools subscribe to the services of the council-funded City Learning Centre (CLC) which provides opportunities for all pupils in the borough to benefit from whole day projects, led by a specialist team, which regular teaching staff then follow up and build upon in the classroom.

54. More broadly, the CLC plays an important role in developing and disseminating resources and best practice across all schools within the borough, leading to a more consistent and complete roll-out of this significant curriculum change across schools with widely differing expertise and experience.

55. Finally, although use of technology in and out of the classroom is a separate topic and not within the UKForCE remit, it does impinge upon how pupils view digital technology and its pervasive importance. It is essential that pupils view digital technology as naturally underpinning all aspects of the school’s operation and the teaching of all subjects, rather than something which is in some sense separate from daily life. Such deep integration of technology into the school is necessary if we are to produce a ‘digitally intuitive’ population.

7. How can the education system develop creativity and social skills more effectively?

56. It is well known that peer instruction and experimental/investigative learning develop creativity, problem solving, collaboration and social skills. There is also very substantial overlap between this set of skills and those encompassed by the term ‘computational thinking’, which is one of the key learning outcomes intended from the new Computing curriculum.
57. We believe that delivery of the Computing curriculum through techniques that encourage peer instruction and guided experimentation is essential for effective development of Computational Thinking. In other words, this core aim of the new Computing curriculum and the general desire to develop more creativity and social skills are completely aligned.

58. There are many resources that encourage children to learn collaboratively about computing experimentally. Examples include:

- **Apps For Good**, in which pupils work in teams, going through the entire life cycle of problem identification, requirements specification, user experience design and actual code development.
- **Technology Will Save Us** - a set of beautifully designed modules that develop pupils understanding of hardware and software by building fun solutions to problems with which they can readily identify (e.g. notification of when a plant needs watering).
- **Code Kingdoms** - an online game in which pupils use simple coding techniques to create new challenges within the game that they can share with their friends, all carefully correlated to the Computing curriculum.

All of the above offerings are intended for use in the classroom. They are also typically augmented by workshops and additional materials to help teachers use the resources to their best advantage.

59. Serendipitously, use of these resources, which encourage pupils to learn through their own experimentation, can also be an important element in overcoming the lack of Computing subject knowledge amongst non-specialist teachers at KS1-KS3. One barrier to this happening is a lack of confidence in discovering and using these resources amongst teachers - hence the DAIS proposal in the previous section.

60. Notwithstanding the above, afterschool clubs such as Code Club do also have a very valuable role to play in engaging and stretching pupils and schools should work with industry volunteers to offer such clubs.

61. Use of the Computing curriculum to develop Computational thinking, creativity and social skills will be fatally impacted by any inspection or assessment regime that encourages box ticking or rote learning. The role of Ofsted in successful implementation of the Computing curriculum is therefore significant. If there is insufficient emphasis on Computing within overall assessment, schools may largely ignore the Computing curriculum, focusing all their energies on literacy and numeracy. On the other hand, a simplistic assessment methodology will lead to rote learning of the least ambitious interpretation of the curriculum. We believe that the Computing curriculum could be an excellent guinea pig for a radical re-think of subject assessment and recommend that the government give this serious consideration.

62. Reasonably soon, say in Spring 2016, government should survey how well the new curriculum has been adopted. Ofsted are well placed to do this and we recommend that they undertake a comprehensive survey at that time, visiting a significant number of schools.
and interviewing pupils and staff for information gathering purposes, and not as part of any particular school assessment.

**8. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?**

63. Several significant flaws in the current post 16 system mean that we are neither inspiring nor equipping students as well as we should, either for current jobs requiring substantial digital skills or for future jobs that will require similar skills. Specifically:

- There is still a commonly held view, as witnessed by some of the phraseology in this Call For Evidence, that in the future there will be two sorts of jobs – i.e. jobs in the digital sector and other sorts of jobs
- Careers advice is patchy, uninformed and often unimaginative
- Parental/employer/social expectations and school assessment methodologies encourage many students into studying, or at least starting, irrelevant or undemanding degrees, when a good quality apprenticeship or industry provided vocational training would be more effective and less costly
- HEIs do not on the whole accord A Level Computer Science the same status as Maths or Physics, but on the other hand rarely recommend or mandate an academically rigorous ‘Computer Science for non-CS students’ module to all their STEM students, let alone to students studying e.g. PPE or English.

64. Recognition that every business is a digital business, and that almost every job will require strong digital skills is necessary when contemplating change to the current post-16 system. The observation about degrees vs. apprenticeships/industry-led training is not exclusive to digital skills, but is perhaps most germane in this area where we have a clear and present skills shortage.

65. Introduction of a Computer Science module for PPE and English students is not an entirely flippant suggestion. For the next few years students at university will not have benefitted from the new KS1-Ks3 Computing curriculum and most pupils embarking on KS1 Computing this year will not be in the workforce until around 2030. Many senior politicians and business leaders in the next three decades would be served extremely well by a greater understanding of digital technology and a CS module at university, irrespective of the student’s primary subject, might be the best way to achieve this.

66. As stated earlier, fundamental, underpinning digital skills are comparable in importance to the three Rs. With that context, we believe there is real merit in apprenticeships that combine academically rigorous digital skills (including ‘maker’ skills) alongside a specific vocation, whether that be electrician, agriculturalist or accountant.

67. As well as adding digital skill elements to all apprenticeships and Level 3-5 qualifications, there is also a strong need for more apprenticeships focused very specifically on the traditional IT and communications sector such as network planning/installation, database administration and development operations. Allowing such apprenticeships and qualifications to be oriented around vendor specific content may make them more attractive to SMEs and beneficial to the employment prospects of the apprentices themselves. It is
essential that we address digital skills for students of all levels and do not simply focus on students attaining A Levels and beyond.

68. The infrastructure and workforce skills in FE are in many instances woefully inadequate and much work is needed to bring FE to the appropriate level. The Further Education Learning Technology Action Group (FELTAG) is having some impact in this regard but will require continued and substantive government support.

Short- and medium-term support to the digital sector

9. How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?

69. This question again pre-supposes a clear separation of businesses into ‘the digital sector’ and ‘other businesses’. We believe this is a fallacy and there is simply a continuum, in which all businesses are digital, but some businesses are more digital than others. Consider the following examples:

- Hassle.com built, deployed and operate a web marketplace for residential cleaning - are they in the digital sector or the cleaning services sector?
- Morgan Stanley, traditionally classified in the finance sector, employs more Computer science PhDs than Metaswitch (a medium sized telecommunications technology vendor) – so are both companies or neither actually in the so-called digital sector?
- The control, navigation and monitoring systems within any modern car contain millions of lines of code – does that mean BMW are in the automotive sector or the digital sector?

70. It might be useful to re-phrase the question as ‘What can be done in the short and medium term to support businesses with a particularly heavy requirement for high end digital maker skills?’

71. Such businesses do benefit particularly from employing graduates with Computer Science degrees, although they generally regard other employability skills such as intelligence, communications and team working as even more important than the Computer Science knowledge. Therefore, any action by government or schools that encourages the most broadly talented and capable pupils to study Computer Science at university will benefit these companies by delivering graduates who are simultaneously extremely able and extremely knowledgeable.

72. Although the main thrust of the new Computing curriculum is to improve the digital skills of the entire population, it also has an important role in increasing the flow of talented pupils into careers as Digital Makers. This is particularly important in regional centres where there is a high concentration of digital technology companies such as Cambridge, Bristol, and increasingly the North East. Ensuring schools in these areas have a strong Computing focus will increase the availability of suitably skilled local talent to meet the inevitable substantial demand for digital makers.

73. Many start-up companies either create digital technology or use it in an advanced manner and so employ a high proportion of digital makers. Therefore this question is particularly relevant to the start-up sector, and in that context, one very valuable element of
government policy is tax incentives that encourage entrepreneurship and early stage investment, such as the enterprise Investment Scheme, the Seed Enterprise Investment Scheme and Entrepreneurs Relief.

10. Is there a need for increased high skills immigration in the short-term? What are the implications of this?
74. This is outside the scope of UKForCE.

11. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?
75. This is outside the scope of UKForCE

12. What do the best local skills delivery models look like? What is the role for local Government, Local Enterprise Partnerships (LEPs) and the third sector?
76. This is largely outside the scope of UKForCE, but see earlier observations on the potential impact that proactive councils such as Camden, and City Learning Centres can have on improving effective delivery of the Computing curriculum across all schools.

Industry
13. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?
77. This is largely outside the scope of UKForCE, but see the observations earlier on the importance of providing more and better apprenticeships and ensuring that those apprenticeships are relevant and cost effective for SMEs.

14. How can businesses help equip the workforce with new skills in a rapidly changing environment?
78. This is outside the scope of UKForCE

Infrastructure
15. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?
79. This is outside the scope of UKForCE

About the UK Forum for Computing Education:
The UK Forum for Computing Education (UKForCE) is an independent committee, acting as a single voice for the computing community on 5-19 computing education issues. It brings together representatives from across the communities of education, computer science, digital media, IT, engineering and telecommunications to share the vision of improving computing education across all education sectors of the UK.

About the Royal Academy of Engineering:
UKForCE are hosted by the Royal Academy of Engineering, the UK’s national academy for engineering. They bring together the most successful and talented engineers for a shared purpose: to advance and promote excellence in engineering.
5 September 2014
UK Music

1. UK Music is the umbrella body representing the collective interests of the UK’s commercial music industry, from songwriters and composers to artists and musicians, studio producers, music managers, music publishers, major and independent record labels, music licensing companies and the live music sector.

2. UK Music exists to represent the UK’s commercial music sector, to drive economic growth and promote the benefits of music to British society. The members of UK Music are listed in Annex.

General

3. UK Music welcomes the formation of the Digital Skills Committee of the House of Lords and looks forward to its inquiry “to consider information and communications technology, competitiveness and skills in the United Kingdom”.

4. The British music industry is at the heart of our creative economy and contributes significantly to UK culture and society. Last year, we reported that the sector contributes £3.5 billion to GVA, employs over 100,000 people and has exports of £1.4 billion. We will imminently be publishing a new report which updates these figures further.

5. The Government has identified the creative sector as a key generator of UK economic growth and employment over the next decade. As an important part of the creative industries, the music sector will play a major role in driving this growth, but to achieve its full potential the industry will need to recruit and retain the best trained, talented, and diverse workforce.

Digital Skills and the Music Industry

6. The music business is increasingly a digital business. The BPI reported that digital accounts for 50% of UK record industry trade revenues. In 2013, PRS for Music online revenues reached £61.2m, an increase of 18.3%. Digital skills are needed to support all aspects of today’s music business, whether it is online or offline music.

7. In an increasingly digital market the music industry needs to recruit and retain a workforce that can adapt and embrace new technologies. It is essential that school leavers have a basic level of digital literacy and that graduates are equipped with the digital skills to gain employment in the sector.

http://www.bpi.co.uk/media-centre/streaming-fuels-growth-for-uk-recorded-music-industry.aspx
8. Research conducted by Creative & Cultural Skills in 2011’s Music Blueprint found that whilst the music industry is a highly qualified sector when compared with the UK working population, employers are still concerned that applicants lack work ready skills. A lack of digital skills was seen as the biggest future skills need.

9. Anecdotal research conducted by UK Music in November 2013 revealed that over three quarters of music employers surveyed said applicants and new entrants lacked basic digital skills including programming, coding, and web design.

10. Rights management in the music industry is key to ensuring creators get paid in the digital value chain. This means that many jobs in the music industry are in IT, programme management, systems and software development, managing data standards and databases. These are global projects and require international collaboration. Music employers inform us that they increasingly require employees to have database experience. The sectors interest is not solely in music technology, but in having a workforce equipped with broad technology skills.

**UK Music Skills Academy and other industry initiatives**

11. UK Music is playing a central role in improving skills and training in the music industry through our Skills Academy. Launched in July 2013, the UK Music Skills Academy is a joint initiative with Creative & Cultural Skills and aims to increase collaborative working between the music business and the education sector for the benefit of young people aspiring to work in the industry.

12. One of the key objectives of the Skills Academy is to improve opportunities for students and ensure graduates are more employable in the music industry. The Skills Academy is developing long-term partnerships between music employers and education institutions to foster genuine engagement and a constructive dialogue to address the sector’s skills gaps.

13. Music is unique, powerful and can engage young people from all backgrounds. UK Music has established a schools programme, ‘Music Skills and Schools’ to help young people aged 14-16 and teachers understand how the music industry works and provide workshops and seminars to develop key skills valuable to the music industry including music production and app development. This year, we plan to reach 1000 young people across the UK.

14. In order to address digital skills gaps in the industry, UK Music members offer training courses to improve their member’s skills and training in this area. For example, the Association of Independent Music (AIM) run regular digital training days covering digital marketing, the use of metadata, global music licensing and social media training.

15. UK Music also supports the City and Guilds music & studio technology and sound engineering Level 1,2,3 qualifications which is funded, approved and catering for 14 to 16 year olds. The entire suite of units is already supported by all relevant industry sectors and is mapped out correctly with all national occupational standards.

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UK Music – Written evidence (DSC0097)

Copyright

16. At the heart of the music industry is the copyright framework. It allows companies to invest in talent and for creators to make a living.

17. The most recent Kantar Media online copyright infringement tracker estimated that one in six (17%, equating to approximately 7.4 million) of UK internet users aged 12+ consumed at least one item of online content illegally over a three-month period and around a quarter of these (4%) exclusively consumed illegal content.\(^{535}\) According to the same research music is the most consumed type of content online.

18. Infringement of copyright is a substantial challenge to the success of the UK music industry. To UK Music, digital skills is just as much about equipping online users and businesses with the correct tools to respect the rights created by copyright and ensure value in the digital world as it is about creating a skilled based workforce.

19. UK Music seeks to promote initiatives that raise awareness of the legalities of accessing copyright content online. For example, in conjunction with Aardman Animations and the Intellectual Property Office we have developed an app based game, Music Inc, which aims to engage young people in a fun and interactive way.

20. Music Inc was launched at the beginning of the year. The app has attracted 176,000 individual players. There are nearly half a million devices (440,000 devices) in 50 countries (UK, USA, Indonesia, Brazil, Germany, Italy, Canada, France, Australia, Netherlands) carrying the game. Players are in the game for an average 20- minutes. The app simulates the music industry and demonstrates how player’s decisions on infringement can impact their business and has formed part of the “Music Skills and Schools” programme. We also welcome initiatives such as the development of the Copyright Hub which attempt to raise greater consumer and business awareness of copyright, as well as the recently announced Creative Content UK programme.\(^{536}\)

Conclusion

21. We would like to be able to reach more young people and seek the support of the Government to help expand our work into schools. This could be achieved through supporting the UK Music Skills and Schools programme and developing digital learning resources that are of relevance to the music industry that can be used in schools.

22. The recently launched Creative Industries Council industrial strategy, Create UK, recommended industry should “commit to funding and developing a toolkit that can be used by schools across the UK, both inside and alongside the new Computer Science curriculum, which will, for the first time require teachers to teach about internet safety.” This is a measure that UK Music is keen to see followed up by the Creative Industries Council and its associated Intellectual Property sub-group. Government should consider how they can further support such activities and future initiatives.

\(^{535}\) [http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/online-copyright/w4/OCI_MAIN_REPORT_W4_FINAL.pdf](http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/online-copyright/w4/OCI_MAIN_REPORT_W4_FINAL.pdf)

23. Alongside this, we propose additional funding for computer training for teachers across the UK and ensure that digital skills are embedded in the music curriculum. This should include education and awareness about copyright, something that is currently missing in the music curriculum. If pupils can understand the importance of copyright from a creator’s perspective then this will improve their digital skills and future employability within the knowledge economy.

24. Finally, the UK Music rehearsal room network should be expanded to provide greater opportunities to young people.537

Annex

UK Music’s membership comprises of:-

- AIM – Association of Independent Music - representing over 850 small and medium sized independent music companies
- BASCA - British Academy of Songwriters, Composers and Authors – with over 2,000 members, BASCA is the professional association for music writers and exists to support and protect the artistic, professional, commercial and copyright interests of songwriters, lyricists and composers of all genres of music and to celebrate and encourage excellence in British music writing
- BPI - the trade body of the recorded music industry representing 3 major record labels and over 300 independent record labels.
- MMF - Music Managers Forum - representing 425 managers throughout the music industry
- MPG - Music Producers Guild - representing and promoting the interests of all those involved in the production of recorded music – including producers, engineers, mixers, re-mixers, programmers and mastering engineers
- MPA - Music Publishers Association - with 260 major and independent music publishers in membership, representing close to 4,000 catalogues across all genres of music
- Musicians’ Union representing 30,000 musicians
- PPL is the music licensing company which works on behalf of over 90,000 record companies and performers to license recorded music played in public (at pubs, nightclubs, restaurants, shops, offices and many other business types) and broadcast (TV and radio) in the UK.
- PRS for Music is responsible for the collective licensing of rights in the musical works of 100,000 composers, songwriters and publishers and an international repertoire of 10 million songs
- UK Live Music Group, representing the main trade associations and representative bodies of the live music sector

12 September 2014

537 http://www.ukmusic.org/skills-academy/rehearsal-rooms/
Notes on the economics of clusters:

Background paper for House of Lords Select Committee on Digital Skills.

Many economic activities cluster together, and this seems to be a particular feature of innovation including that in the digital sector. This note sketches some of the underlying economic issues but does not focus on the digital sector (on which the author is not an expert). Why do some activities cluster, and what are the implications?

Causes:

Activity tends to cluster because:

(i) Proximity to supplier and customer firms economises on shipment costs/ delays (e.g. just-in-time supply creating motor industry clusters).

(ii) Proximity to supplier and customer firms facilitates communication about product specifications, design.

(iii) To benefit from knowledge spillovers – a ‘buzz’ of sector specific interaction.

(iv) To locate close to a pool of labour with sector specific skills (and for new entrants, the possibility of poaching workers from existing firms).

Pulling in the opposite direction, economic activity tends to disperse across space for two main reasons:

(v) The need for firms to reach spatially dispersed final consumers of their products.

(vi) To escape from high costs associated with large clusters (e.g. London house prices).

The balance of these forces is sector specific and changes through time – some classic examples of clusters are (or were) Sheffield cutlery, Hollywood, Silicon Valley (hardware and then software), City of London financial services.

Factors (i) and (v) above are unlikely to apply in the digital sector. It is sometimes suggested that ICT will lead to the ‘death of distance’ and kill arguments (ii) and (iii). This seems not to be the case: face-to-face communication remains important, partly to build trust in relationships, and also in activities (such as innovation) where ideas are complex and fast moving and it is important to be ‘in the loop’. Argument (iv) remains crucial, if tempered by (vi).

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538 For a recent survey see G. Carlino and W. Kerr ‘Agglomeration and innovation’ Harvard Business School, August 2014, http://www.hbs.edu/faculty/Publication%20Files/15-007_e181fd00-4426-4db8-8f70-89b1b5054a8f.pdf
Consequences:

(i) Clusters are hard to start. Much conventional economic analysis assumes the ‘law of diminishing returns’, i.e. the returns to an activity are greatest for the first-mover, and then decline. By contrast, clusters (and arguments (i)-(iv) above) create increasing returns, with the opposite consequences. Returns are initially low but then build up with the scale of the sector. Consequently, it is difficult to start a new cluster; no single firm wants to move to a new place, and coordinated action (many firms deciding to move) is almost impossible to achieve.

(ii) Indeterminacy in location: A place has to meet various preconditions to be a likely site for a cluster; it has to be attractive for appropriately skilled workers, have available space, and be able to access complementary activities (e.g. university research). However, meeting these preconditions is not a sufficient condition to attract a cluster. There has often been an element of chance/historical accident in where clusters have become established. But once established the benefits of scale enable a cluster to thrive, even if alternative locations appear to offer better conditions.

(iii) Growing to scale: Since the advantage of a cluster comes from its scale, enabling growth is essential. This involves supply of business space, housing, transport, and related services. Conversely, the idea of creating many clusters in a particular sector is self-contradictory.

(iv) Messages: It is important for policy to ensure that places meet the preconditions and that growth in successful clusters is not impeded. Attempting to manufacture the start of new clusters has rarely been successful. (There is a catch-22; if it were possible there would be so many clusters that there would be no value in creating more.)

3 November 2014
Virgin Media, Boston Consulting Group and BT – Oral evidence (QQ 76-86)

Transcript to be found under Boston Consulting Group
Virgin Media – Written evidence (DSC0100)

Introduction
The current phase of digital policy has focused almost entirely – and rightly – on supply. In this Parliament upwards of £1.5bn of public subsidy is being spent to address areas of market failure in the supply of superfast broadband, delivering 95% penetration by 2017. There has been significant public scrutiny of that body of policy and the outcomes it has delivered. Virgin Media does not intend to rehearse those arguments in this submission.

Instead, this submission focuses on the critical next phase of digital policy – how to build and sustain demand for high speed connectivity - which has received far less attention to date. The Digital Skills Committee has a unique remit to consider this question in depth and propose a coherent package of policies aimed at stimulating demand.

In setting upon the next phase of digital policy, we should feel optimistic about the base we are starting from. The UK market is characterised by aggressive infrastructure competition driving investment in world-class networks and services. Those investments are already driving an explosion in consumer demand for data-heavy services, which our future-proof networks are absorbing. Taken together, those two conditions have delivered a digital economy already worth £82bn per annum and growing.

In building on this success there are two key challenges that policy makers now need to address.

First, there are 10m adult citizens and 20% of small businesses who currently have no online presence. The underlying reasons for this are not about access. 92% of SMEs have access to the internet and, with rollout of superfast to rural areas, residential access to superfast will exceed that by 2017. The central barriers to take up are:

1. Lack of awareness of the benefits of connectivity - a marketing barrier; and
2. Low levels of digital skills and confidence - a capability barrier.

There have been some early examples of demand-side intervention over the course of this Parliament aimed at removing these marketing and capability barriers. The Super Connected Vouchers scheme, “digital by default” public service reform, Web Fuelled Businesses, GoON UK’s work and the sponsorship of Tech City have all produced laudable successes. However, each has operated as a largely distinct policy intervention, and Departmental responsibility has been spread across Government. A more coherent policy framework targeted at ending digital exclusion by stimulating demand for superfast broadband is now required.

The second challenge is to create the right conditions for infrastructure investors to continue to keep pace with rising demand. In considering that challenge, there has been a tendency for the debate to fixate on setting a particular speed target for the market to reach and/or prescribing a particular network topology required to meet it. Evidence of existing network capacity and success in absorbing exploding data consumption strongly suggests that these are red herrings for policy makers – the market is investing in future-proof technologies. What’s more, the strong dynamic of infrastructure-based competition ensures that
investment will continue as the insurgent (Virgin Media) and incumbent (BT) vie for speed leadership.

The challenge for policy makers then, is how to spread that dynamic of infrastructure-based competition across more of the market. Private investment in broadband infrastructure is currently restrained by a series of planning regulations and red tape which constitute 85% of the total cost of network build. Many of those regulations are out-dated and do not reflect the technological advances that the telecommunications industry has gone through over the past two decades. By giving network operators more flexibility in the methods we use to deploy broadband networks, and removing some of the costly red tape associated with streetworks management, Government could dramatically improve the financial conditions limiting network investment.

The remainder of this submission is divided into two sections:

1. Demand stimulation as the focus of the next phase of digital policy
2. Delivering infrastructure-based competition

Section 1: Demand stimulation as the focus of the next phase of digital policy

There are significant societal and economic benefits associated with getting more people online. Digitalisation of public services is projected to save Government between £3.30 and £12 per transaction\(^{539}\) - a potential annual saving of £5.1bn\(^{540}\). The UK already benefits from a thriving digital economy – the largest in the G20 – which is projected to constitute 12% of GDP by 2016\(^{541}\) and sees UK consumers spend more per annum online - £1,175 per head in 2013\(^{542}\) – than other developed economies. Digital maturity and online presence is directly linked to business growth. A digitally mature small business is three times more likely to grow than an immature one\(^{543}\). The total economic benefit of getting SMEs online is estimated to be as high as £18.8bn in annual revenue growth and could stimulate the creation of 58,000 new jobs\(^{544}\).

The fact that 10 million UK adult citizens and 20% of SMEs currently have no online presence therefore has a direct impact on the UK’s long-term global competitiveness.

Some believe that the remedy to digital exclusion is simply to provide access to superfast broadband. Of course addressing access is the starting point to driving digital engagement, but evidence of existing consumer behaviour strongly suggests that access alone does not solve the demand challenge.

- 79% of non-users state that they do not use the internet because they don’t see the benefits of being online and 63% cite a lack of basic digital skills.\(^{545}\)

\(^{539}\) PWC research
\(^{541}\) http://www.bbc.co.uk/news/business-17405016
\(^{542}\) http://media.ofcom.org.uk/news/2013/uk-communications-deals-cheaper/
\(^{543}\) http://resources.lloydsbank.com/economic-research/uk-business-digital-index-2014/
The possession of basic online skills have also been linked to socio-economic conditions, with BBC research suggesting that 68% of people from lower socio-economic backgrounds cannot perform basic online tasks. Only 19% of digitally immature SMEs believe that being online could help grow their revenue whilst lack of access does not appear to be widespread – according to the FSB, 92% of SMEs have access to the internet. A quarter of SMEs say that a lack of basic digital skills holds them back. The Centre for Economics and Business Research listed the prohibitive costs for SMEs in gaining technically trained staff capable of undertaking large scale data analysis as the primary barrier to the UK realising the £42 billion opportunity associated with SME adoption of data optimisation. The Intel Small Business Index (2011) identified lack of financial and human resources as the primary reason that close to 50% of SMEs have failed to adopt advanced technology. In the creative sector, where technical capacity is perhaps a greater need than most, 8 out of 10 SMEs have no specific training budget or spend less than £1,000 per annum on workforce training. Given these financial constraints, there is a strong sense amongst SMEs that lack of direct government funding prevents them from training staff in new technologies – 78.5% agree.

This evidence points to a more complex set of challenges to overcome in getting digitally excluded citizens and businesses online. There is a significant section of society that is not yet convinced of the benefits of being online. This presents a marketing challenge to both private organisations and Government. Equally, many of those who currently live offline lack digital confidence and skills which presents a capability challenge. Virgin Media does not have specific policy solutions to these challenges at this stage. However, we make the firm recommendation to the Committee that the next phase of digital policy – and any public funding associated with it – should focus on a coherent demand stimulation policy framework that seeks to meet those two challenges.

In developing this framework, Virgin Media draws the Committee’s attention to the lessons we have taken from existing, piecemeal demand stimulation policies that have been developed over the course of this Parliament.

Super Connected Cities Voucher Scheme

The £150million Super Connected Cities Programme, providing financial support of up to £3,000 for SMEs to upgrade their internet access – is a welcome move towards demand stimulation on the part of Government. Virgin Media Business is the largest provider of vouchers under the scheme to date.
The Voucher scheme has, in its infancy, focused on one perceived barrier to SME take-up of broadband – upfront affordability. For very small businesses that have traditionally existed offline, and have tight budgetary constraints and single figure numbers of employees, it is undeniably the case that many are unconvinced that the benefits of connectivity outweigh the costs. For those hard to reach businesses, it may be that removing the price barrier is sufficient to unlocking demand.

Early experience from the Voucher Scheme suggests however that the challenge is more complex than that. Greater focus and funding may be required in marketing the potential benefits of broadband under the Vouchers Scheme. **There is a strong case for increasing the proportion of Super Connected Cities funding spent on marketing in addition to that spent on the connectivity subsidy itself.**

**We urge Government to continue to fund the Voucher Scheme beyond its existing deadline of March 2015.**

**Digital training for small businesses**

Existing Government-supported digital training programmes for SMEs could be better targeted towards ‘hard to reach’ digitally immature businesses.

The BIS sponsored Web Fuelled Businesses programme features some extremely valuable content for SMEs, as well as very high profile entrepreneur endorsement. Content can be accessed – largely free of charge – by small businesses via a series of webinars hosted on the website. However, the content and format is not as accessible for businesses that have yet to embrace the digital world as it might be for more digitally confident users. Whilst it is a valuable contribution, Virgin Media would question whether a more hands-on approach to digital training is required for digitally immature businesses.

In 2013, Virgin Media partnered with digital skills provider Freeformers to conduct an intensive, three week training programme for 25 small businesses in Birmingham. We deliberately targeted businesses who had to date had not invested in digital services and were unconvinced by what broadband could offer them – so-called hard to reach businesses – from a range of sectors. Virgin Media and Freeformers devised a digital training module that started at a very basic level of technical understanding and built to providing advance training on how to code, build a website and populate it with content, inbed video and develop a social media strategy. The fast moving curriculum demanded a classroom-based environment to ensure that the participants could ask questions and build as they learnt.

Virgin Media received extraordinarily positive feedback from the group of businesses and at the end of the three week training programme, observed a material improvement in the digital capability of all participants.

The key lesson we took from this process is that it is possible to engage even very traditional small businesses in digital technology and empower them to pursue digitalised business practices. But the forum and curriculum that is used to achieve that result is critical. **For hard to reach businesses, Virgin Media’s experience was that they required structured, classroom based teaching and benefitted most from a learn-by-building approach.**
In our view, this is where Government resources can have most impact, supporting hard to reach businesses get over the first hurdle to take their first steps online. Virgin Media is committed to supporting SMEs as they continue to develop their digital skills.

We launched the Big Digital Skills Hub (http://learndigitalskills.co.uk/) a new free online digital learning tool earlier this month. It is fronted by Sir Richard Branson, and brings together some of the top industry experts to offer SMEs 15 tutorials of digital knowhow. The topics and modules address specific challenges that SME’s face – ranging from setting up and maximising a website, to social media and content marketing.

We will be running a tour around the UK to showcase the Hub and ensure that businesses get advice – face-to-face as well as online – on how to improve their digital skills, and grow their business.

Tech City
Tech City has also been an extremely successful marketing project, building the profile of East London as a tech centre, attracting inward investment, stimulating demand for connectivity amongst SMEs, and driving an uplift in digital skills.

**Tech City provides a useful blueprint but is a narrowly focused initiative – Virgin Media believes the model should be extended and made more ambitious.**

In doing so, it is important to reflect on what has made Tech City a success. It was not a victory for Government-sponsored investment in infrastructure – Old Street Roundabout already benefitted from world-class broadband as Virgin Media demonstrated in 2011 when we tested the then world’s fastest speed of 1.5Gb. The vast majority of business premises in Tech City are within reach of a Virgin Media business grade leased line connection and Virgin Media announced in August 2014 that we are in the process of expanding our network in East London, including areas within Tech City, by 100,000 homes.

The real lesson that Tech City has demonstrated is what can be achieved when Government markets the UK as a leading site for technical innovation as part of its trade and investment story to the world. Attracting leading brands as anchor tenants was critical to its success. It has shown what can be achieved when cities aggregate demand for digital skills, services and innovation in a location that has the right foundations of connectivity and a pipeline of talent.

Virgin Media would encourage similar Government support for Tech City-style initiatives which are being launched by cities up and down the country focusing on marketing the attractiveness of those cities and the strength of their broadband infrastructure to global tech companies, and ensuring that a pipeline of skilled workers and SMEs exist for anchor tenants to take advantage of.

**A final observation on digital skills - start in the classroom**
Recent research by the Prince’s Trust found that whilst the majority of young people (66%) have the functional skills to carry out a large range of activities on computers – particularly social activities such as emailing friends or accessing social media - a significant proportion lack confidence when it comes to performing basic tasks such as creating a word document
or creating a spreadsheet, let alone learning how to code. As such, we welcome the introduction of the new computer science curriculum in England, and support its concentration on computing and digital skills alongside traditional computer literacy. Virgin Media’s business-to-business arm, Virgin Media Business, currently supplies connectivity to 20% of the education sector market – powering the needs of 4,600 schools, colleges and universities. We provide robust and dedicated connectivity to meet the needs of each school – whether it’s for 10Mb or 1Gb in speed. However, we want to go beyond providing connectivity to help schools and the Department for Education actively seek out the best ideas for how broadband can transform UK classrooms and ensure that schools maximise the potential benefits of broadband and digital technology.

This is why we launched the ‘Generation Tech’ education campaign in April this year, with the support of Sir Richard Branson and the Department for Education. 20,000 schools have been invited to make submissions to an interactive website (www.generationtechvmb.co.uk) illustrating how young people are using technology in the classroom today. Teachers will also fill in a survey on the state of digital learning in their schools and appoint a Digital Youth Council who will present recommendations on how the use of technology in UK classrooms can be enhanced later this year.

We would encourage the Committee to consider the learnings from this campaign – as it is the first state-of-the-nation review of the vital role that technology plays in education. It’s the most ambitious listening exercise ever conducted to understand how technology is shaping education, shining a light on the best examples and getting students and teachers excited about the future.

Section 2: Delivering infrastructure-based competition

Commercial investment in next generation network infrastructure - £13.5 billion on the part of Virgin Media - is the foundation on which an internet economy currently worth £82 billion is built. This investment represents extremely good value for UK plc, with every £1 invested in networks underpinning a further £5 of value generated by use of that infrastructure.

In markets where there is a strong challenger network operator investing alongside the incumbent, broadband penetration is on average 20% higher and the incumbent invests 8% more of its revenues in network upgrade. In the approximately 50% of the UK where Virgin Media has network, our investment, and the response it has stimulated from our competitor BT in upgrading its own network, has delivered globally competitive speeds. Virgin Media’s commitment to raising the ceiling of broadband speeds in the UK – most recently through the introduction of a new top tier of 152Mbps and an entry level 50Mbps speed which is three times faster than the UK average – has spurred increases in speed by our competitor to the benefit of the entire market. As a result, average broadband speeds have quadrupled since 2008 and BT has been pushed to upgrade its own network through the roll-out of Infinity.

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Our investment delivers genuine choice for the consumer. Our hybrid fibre coaxial network is a fundamentally different topology to that of BT’s and delivers a different quality of service. As demonstrated by 6 years of Ofcom broadband speed reports, Virgin Media delivers the headline speeds it advertises to consumers. We have topped each Ofcom report and have proven that there is no significant degradation of speeds over our network, since speeds do not decrease with distance over coaxial as they do over copper. Aggressive competition in the UK broadband market has not only delivered genuine choice but also value to consumers. Average broadband bills have decreased by 7% in real terms since 2008 and the UK has the lowest priced available broadband products of the EU’s leading telecommunications markets.

Virgin Media’s network has the capacity to continue to meet projected trends in consumer demand for more traffic long into the future. A recent study undertaken by Communication Chambers on behalf of the Broadband Strategy Group identified that, even in peak times of consumption, the average home broadband connection was using just 0.8% of its capacity. The report draws an important distinction: whilst total internet traffic continues to increase rapidly (Analyses Mason estimate by 42% per annum), that does not correlate to consumers needing radically higher bandwidth (speed). In fact, the report projects that “the median household will require bandwidth of 19 Mbps by 2023, whilst the top 1% of high usage households will have demand of 35-39 Mbps”. Since Virgin Media’s entry level speed is now 50Mbps, these projections clearly fall well within the existing capability of our network. What’s more, we have demonstrated that our standard residential network is capable of delivering far higher speeds. In 2011 we trialled a 1.5Gpbs connection – at the time the world’s fastest broadband speed – across our standard residential broadband network at Tech Hub in Shoreditch Roundabout. We are currently trialling a 1Gbps offer to a small village in Cambridgeshire.

The report identifies three factors that influence the peak bandwidth requirements of a household: the number of people using the internet simultaneously; for what period time; and the bandwidth requirement of the activity they are doing. The first two factors are clearly limited in how much they can increase. The average number of internet users per household is stable at 1.9 and the rate of increase in average time spent online has started to slow (37hrs for the UK in 2013 – an increase of 5% on the previous year). The bandwidth requirements of online activities are also currently very stable. HD video is the main driver of increasing traffic and estimates of its bandwidth requirements vary between 5Mbps and 10Mbps. Streaming via 4k TV is estimated to require a maximum of 20Mbps. The report also notes that networks are getting more sophisticated in how they process video. Video compression rates are improving at a rate of c10% year on year, which has a significant impact on the bit rate – and therefore – bandwidth requirement of video streaming.

In short, the report concludes that the UK’s existing network infrastructure is more than capable of meeting the plausible demand scenario that it projects. Where there is strong demand for high speed connectivity and two competing infrastructure investors, the market

http://www.broadbanduk.org/2013/11/05/bsg-publishes-new-model-for-analysing-domestic-demand-for-bandwidth/
benefits from a self-sustaining cycle of investment. Those conditions are serving the UK well and should be encouraged to flourish.

First and foremost, that requires that Government is wary of any intervention that might disrupt those competitive dynamics and chill private investment. Any Government intervention to use public money to subsidise network build in areas where the market is already meeting supply would critically undermine those conditions. It is therefore vital that any future Government-funded broadband roll-out be precisely targeted to areas where there is market failure in the supply of superfast broadband.

However, Virgin Media believes that it is in the taxpayers’ best interest for Government to first consider how far private investment can help meet failures in the supply of broadband under optimum investment conditions before considering whether public funding is required. Virgin Media is committed to expanding our network footprint beyond the approximately 12.7 million homes that can currently access our services, where there is a viable economic case for investment. In 2014 alone, we have announced a network expansion programme to c.150,000 and are determined to build out further. Our ability to do so is limited by the fact that 85% of our build out costs are the product of planning restrictions relating to how we deploy our network or burdensome and costly streetworks regulation. These are not optimum investment conditions and as such, there is a high risk that taxpayer money could be wasted subsidising network build – particularly on the fringes of existing networks in UK cities – where private investment could meet demand if regulatory barriers were removed.

Virgin Media draws the Committee’s attention to the following specific areas of planning regulation that act as barriers to private network investment:

- **Restrictions to innovative deployment techniques:**
  
  Innovative deployment techniques could radically reduce the cost of network build.

  Narrow trenching would cut the costs of trench deployment by one-third and micro trenching would reduce it by two-thirds. Approximately 85% of the cost associated with building broadband infrastructure is civil engineering cost or "civils" and the vast majority of those (again 86%) are from the average £43 per metre cost of digging a traditional trench in the footpath.

  Narrow-trenching reduces the width of a trench from c250/350mm to anywhere down to 70mm. That dramatically increases the amount of distance that can be dug in a day whilst cutting the environment impact of broadband deployment in half. Narrow-trenching does not alter the depth at which broadband networks are deployed.


  Even though narrow-trenching is included in the SROH, in Virgin Media’s experience, Local Authorities are simply resistant to entering into discussions about either method of innovative deployment.
The one exception is Cambridgeshire County Council which has agreed for Virgin Media to undertake a narrow-trenching trial in Papworth, supplying 290 homes in that village with 1Gbps speeds. This trial is currently live and will be complete by the end of September.

We encourage DCMS to work with the Department for Transport to update the code with a firm encouragement of innovative techniques such as narrow-trenching.

- Moving from methods-based assessment of reinstatements to performance-based

Linked to the issue above, the Specification for the Reinstatement of Openings in Highways is currently extremely prescription in set rigid standards on the methods used for reinstating footways following a broadband deployment.

In practice, these prescriptions limit our ability to apply flexible civil engineering solutions and act as a barrier to techniques like narrow-trenching.

In addition, Local Authorities can and do charge for technical failures to comply reinstatement standards, even where the reinstatement is performing perfectly.

Since 2008, VM has paid more than £12m to Local Authorities on coring/sampling/testing and replacement of fully functional reinstatements.

Further, there is no effective arbitration process for telecommunication companies and Local Authorities to go through to help resolve cases so they often unnecessary result in costly litigation.

VM wants an urgent review of reinstatement rules under the SROH Code to move to a performance-based assessment whereby a reinstatement is only considered failed if it is not functioning, and believes that Local Authorities should bear the cost of sampling/testing/coring where a reinstatement is not a fail.

We would also welcome a formalised arbitration process and incentives for Local Authorities to go through arbitration before litigation.

- Wayleave applied to overhead deployment:

Virgin Media has been unable to build a viable business case for overhead deployment using third party infrastructure owing to the unrestricted wayleave demands that third parties are able to place on us.

Overhead deployment can reduce “civils” costs associated with network expansion by c35%.

However, there is insufficient arbitration between landlords and network operators and no constraint on landlords freedom to charge.

Virgin Media believes that the Electronic Communications Code is in urgent need of review and measures should be introduced to constrain the demands of landlords beyond a reasonable market price for access to their infrastructure or land.
• Permit scheme

Guidance from the Department for Transport says that permit schemes should only be applied to Category 1 and 2 roads, where the risk of congestion is highest.

However, 50 of the 63 permit schemes currently activated by Local Authorities extend the schemes to Category 3 and 4 roads – smaller, residential, non-critical roads. These are the roads that VM typically provides residential broadband, TV and telephony services to.

Since 2010, VM has paid £13m to local authorities to undertake small works on Category 3 and 4 roads.

Department for Transport guidance is purely advisory and there is no requirement for Local Authorities to comply with it.

Virgin Media wants to see Local Authorities design permit schemes with the actual policy objective that they were created for in mind – reducing traffic congestion on critical roads. We believe amendments are required to the Traffic Management Act to give statutory authority to DfT guidance and have it apply retrospectively to existing schemes.

15 September 2014
Summary

1. There have been regular enquiries into shortages of what we now call “digital skills” for almost 50 years. The underlying cyclical pattern was identified in the 1980s. Recession accelerates the decline in demand for old skills and delays investment in training for the new skills that are taking their place. Recovery sees a “crisis” and another round of studies. No amount of effort in “trying to predict the unpredictable” in order to better target vocational education, will bring about significant change unless we better reward employers who recruit trainees and retrain existing staff more than those who compete for staff trained by their customers or competitors, import supposedly skilled staff or export jobs.

2. It is currently more economic for many UK employers to compete for skilled staff or import from overseas, rather than train their own. This problem will not be addressed until we level the playing field between those who recruit trainees and retrain existing staff and those who import supposedly skilled “contractors”. Some of the latter can be paid tax free allowances for travel and accommodation and exempted from national insurance up to year. This can enable employers to save 50% (sometimes even more) compared to UK staff or contractors with equivalent take-home (after tax and expenses) earnings.

3. We need to copy our overseas competitors in exempting employees following professionally and technically accredited training programmes from income and payroll (c.f. National Insurance) taxes and allowing individuals acquiring new skills, not essential to their current jobs, to offset the cost against current and future earnings. We also need the same tax and expenses regime for imported staff and contractors as for their UK counterparts. The changes needed also include addressing how IR35 http://en.wikipedia.org/wiki/IR35 penalises those seeking to keep abreast of changing demand for skills.

4. When seeking to predict skills needs, we need to distinguish between core disciplines (which change slowly, if at all, over time) and technology, product and service technology related skills where demand can change before the curriculum, let alone content, is agreed.

5. We also need to find better ways of relating publicly funded and accredited qualifications and courses to current and emerging skills needs and employers' recruitment and training plans, without overloading those who do seek to plan ahead with “consultations” asking questions they cannot answer. The solution entails pooling budgets for demand assessment and forecasting via, for example, consortia of Sector Skills Councils and LEPs, to enable the use of industry strength market research

6. Few employers can forecast their needs more than a year ahead in the detail needed to plan conventional courses and qualifications. Those able to do so commonly wish to mix and match modules for just-in-time delivery (to meet immediate skills needs) with those for longer term career development across academic and professional disciplines. This presents challenges to colleges, universities and funding agencies. Those willing and able to respond can derive significant earnings from the delivery of short course modules (both residential
and on-line) within the global apprenticeship and continuous professional development programmes of major engineering and financial services employers. They are alleged, however, to be actively discouraged by funding councils from doing so.

The need to break out from Ground Hog Day

7. There have been enquiries into problems with regard to shortages of “Digital Skills” (variously defined), every few years since 1965, when an interdepartmental working group of the Department of Education and the Science and the Ministry of Technology was established. Their 1967 report into an expected shortage of Systems Analysts by 1970 led to the establishment of the National Computing Centre, which later ran studies into the similar (but not identical) skills shortages of the early 1980s.

8. The underlying pattern of cyclical skills shortages was identified in the 1980’s and was summarised, with supporting statistical examples, in the 1996 IT Skills Trend Report http://www.eurim.org.uk/activities/skills/96SKILLS.pdf. (pages 13 - 18) as follows:

9. “Except for the decimalisation boom and bust, UK IT recruitment effort over the past thirty years has followed the trade cycle with the magnitude of each boom and bust growing more extreme as each wave of technology change hits the industry ... The first sign of economic downturn, before it shows in Government statistics, is the scaling down or cancellation of graduate recruitment programmes among those employers who plan ahead ... a well established pattern of "boom and bust" with the trauma of transition, as each wave of changing technology and associated skills hits the industry, made more painful by the economic cycle.

10. [The graph below is based on analyses of recruitment advertising in Computer Weekly from 1975 – 1991 and across the Trade and National Press from 1991 – 1995. The extrapolation from 1995 was based on discussion with recruitment consultancies and was later confirmed accurate save that the crash with the dotcom bust was sharper and the recovery slower. The subsequent switch to on-line recruitment complicates attempts to look at recent trends]
12. Recession accelerates the decline in demand for old skills and delays investment in training for the new skills that are taking their place. The effect of the trade cycle is to magnify the problem and complicates any solution.

13. The basic cause of the periodic crises is that not enough users take on trainees so that even in recession we can have shortages of skilled and experienced staff in the areas of future growth. The problem is compounded by the low level of refresher and update training given to most of those already in the workforce. Employers who do not train their own staff bid up the price for skilled staff in order to poach from those who do train, whether as permanent staff or, more usually, as short term contractors.

14. Meanwhile those individuals who have not been able to update their skills find it difficult to retrain and harder still to obtain the necessary practical experience to re-enter the workforce, if they have been made redundant.

NEW TECHNOLOGY
New skills required to apply the technologies

NEW MARKETS
More skilled staff to fuel growth

HIGH INITIAL DEMAND FOR SKILLS
Low supply of Trainee Positions  Experienced Staff
Low training due to High cost and fear of losses

How the debate on “solutions” has evolved (or not) over the past 40 Years
16. I have participated in what are now called “Digital skills” studies and action plans since ICL sponsored me on the Master Programme at the London Business School from 1971 - 3, during the slump in activity that followed the decimalisation skills “crisis”. I used live data
from a previous employer (STC Microwave and Line Division) for a Manpower Planning project to illustrate why the best practice of the day did not work during the run up to that “crisis”.

17. Shortly afterwards the views from around 50 organisations (albeit all in a single industry sector) were used for the MinTech study to produce “A Computer Development Plan for the Regional Water Authorities” (published May 1974 by ICL and DTI).

18. This was the first and (and may have been the last) study to factor the problems of recruiting staff with the necessary skills and experience into a “Digital” strategy. It recommended a policy of retraining user staff rather than seeking to compete in the open market: “Since the majority of such staff [analysts and programmers] are not nearly as mobile as people think, this is probably sufficient to induce a sharp rise in salaries in a confined market ... The speed of progress indicated ... will not be practical [unless the new Regional Water Authorities pooled resources in collaborative partnerships] .... because the development staff are not available and cannot be trained in time”

19. In 1979, (when my day job for the Welcome Foundation included looking at “Medical Informatics” including opportunities from using technology to help look after an ageing population), I was able to get a recommendation that: “extra funds [be] earmarked at school level to give education in living with and using the new technology by providing at least one micro computer with appropriate teaching material to support staff in every secondary school in Britain by 1982” embedded in both Conservative and Labour policy papers and the DTI briefs for who-ever won the election. Part of the reasoning was summarised in the Conservative post-election discussion paper “Cashing in on the Chips” http://media.wix.com/ugd/6ba694_fe1a4edac3535003dfafa0275b8e3fd4.pdf .

20. In 1987 a National Computing Centre team summarised employer’s views on what needed to happen in “The IT skills Crisis – a prescription for action” http://www.worldcat.org/title/it-skills-crisis-a-prescription-for-action/oclc/60009165. The headline conclusion was: “both IT users and suppliers believe that priority for Government action should be given to tax incentives and improved information services to encourage training initiatives and expenditure by industry rather than additional direct public spending or intervention. The main exceptions are to do with local initiatives in regions of high unemployment, including inner London, training for school leavers and Government’s own training and staff development responsibilities as the largest direct and indirect employer of IT applications staff.”

21. Part of the objective of that survey was to gauge the interest of the NCC’s then 1,800 user and 200 supplier members in action on skills. It was agreed that a 2% response would indicate apathy and anything over 5% would indicate genuine interest. Most skills surveys, then and now, are based on response rates of around 2% (i.e. they are not statistically significant and indicate either a faulty sample or a lack of interest on the part of the target audience). That survey had a response rate of 10%. I suspect that a similar survey study today would attract a similar response.

22. From 1988 – 92 the first Women into IT Campaign helped raise the proportion of girls taking IT related degree courses from barely 10% to nearly 30% and female employees
(including returners) to over 25%, before the Department of Education and Skills decided not to build on the DTI pump-priming and the Women into IT Foundation had to be wound up before the Trustees became personally liable. That success demonstrated that action to improve careers advice and guidance, led by employers seeking to portray themselves as employers of choice, can change perceptions in schools and universities. It also showed that evidence of clear employer support is not sufficient to overcome departmental opposition. At that time the opposition was to “affirmative action” and performance measures (placement into work) which threatened established skills programmes.

23. At about the same time (1992) the West London Training and Enterprise Council obtained funding to use computer assisted telephone interviewing for its Labour Market survey and to attach sections on computer use, training needs and how they were being meet. The result was the only statistically reliable snapshot of private sector employer views: a response rate of over 50% from a structured sample of 1,500 local firms. It showed a far greater use of technology, including among small companies, than expected but also an almost total lack of either training or professional support. The headline of the published management summary http://www.worldcat.org/title/users-have-taken-over-the-system-west-london-it-skills-survey/oclc/059538834 was “The users have taken over the system”.

24. The main report (not published) demonstrated that the IT skills programmes of the day were not seen as relevant by employers. What they most wanted was help in identifying well educated (literacy and numeracy) and motivated (including time-keeping and social behaviour) recruits. If the “TEC” wished to use computer literacy as a euphemism for basic skills, that was up to it. Most of the small minority of employers willing to work with the TEC on planning its programmes wished to attend selection meetings and sit in on classes to spot those who they might wish to recruit. They were then happy to provide targeted computer courses as part of work experience placements before doing so.

25. From 1991 until 1997 the Women in IT Foundation and (later) IMIS (The Institute for the Management of Information Systems, later taken over by the British Computer Society) produced annual IT skills surveys (based on analyses of recruitment advertising and surveys of salaries and staff turnover). After a presentation of the 1995 report to the then Shadow Chancellor, the 1996 report http://www.eurim.org.uk/activities/skills/96SKILLS.pdf. was upgraded to collate thirty years of material on trends with the technology forecasts being used by corporate planners in major suppliers and users, to cover the action needed to address the expected skills “crisis” during the run up to “Y2K”.

26. Work on checking which systems had not already been modified to handle Y2K, (the year 2000 had a different leap year routine and software with two digit date routines might also need re-writing), was expected to coincide with that on EMU (the amendments needed whether or not the UK joined the European Monetary Union). At the same time the industry was expected to face one of its cyclical crises, exacerbated by competition for the skills to enable businesses to begin the transition to Internet-based systems for on-line transactions.

27. That report was one of the few on IT skills to sell more than a handful of copies. The report and the events and publicity organised around its launch, helped bring forward by several months the work (across the EU as well as in the UK) which enabled serious problems to be avoided. Among the most effective programmes was that to train 40,000
Millennium Bugbusters. This transformed the UK supply of micro-computer support technicians, using courses contracted only to suppliers who could demonstrate (to a panel of assessors with experience of running both IT operations and IT training programmes) their ability to deliver short, intensive, hands-on training, delivered by named staff with relevant experience. The nature of the quality control was controversial because few of the organisations then running mainstream Government-funded skills programmes met the criteria required and the Treasury, who had provided ring-fenced funding, refused to allow any relaxation.

28. Section 8 of the 1996 Skills Trends report contained 40 pages of action plans for:

- employers - including integrating skills acquisition, development and retention
- suppliers - including the supply of skills to handle current and future products lines
- individuals – including taking charge of your own career path
- training providers – including “clearing the certification jungle”
- government – including to:
  (i) cut the pre-tax cost of training by rationalising funding around programmes using inter-operability standards for modular delivery and
  (ii) cut the post-tax cost of training e.g. “that those following professionally recognised training and/or update courses .... be exempted from national insurance and/or income tax” and
  (iii) support activities to improve careers advice.

29. About the same time EURIM (now the Digital Policy Alliance) produced a short paper, with help from the British Computer Society, IMIS, IEE (now IET) and others, on “Re-skilling Europe for the Information Society” study. This called for action to use the challenges of Y2K and EMU to help bring UK and EU education and training into the 21st century, to cope with a world in which demand for skills can be expected to change before curricula are agreed, let alone the courses delivered: http://www.eurim.org.uk/resources/briefings/br18.pdf

30. The first three recommendations were:

- Education and training policy must better distinguish between core educational and academic skills (which rarely change over time) and vocational and technology skills (where traditional methods can no longer cope with the pace of change).
- Vocational curricula and course content and delivery must be better related to current and emerging skills needs and employers' recruitment and training plans.
- Commercial market research and quality assurance techniques should be used to assess skills demand and the relevance and effectiveness of training delivery.

31. The initial funding to enable the embryonic ITNTO (IT National Training Organisation) evolve into one of the most successful of the Sector Skills Councils was announced by John Healey, Minister for Adult Skills at an IT Skills Summit organised by IMIS and Comptia in 2002. Ministers have since made many speeches similar to his opening comments http://www.eurim.org.uk/activities/skills/ess2002.php on the need for both mass market
programmes to prevent social exclusion and focussed programmes for technical and professional skills but few have been so succinct and clear.

32. Unfortunately he was reshuffled two hours later. By the time the funding emerged (over 18 months later) momentum had been lost and the initial support group of 20 Human Resources Directors from major ICT employers had lost patience. It took nearly a decade for momentum it to be recovered. EURIM (now DPA) was among many industry-supported groups which suspended attempts to influence Government skills programmes other than in support of activities planned by e-Skills.

33. That momentum has now been recovered and many of the Sector Skills councils (including e-Skills) have strong support from employers. But they are once again threatened by a fragmentation of initiatives and consultations which fail to recognise the cost and difficulty of obtaining representative inputs from employers and students on their needs and expectations.

34. A key finding from the summary report of the 2001 Skills Summit http://www.eurim.org.uk/activities/skills/ess2001.php, used in the submission to get John Healey to make his announcements to the second summit in 2002, was:

- There are too many surveys, initiatives, programmes and organisations at every level but particularly with regard to the identification of employer needs. We are suffering from study and initiative overload. We need to do less but do it better. We also need to achieve economies of scale without compromising quality or losing local enthusiasm and personal tutorial support.
- The result is a mix of ignorance and paralysis. Even organisations with large industry education teams (e.g. Microsoft with a team of 12) cannot respond to more than a fraction of the invitations and/or surveys they receive from government departments, universities, colleges, schools and industry bodies. Those who try to do more have no time to do their day jobs.
- There are far too many funding agencies and programmes with complex rules, expensive bidding processes, slow decision processes. Too much is capital spend when the need is usually for a flexible mix of capital and revenue spend. This leads to waste of public funds in parallel with mounting frustration at lack of funds to exploit success.”

35. The then Head of the Microsoft team told the 2001 Skills Summit that they had logged over 3,000 requests in the previous year for inputs to those planning courses and qualifications. Hence the very strong support from all the users and suppliers present for a wholesale rationalisation of consultations and surveys and the suggestion that, instead of demanding duplicated evidence of employer support, those planning bids for public funding should quote evidence of local demand using material collected and collated via the relevant sector skills councils based on industry strength market research.

36. Good market research is, however, more expensive than “consultations” and semi-academic desk studies based on collating the results of surveys with response rates too small for statistical significance. Such studies can be (and often are) systemically misleading.
What has changed since the last century and what has not?

37. It is now much easier and cheaper to organise affordable on-line, multi-media material for delivery when, where and how needed by employers and students. But the first three recommendations of the 1997 Eurim briefing “Reskilling Europe for the Information Society” remain valid:

- **Education and training policy must better distinguish between core educational and academic skills (which rarely change over time) and vocational and technology skills (where traditional methods can no longer cope with the pace of change).**
- **Vocational curricula and course content and delivery must be better related to current and emerging skills needs and employers’ recruitment and training plans.**
- **Commercial market research and quality assurance techniques should be used to assess skills demand and the relevance and effectiveness of training delivery.**

38. Many of the questions asked by the Committee are still unanswerable or else run the risk that policy based on the answers will be out of date before it is implemented.

39. An example might be answers based on the assumption that current Internet Business Models (novel in the last century, now dominant and supported by growing armies of lawyers, regulators and compliance officers) will survive much more than another five years before they begin to crumble, if only because it is impractical to criminalise whole generations of teenagers who do not accept the mindsets behind them.

40. Such models, based on global players running centrally controlled networks and big data clouds are being increasingly “complemented” by different models around the world, including those based on local connectivity meshes which can not only offer more security (including from remote surveillance or attack) but are also capable of supporting smart homes, cities and those physically dependent on tele-care and welfare – regardless of whether national and international networks are still running.


Is the Committee asking the right questions?

41. Among the questions that I believe the Committee should be asking are:

- **How do we make it more attractive for employers to retrain existing staff and recruit trainees than to recruit from their competitors or customers or to import skills or export jobs?**
- **How do we make it easier for individuals to identify and demonstrate that they have acquired the skills in current and prospective demand?**
- **How do we make it easier for those at all stages and levels of the UK education and training supply chains to deliver what is in current demand, when, where and how it is needed?**
- **How do we ease the pain of moving from timetabled courses to lifelong learning networks that enable students (of all ages) to acquire the skills in current demand, when and where needed?**
• How do we ensure socially inclusive, local access to world class learning and training: from school, through apprenticeship, college, university to continuous professional development?
• How do we provide accurate, attractive and realistic careers advice when pre-planned technical and professional career progressions are becoming the exception rather than the norm?
• How do we help those employers who do plan ahead and can offer career progressions to better identify, motivate and exploit talent that is currently going to waste?

Answers to the questions in the consultation:

42. What is the pace and change of the future digital technology landscape over the next 5, 10 and 15 years? What are the leading innovations?

This is impossible to answer and not worth the effort.

I have enjoyed participating in ten and twenty year forecasting exercise and even wrote one for 50 years: as an entry for an essay competition on the 50th Anniversary of Leo (the first commercial computer) http://is2.lse.ac.uk/leo/Archive/virgo.pdf.

I regularly engage in discussions on what I have so far got right or wrong, whether I could have done better and whether it is easier or harder to make predictions today.

43. What are the main challenges for economic growth as the UK transitions to a knowledge driven economy?

The biggest challenge is reform of the Intellectual Property Rights regime in the teeth of determined opposition from those wishing to protect the past from the future. If 14 years was an appropriate period of protection for the fast moving 18th Century why should longer be needed today – except when safety testing (as with pharmaceuticals and other complex products) may take a decade or more. In the latter case the lion’s share of the protection should go to those who do to the testing and bring the product to market, not to those who patented a compound or technology but made no attempt to bring it to market. In the 18th Century failure to bring a patent to market or keep a book in print was grounds for loss of protection.

44. What is the employment impact on the UK’s labour market?


Unfortunately the latter, drafted to counter studies akin to those published recently claiming that half of current jobs will disappear over xx years because of technology, does not appear to be available on-line.

45. What are the regional differences?
Depends largely on local investment on broadband infrastructures that are fit for purpose.

46. What skills do future workers need in order for the UK to be globally competitive? How do the digital skills required for technical roles compare to those needed by the wider workforce to operate in a digitally competitive environment?

The core requirement, identified in “Learning for Change” is the ability and willingness to acquire new skills rapidly as demand changes. That depends on the quality of basic education, including associating the process of acquiring new skills with pleasure, not pain. The underlying abilities and attitudes required at different levels, from the everyday use of digital devices, through end-user skills, application and technical support, to product and service innovation, development and testing are very different. We make a serious error when we muddle them together as “digital skills”.

47. As stated in EURIM Briefing 18, over a decade ago:

- Education and training policy must better distinguish between core educational and academic skills (which rarely change over time) and vocational and technology skills (where traditional methods can no longer cope with the pace of change).
- Vocational curricula and course content and delivery must be better related to current and emerging skills needs and employers’ recruitment and training plans.
- Commercial market research and quality assurance techniques should be used to assess skills demand and the relevance and effectiveness of training delivery.”

48. The other fundamental problem, is that the definitions used in almost all public sector accreditation, let alone funding, planning and forecasting, processes are too broad for employers to understand the competence they can expect. More over most delivery programmes are segmented into technical and professional career development “drainpipes” that do not fit a world in which employees and students need to acquire patchworks of skills to meet changing needs. The need is to mix and match just-in-time delivery modules from a variety of sources in ways that depend more on the ability to respond rapidly to changes in demand than to predict those changes. Those seeking to prepare current and potential customers to use the product and service innovations they are planning should take responsibility for ensuring the availability of the necessary modules.

49. Can the current supply chain deliver this?

No. It is far too constrained by demands to fit UK into accreditation and funding frameworks which cannot respond in time to meet evolving needs. In consequence there is a basic split between those who are seeking to meet global skills needs (whether the UK delivery of courses and materials developed elsewhere or the UK development of courses and materials designed for overseas delivery) and those responding to the demands of UK-centric funding agencies to produce courses and qualifications that will fit government targets, including for accreditation revenue streams and royalties.

50. How are we teaching students in a way that inspires and prepares them for careers in the future workforce in occupations that may not yet exist, rather than the current one? How can this be improved?
This may be best answered by contrasting those Digital Degree courses with success rates of close to 100% and those with Computer Science and Media Studies Courses that have placement rates of under 50%. The ITMB course, now offered at 19 Universities http://www.itmb.co.uk/itmb-public-pages/universities/, appears to achieve 100% placement on the back of close employer engagement with all students, not just all centres. Many of those with poor placement rates have little, if any, engagement with either employers or alumni and almost none with employers who send their recent alumni to spot for talent among their successors – arguably one of the best tests.

51. How are schools preparing to deliver the new computing curriculum in an innovative way?

There are a great many excellent initiatives. The problem is to spread enthusiasm and good practice. Many of the most successful past initiatives have involved students and recent graduates acting as teaching assistants within school timetables. This presents challenges on both sides. Good programmes therefore die unless funded: students building up debt and recent graduates paying it off, cannot afford to cover their own expenses.

52. How can the education system develop creativity and social skills more effectively?

There is a tension between developing individual creativity and developing social skills. “Learning for Change” http://dooooooom.blogspot.co.uk/2010/12/learning-for-change-view-from-1982.html sold out after being condemned in a review in the Times Educational Supplement for advocating cheating. The relevant paragraph was: “The second new skill is problem structuring and solving, and in particular group problem solving of the kind used by the class "cheat", who knows which classmate’s homework to copy in which subject. By definition, this skill is selected against in our educational system and thus its most skilled practitioners frequently end up working against society as rebels, criminals or parasites rather than in the key management posts which they should occupy”.

The following paragraph was not quoted in the review:

“Thorough and imaginative approaches to group problem identification, structuring and solving are going to be essential in the factory of the future where quality control is going to be one of the main occupations. Ensuring that complex computer controlled products are functioning correctly, and that the specification of the control program is adequate under all circumstances and not dangerously inadequate under even the most unlikely circumstances, may well become the most labour intensive part of the production process.”

That was 30 years ago. Today the Cybersecurity Challenge http://cybersecuritychallenge.org.uk/ with school teams pitted against each other to create and defend their own systems while breaking those of their opponents is a good example of attempts to resolve that tension and foster group creativity while also stretching the individuals.

53. How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?

At the time of the first Women into IT Careers campaign (1988-92) we came to the conclusion that most of the careers material then available in schools should be taken out
and pulped. It was worse than useless. The situation today is little better. There are some great ideas (and some good material) around but producing and disseminating good material and guidance with regard to the careers currently available, let alone positioning for a world of change, requires engaging employers who have become used to exporting jobs or importing skills from overseas. The difficulty of achieving this, other than by local action, with local employers, including those in the public sector, cannot be over-estimated. Government should begin by overhauling its own careers materials and participating in collective exercises with regard to those skills where it is itself a major employer. A good example is the GCHQ support for the Cyber Security Challenge.

54. How can the digital sector be supported in the short and medium term? What is the role for higher and vocational education, national colleges, industry and industrial policy?

Colleges and Universities need to work with those employers who recruit from them to take a flamethrower to the current jungle of duplicated courses and qualifications so that they can acquire the freedom to mix and match world class material from around the world to educate, enthuse the next generation of innovators and ensure that those expected to use and maintain that which has not yet been invented are looking forward to acquiring the skills necessary, whenever, wherever and however the opportunity arrives.

Government policy should focus on:

- Ensuring all parts of the UK and all individuals have on-line access (including supported access via libraries and community centre, not just home and work-place) to world class learning materials. That means ensuring broadband connectivity that is fit for purpose.
- Provide a level pre-and post tax playing field for employers so that they can afford to recruit UK trainees and retrain existing staff instead of importing supposedly skilled contractors who can offset training costs and claim tax free accommodation and travel allowances not available to UK employees or contractors.
- Exempt those following professionally accredited training programmes, including apprentice contracts from income tax and national insurance.
- Allow individuals (including the self employed) to offset the cost of acquiring new skills against current and future tax
- Retraining and upgrading the skills of those in the public sector so as to reduce reliance on outsourcing and offshoring.

55. Is there a need for increased high skills immigration in the short term? What are the implications of this?

We need to disentangle the importation of skills to meet supposed shortages (which would have been recruited locally or by retraining existing staff had we a level playing field, see 36 above) from facilitating global careers progressions - where spells in the UK commonly form part of the route to the top of multi-nationals or we wish to encourage the latter to base key operations in the UK.

It is alleged that if we had a level playing field on tax on accommodation, travel and other expenses many of the supposed skills shortages would “disappear” and we would be left with
“genuine” demand. This is one of those areas where the devil is in the detail, not the headline policies.

The most serious “anomaly” is with regard to National Insurance where those employed by contractors based in nations with which the UK does not have reciprocal arrangements can be exempt for up to a year (see last section of http://www.hmrc.gov.uk/nic/work/ni-uk.htm) as well as receiving untaxed allowances for accommodation and travel. The situation with regard to reciprocal arrangements is more complex. Some make it more attractive to employ UK nationals in other states. Others make it more attractive to employ their nationals in the UK.

We also need to disentangle the issues concerning student visas, including permission to undertake work experience. It has taken over a decade to persuade the Home Office to begin to take action on blatantly false “colleges” and “universities” and it is doing so in way which harm those that are genuine but still enable fraud. This is another area where the devil is in the detail.

56. Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?

Yes – but this needs to be disentangled from the need to mandate those advocating “digital by default” public sector services to ensure they are fit for use by those in most need. I suggest taking evidence from organisations like Abilitynet http://www.abilitynet.org.uk/ with regard to the common failure to follow adequate, let alone good, practice.

57. What do the best local skills delivery models look like? What is the role for Local Government, Local Enterprise Partnerships (LEPs) and the third sector?

They are driven by local employers, including Local Government and the Third Sector, supported by the relevant sector skills councils and national employers through their local operations.

58. What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge driven economy? How are these best overcome?

By far the biggest obstacle is the cost, particularly time, of supervised work experience before trainees and/or apprentices can be trusted to work on their own. Hence the need for generous tax incentives (e.g. exempting apprentices from National Insurance and Income Tax), on top of good quality mentoring support via local training providers, to help cover that cost. The current limited exemptions for low paid level 2 apprentices are a good start but the approach needs to be extended to those on higher level contractual training programmes (e.g. those in line with the main test case Strathclyde Regional Council v. Neal http://www.xperthr.co.uk/law-reports/case/Neil-v-Strathclyde-Regional-Council-1984-IRLR-14-CS/1729/ )

59. How can businesses help equip the workforce with new skills in a rapidly changing environment?
By training their existing staff and recruiting trainees. But to do this, while surviving in a globally competitive environment, they need a level tax playing field plus the availability of local training, mentoring and career development providers who will help their staff develop underlying aptitudes at the same time as accessing just-in-time modules for those skills in immediate demand.

60. Does the UK have a competitive infrastructure to support a knowledge-driven economy? How does the UK compare to other countries?

No. Because it has failed to look at skills issues from the perspective of employers, as opposed to that of providers and funding agencies, for half a century, perhaps longer.

4 September 2014
Virtual College

1.1 Virtual College has been championing the adoption of learning technologies since its inception in 1995. We have pioneered the development of bite size vocational online courses helping to equip the workforce with new skills and knowledge.

1.2 As a leading provider, in the past 19 years we have trained 1.4 million people in the UK using online technology in sectors ranging from Safeguarding, Healthcare, Social Housing, Local Government, Construction, Retail, Professional Services and Catering. We have also supported colleges and training providers to deliver 50,000 apprenticeships in the last three years alone.

1.3 The increasingly rapid adoption of new technology to enhance the traditional approach to learning is helping not only to reduce costs but also to increase quality and consistency. The use of new technology has also widened access to education and training.

1.4 The Government has recently accepted the recommendations of the Further Education Learning Technology Action Group (FELTAG) for an online learning target of 10% by 2015/2016 and 50% by 2017/2018 for publicly funded FE courses. This means that UK is well placed to capitalise on this revolution in education and training.

1.5 Virtual College is developing a Personal Learning Vault (PLV) initiative whereby each individual at school age is given free access to a digital, cloud based repository. They will have access to this for the rest of their lives and will use it to store all education, training and personal development information digitally.

1.6 Our VOOC® model (Vocational Open Online Courses) is structured around providing free bite size vocational learning opportunities which help to engage individuals in training at all stages of their life.

1.7 As an example, the Career VOOC® concept is designed to update career guidance for digital natives. Delivering advice and information in a more effective way and perhaps more importantly, via their own Personal Learning Vault giving them a self-development route to support a truly lifelong learning journey.

Challenges

1.8 McKinsey Analysts estimate that the number of skillsets needed in the modern workforce has increased rapidly from 178 in September 2009 to 924 in June 2012.557

1.9 For example, today mobile computing supports millions of jobs world-wide. These jobs demand a wide range of skills and competencies that simply did not exist before the Apple iPhone was launched a mere seven years ago.

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557 Mona Mourshead, Diana Farrell, and Dominic Barton, “Education to Employment Designing a System that Works” McKinsey Center for Government p73
This rapid change in pace means that today’s workforce can’t rely on a few years of further or higher education at the beginning of their adult lives to gain the skills demanded in a modern, high-tech economy. Instead, lifelong learning to top-up skills and competencies, as and when they are required, must become the norm.

This means that more people will need more training, more often, at more points in their lives, delivered in more ways, to suit more life stages.

The current provisions for delivering further and higher education do little to address these challenges. If we are to produce a workforce for the ever changing digital economy we need to develop and evolve training structures that match its requirements and provide opportunities for everyone to continue to up-skill as needed throughout their lives.

Recommendations

Our recommendations refer to the industry section point 14. How can businesses help equip the workforce with new skills in a rapidly changing environment?

Our key recommendation is that the government should support and encourage the evolution of Britain’s training and qualification environment so that it matches the emerging requirements of employers and employees in the fast developing digital economy. This means adding life-long, bite size training programmes to complement and enhance more traditional training methods.

To do this, businesses, education, training providers and the government need, as a priority, to create a roadmap towards a gold standard for life-long training that allows for innovation and competition between providers. But we must also give consumers/students clear choice combined with security in the ‘value’ of their qualification.

A key plank in establishing this standard must to be the creation and adoption of an effective way to simplify the accreditation process to support bite size learning opportunities that matches that of traditional learning courses.

Government should also encourage the formulation of bite size vocational degrees. These would consist of many smaller modules not necessarily delivered in order, with no time limit, which are developed in partnership with industry and employers. This bite size structure, which will incorporate a significant element of online study, linked to shared communities, will allow greater flexibility and responsiveness to the rapidly changing digital environment.

Government to support Virtual College’s Personal Learning Vault initiative which aims to equip the workforce with a place to store all education, training and personal development information digitally in a cloud based system. Without this it will become ever more difficult for employers and employees to manage an increasingly complex training and qualification environment.

* VOOC® is a registered trademark of Virtual College Limited and is a UK initiative to help accelerate the adoption of vocational skills in the workplace.

4 September 2014
Professor Judy Wajcman, Professor Phillip Brown and Professor Alan Manning – Oral evidence (QQ 15-25)

Transcript to be found under Professor Phillip Brown
Dr Victoria Wang and Professor John Vivian Tucker – Written evidence (DSC0023)

Submission to be found under Professor John Vivian Tucker
Welsh Government – Written evidence (DSC0123)

1. Summary
1.1. This document contains the written evidence of the Welsh Government in relation to your inquiry into ICT, competitiveness and skills in the UK.

2. The Welsh Government Policy Approach

The changing technological landscape
2.1. The pace of change through the daily development of new and emerging technologies is driving a greater need for Wales and the UK to remain competitive on a global stage. Many of the current business products or models did not exist a few years ago which has led to a considerable impact on the skills requirements of the workforce. Increased numbers of businesses, across all sectors, are investing more to enhance their use of technology and this has led an increased demand for technology skills.

2.2. Changing technology is also leading to changing job profiles – such as Big Data and Cloud computing specialists, rather than classic ICT jobs. Increasing levels of e-Crime is creating one of the key challenges for the online world. Businesses must have specialist skills to protect themselves and their clients from cyber-attacks, including the knowledge, tools and ability to prevent and deal with common cyber risks and to be able to safeguard digital information.

Future workforce need(s)
2.3. Therefore in terms of future trends the Welsh Government considers that cloud, mobility, data analytics and cyber are the technologies that business must keep pace with in terms of how they develop their products, services and upskill employees to maximise their use. Businesses in Wales must have access to a talent pool with the right skills to meet their current and future needs. Particularly as the digital economy accounts for over half of UK GVA and technology will underpin the majority of future job creation across all sectors of the economy.

2.4. Wales, as is the wider UK and Europe, is struggling to meet the ICT needs of industry with regard to the availability of appropriately skilled recruits. We anticipate that more than 3,000 ICT trained recruits are needed each year just to meet existing demand from Wales’ growing IT sector. Furthermore research by e-skills UK shows that the utilisation of ICT by businesses in Wales could add £1.5bn to the Welsh economy by 2020, translating into 18,000 new jobs across many occupations and sectors over the next 5 to 7 years. We fear there could be a huge gap of skilled ICT workers to fill those jobs. Without action Wales could miss out on the economic opportunities presented by technology.

2.5. The WG Monthly Labour Market Report for February 2014 from the Learning and Skills Observatory Wales (LSO) focused on the ICT sector in Wales and provided many of the following headlines:
Sector data for 2011 and 2012 suggests that the ICT business base is starting to grow again after the recession of 2008, with almost 1% growth in the number of active enterprises.

In terms of subsectors there has been particular growth in software enterprises with strong growth in the number of employees and a very strong resurgence in communication.

The number of students taking ICT GCSE in Wales has dropped significantly in recent years. Entries have fallen year on year since 2007/8, and the rate of fall has been particularly sharp in the last two years. Figures show that the rate has decreased by 50% from 2007/8 to 2011/12.

Whilst the medium term trend for undergraduates at Welsh HEIs is one of no significant change, with the same numbers in 2012/13 as in 2007/8, this masks a significant decline from peak levels in 2009/10, of 7%. The number of post graduate enrolments fell by 13% from 2008/10.

2.6. There is significant evidence that ICT education and skills provision (across the UK) is not meeting all of industry’s needs. In terms of skills that are hardest to find e-skills UK has stated that IT and Telecoms related skills shortages tended to be associated with Programmers/Software Developers and Web Design/Development professionals.

2.7. Employers report that the technical skills that were proving the hardest to fill were .Net/ASP.NET, Dynamics, SharePoint, Visual Basic/Visual Studio, C#, PHP and VMWare. This shortage is no different in Wales and many of our companies report difficulty in finding suitable candidates with the necessary IT skills.

2.8. Organisational readiness and agility to take advantage of new ICT and digital technologies will also require management and leadership capabilities within and across the wider workplace that recognise and exploit the potential of ICT as a supporter or enabler for growth. A high percentage of existing workers are, therefore, increasingly likely to need enhanced ICT skills that allow them to exploit the technology to work more productively.

Short and medium term support to the digital sector in Wales

2.9. The Welsh Government is taking steps to upskill sections of the ICT workforce. In response to demand identified by employers across Wales, the Welsh Government invested over £1.3million of its own budget and European Social Funds (ESF), in an innovative higher level entry / CPD programme that seeks to address the current and future skills demands of the ICT sector in Wales. Working in collaboration, the Department for Education and Skills and the Department for Economy, Science and Transport, have funded two pilot programmes delivered by e-Skills UK which have better equipped over 450 people with the specific ICT skills needed by industry.

- To meet the needs of those who are in work but want to refresh their skills, subsidised IT training courses were made available to employers based in Wales through the Pathways to Digital Growth.
- For those currently out of work, free training was made available in five areas including Technical Support, Software Testing, and Database Development. Up to 220 adults have participated in the Pathways to Digital Employment programme, receiving entry into a
paid-for exam in an industry recognised qualification, alongside employability training including CV writing and interview preparation.

**ICT in Education**

2.10. Welsh Government aims to help learners to develop the skill confidence and maturity to navigate this new world and make use of the opportunities it provides. We have invested (c.) £39m through our Learning in Digital Wales (LiDW) Grant to provide enhanced internet connectivity to all schools in Wales. To date, all local authorities have benefitted from improvements in core connectivity, 86% of schools have received internet upgrades and 91% of schools have benefitted from in-school Wi-Fi infrastructure.

2.11. We have established a National Digital Learning Council to provide expert and strategic guidance on the use of digital technology in teaching and learning in Wales. The remit of the Council is to guide the implementation of the LiDW programme and to promote and support the use of digital resources and technologies by learners and teachers.

**ICT Resources in School**

2.12. Learning Wales is a web-based resource designed to support teachers and practitioners across Wales to improve standards in schools, colleges and post 16 institutions. Learning Wales was originally launched in September 2012 as a high quality resource for school teachers and practitioners and has recently been improved and extended to include information and resources aimed at the post 16 sector.

2.13. In addition, the Welsh Government is investing over £4 million in the National Digital Content Repository and the all Wales learning platforms Hwb and Hwb+, which will provide access to digital tools and resources for learners aged 3 to 19 across Wales. Hwb is the bilingual National Digital Content Repository which hosts digital classroom tools and thousands of digital classroom resources. Hwb+ is a bilingual Welsh and English online learning platform.

- To date 1615 schools (98%) have been provisioned with their own Hwb+ site
- Over 520,000 user accounts have been created for teachers and learners

2.14. The Welsh Government is strongly committed to safeguarding children and young people in Wales. We are intensifying activities to promote child Internet safety, to ensure that children, parents and adults who work with children in Wales know how to use the Internet safely and responsibly.

2.15. The Wales Education Data Improvement Initiative Project (WEDIIP) has just been initiated. This is a ‘proof of concept’ (PoC) activity which seeks to determine how local authority collaborative working is able to realise greater efficiency through the use of joint management information systems (MIS).

**ICT in the Curriculum**

2.16. As part of the non-statutory skills framework ICT in the Foundation Phase is taught across the Areas of Learning. Children’s skills are developed through active learning experiences that provide context and develop their understanding of how and why ICT is used. More recently in the revised Areas of Learning for Language, literacy and
communication and Mathematics Development, ICT has been included in the range of experiences to encourage, where resources permit, children to develop their basic skills through emergent technologies.

2.17. Through the teaching of ICT, at key stage 2 and key stage 3, learners should be given the opportunity to use an increasing range of ICT tools and resources to find, process and communicate relevant information from a variety of safe and suitable sources; to develop and communicate their ideas in appropriate ways with a developing sense of purpose and audience, to use a range of ICT skills and resources to find, analyse, communicate, present and share information and become increasingly aware of the social, ethical, moral and economic effects of ICT in the wider society.

2.18. ICT, coding and the use of digital technology has already become integral to the delivery of the curriculum in many Welsh schools. A number of steps are presently being made to encourage further growth in this area. The Welsh Government has allocated £450,000 of funding for the delivery of computer coding workshops to pupils and teachers in every secondary school in Wales. These workshops will provide opportunities for teachers and learners to develop hands on experience of a range of coding activities and tools including Raspberry Pi and .Net Gadgeteer. The aim of these workshops is to improve the teaching of computing in secondary schools in particular ensuring that every secondary school has one or more teachers with direct experience of working with code.

2.19. In March 2014, the Minister for Education and Skills appointed Professor Graham Donaldson to undertake a comprehensive, independent review of curriculum and assessment arrangements in Wales. He is tasked with putting forward recommendations for a clear vision for education in Wales, from Foundation Phase to Key Stage 4. Professor Donaldson is considering the recommendations from several task and finish groups including those put forward by the ICT steering group. He has also met with the co-chairs of the ICT steering group, Stuart Arthur, Dr Tom Crick and Janet Hayward, as part of his evidence gathering process. Professor Donaldson is due to report his findings to the Minister for Education and Skills at the beginning of 2015.

Industry and Infrastructure

2.20. Welsh employers have expressed concern over the relevance of what is being taught in schools, the resultant effect on young people being ‘switched off’ careers in the ICT sector and their lack of the necessary digital skills for the current and future jobs market.

2.21. At the request of the Welsh Government an ICT Steering Group was established to review ICT curriculum in Wales. A report was published on 4 October 2013 recommending the need for ICT Curriculum changes. The report contained 12 recommendations including the suggestion that a new subject named Computing should be created to replace ICT. This new subject will disaggregate into two main areas: Computer Science (CS) and Information Technology (IT).

2.22. The Welsh Government’s ‘Programme for Government’ committed to creating a superfast broadband network in areas of Wales, the resulting Superfast Cymru Programme is the largest partnership of its kind in the UK, working to give, when combined with commercial roll-outs, 96% of premises in Wales access to fast fibre broadband by 2016.
2.23. The Welsh Government has worked with LINX (the London Internet Exchange), Cardiff Council and other partners to create an internet exchange that enables internet service providers to exchange internet traffic between their networks.

**ICT Qualifications**

2.24. Digital Literacy, creativity and innovation are at the heart of the transferable skills, which are central to the revised Welsh Baccalaureate and Essential Skills qualifications. A primary objective of the revisions to these qualifications is to ensure that learning and assessment are relevant and engaging so that learners are well-equipped to meet the anticipated challenges of life in the twenty first century.

2.25. The revised AS and A level qualifications in Computer Science will be taught in Wales from September 2015. The content of this specification reflects the views of higher education and other stakeholders.

**ICT Pedagogy**

2.26. The New Deal for Practitioners will be announced early in the New Year and is the workforce development plan to support the delivery of Qualified for Life. The New Deal will focus on the development of the education workforce in Wales and will support the implementation of the recommendations from Professor John Furlong and Professor Graham Donaldson.

2.27. A report on the review of ITET in Wales in 2013 recommended that we continue to utilise and maintain incentives as a flexible measure that can be adjusted annually to encourage the recruitment of high performing candidates in specific areas of need. The report findings concluded that the incentives targeted to the highest achievers in terms of subject specialism, degree classification, and that incentives along with the adoption of new initiatives are essential measures that are needed to promote teaching as a career for the very best graduates in Wales.

2.28. The Welsh Government is currently considering the scope of the financial incentives available to support Initial Teacher Education and Training during academic year 2015/16. To support recruitment in academic year 2014/15 we have made incentives of up to £15,000 available, depending on degree classification, to graduates undertaking postgraduate course of teacher training in ICT/Computer science in Wales. Postgraduate ITET students are also eligible to receive the Tuition Fee Grant of £5,535.

2.29. ICT/Computer science is also a designated recruitment priority subject for the employment-based Graduate Teacher Programme and participating schools can receive support toward salary costs.

2.30. Recruitment to intake targets in ICT and computer science subjects remain challenging. Initial data for recruitment in 2014/15 academic year shows that ITET providers are

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558 [http://www.wjec.co.uk/supporting/wjec-qualifications-in-wales.html](http://www.wjec.co.uk/supporting/wjec-qualifications-in-wales.html)

experiencing some difficulties in recruiting to target in IT related courses and Welsh Government is considering options for more effective targeting toward recruitment priority subjects.

ICT and Vocational Education

2.31. Our Traineeship programme aims to support young people gain sustained employment by helping them develop confidence and motivation, improve their skills levels through the delivery of NVQs in any chosen occupational area, as well as gaining employability skills and valuable work experience, aiding transition into employment. The programme is for 16-18 year olds not otherwise engaged in post-16 education or employment and offers a tailored package of support for a young person, ensuring that a wide range of skills are developed.

2.32. The programme seeks to improve skills levels through the delivery of entry level qualifications up to NVQs Level 1 in their chosen occupational area and includes the delivery of essential skills qualifications to enhance their learning experience. The Essential Skills Wales suite contains learning on communications, application of number, ICT and wider key skills.

2.33. These skills include the development of any ICT skills which are deemed to be relevant or necessary to the occupational focus. The programme aims to ensure that the young person is able to sustain employment in an increasingly digital environment; developing the necessary skills and confidence to succeed.

2.34. Learners on Engagement Traineeships can undertake qualifications at Entry Level in the Qualifications & Credit Framework (QCF) and National Qualifications Framework (NQF) and wider key skills within Essential Skill Wales qualifications at level 1. For a Level 1 Traineeship, learners can undertake approved qualifications at Level 1, or an Essential Skills Wales qualification at level 1 or 2.

2.35. In response to the Review of Qualifications, the current Essential Skills Wales (ESW) and wider Key Skills qualification will be replaced from September 2015 by a new suite of qualifications encompassing seven essential skill areas, which will include digital literacy as a replacement to the existing ICT element.

2.36. The Jobs Growth Wales (JGW) programme does not specifically target opportunities within a particular sector, although we have worked with a number of micro businesses/SME’s within the ICT sector. These JGW opportunities allow young people to gain valuable skills and work experience which will enable progress to their future careers in the ICT sector.

ICT in Higher Education

2.37. The Higher Education Funding Council for Wales supports the development of the higher education sector’s information and communications technology through a number of initiatives. In particular, HEFCW:

- funds the Joint Information Systems Committee, which supports UK post-16 and higher education and research
Welsh Government – Written evidence (DSC0123)

- has invested in a Welsh Video Network for the sector - one of the largest Internet-based videoconferencing networks in Europe

2.38. Technology helps provide the platform to showcase to the wider world the innovative uses of technology being made by Welsh education providers to enhance the learning experience. It has made the delivery of higher education more accessible to, and flexible for, a range of learners across Wales and, in some cases, increased rates of student retention. On-line fora give greater access for higher education providers to engage in pan-Wales developments, such as Open Education Resources Wales, and to engage with developments led by UK-wide organisations such as Jisc and the Higher Education Academy.

2.39. One positive impact on students is the Virtual Learning Environment. VLEs have provided students with a single, streamlined gateway to learning materials and resources, which because they are available on-line, can be accessed at their convenience. This flexibility is often enhanced through the use of apps, Wi-Fi and/or bring your own device (BYOD), which allows students to take full advantage of their institution’s e-resources. For staff, VLEs have given them greater flexibility when managing their courses and contacting the students. Making materials and resources available through these systems has allowed staff to tailor modules more fluidly and adapt to students’ suggestions.

2.40. The development of Open Educational Resources for the Welsh-medium e-learning portal, 'Y Porth', has promoted the innovative use of technology in the sector and is a leading example within, and beyond Wales, of good practice in promoting open access to materials. The VLE on 'Y Porth' and a network of interconnected Learning Spaces has allowed universities across Wales to share resources and deliver modules collaboratively

Essential Skills in the Workplace
2.41. The Essential Skills in the Workplace programme is a European Social Fund (ESF) programme led by the Department for Education and Skills (DfES) in Welsh Government. It is designed to address the high proportion of adults in Wales without the necessary literacy, numeracy and ICT skills to function effectively in the workplace. It can be arranged to take place at the employer’s workplace at times to suit employers and employees alike. The programme aims to encourage employer engagement by raising awareness of the benefits of addressing low skill levels within the workplace. The key objectives of the programme are:

- To increase and enhance provision of essential skills support (including. literacy, numeracy, ICT and English for speakers of other languages) up to and including qualifications at Level 2.
- To increase employer engagement in the delivery of basic skills support by raising awareness for the need for a skilled workforce and to gain the employers’ commitment to supporting essential skills training for their workforce.
- To increase training for basic skills tutors/mentors delivering basic skills support in the workplace.

Wales Union Learning Fund
2.42. The Wales Union Learning Fund (WULF) was launched in April 1999 in order to build capacity within the Union movement to maximise learning engagement with both individuals and employers. Since its inception, the WULF programme has assisted and
encouraged a wide range of learning. The programme focuses on increasing the take-up of learning by non-traditional learners; and overcoming barriers to learning, such as personal, occupational or work based factors. The delivery of WULF’s objectives is supported by Union Learning Representatives (ULRs).

2.43. Through WULF, the Unions, employers and ULRs have worked together to create workplace learning centres. These offer individuals of all ages, across Wales, an opportunity to develop or refresh their skills. They also offer an opportunity for individuals to access and use the ICT equipment available in the centres. Many of these centres are open to the public to allow both the community and union members to access learning opportunities.

2.44. In 2014, the Unison union opened their first Digital Learning Hub in Wrexham, and the Unite union has worked with an employer in Rhondda Cynon Taf to open a Learning Centre at which is available for their employees but to also be open to individuals with disabilities/health conditions within the RCT community.

Digital Inclusion

2.45. Good progress is being made to tackle digital exclusion in Wales. The National Survey for Wales 2013-14 tells us there are 21% of Welsh adults who do not regularly use the internet, compared to 34% in 2010. Some 18% have never used it.

2.46. Our Digital Inclusion Delivery Plan sets out targets and actions to reduce digital exclusion amongst Welsh adults to 18% in 2015 and 13% in 2017. The 2017 target date aligns with the Department for Work and Pensions target for getting Universal Credit claimants online, which we know will pose a challenge for many.

2.47. Digital inclusion continues to be embedded across other key related Welsh Government policy areas including our Older People’s Strategy, Tackling Poverty Action Plan and Framework for Action on Independent Living. Digital Inclusion is one of the five key integrated strands which feed into the Welsh Government’s Digital Wales Strategy.

2.48. We have a strong record in Wales of investing in digital inclusion activities across our communities to ensure as many people as possible benefit from the opportunities offered by the latest technologies. Our current European funded Digital Inclusion programme, Communities 2.0, helps to break down the barriers for our most digitally excluded groups in society to get online. The programme also helps social enterprises and community and voluntary organisations adopt and exploit digital technologies. The numerous case studies on the Communities 2.0 website demonstrate how the programme is having a positive impact on people’s lives.

2.49. Communities 2.0 prioritises support to older and disabled people, social housing tenants and the unemployed and working age economically inactive. Through community based sessions, Communities 2.0 provides invaluable support to help individuals overcome barriers, build their confidence and create opportunities for them to use new skills. Sessions range from absolute beginners courses where individuals learn basic internet skills, including how to use a keyboard and mouse, to more advanced digital skills. To date, the programme has supported over 52,000 individuals to get online.
2.50. Communities 2.0 works closely with partners across the public, private and third sectors to widen the reach of the programme and make activities more sustainable. The Programme has brokered mutually advantageous relationships, like the strong partnership which has developed with public libraries and Jobcentre Plus to ensure claimants are supported to acquire the basic internet skills required to search and apply for jobs.

2.51. In addition to working with and through willing partners, key elements of good practice contributing to the programme’s success include finding appropriate “hooks”. The use of engaging cultural content like the ‘People’s Collection’, which is a website full of fascinating photographs, sound recordings, documents, videos and stories about the history and heritage of Wales and its people, is one such example. Increasingly, people are requesting support to help them use Skype to keep in touch with friends and family and want to learn more about social media. Developing and offering provision in small informal sessions with no ongoing commitment and making effective use of volunteers based on sound models for “Training the Trainer” have also proved successful.

2.52. The Communities 2.0 programme ends in March 2015. A successor digital inclusion programme is in development, which will focus on the digital inclusion of individuals by building on the strong partnership working and co-ordination activities undertaken by Communities 2.0.

2.53. In addition to developing local initiatives, Communities 2.0 have brokered national initiatives to support our priority groups. The Royal National Institute of Blind People (RNIB) Cymru ‘Get Connected’ Project, supported by Communities 2.0, was particularly successful and helped over 1,500 people with sight lost to use technology to enable them to live more independently. This project formed the basis for RNIB’s ‘Online Today’ programme, which recently received £5.8m from the Big Lottery’s Basic Digital Skills Fund.

Academia’s role in digital inclusion

2.54. The Welsh HE sector has faced challenges common to many sectors eg, resourcing issues; addressing preconceived perceptions among staff and students on the use of technology; and recognising that it can take time to embed activities into existing learning and teaching practice. However, technology has had a positive influence on many aspects of the Welsh learning and teaching experience. From the more common uses of technology, such as VLEs, to the more ground-breaking ways of engaging the student, Welsh higher education is helping to make a real difference to the way students learn and interact with their institutions. It is also helping to promote the Welsh language, improve teaching methods and support institutional good practice. The challenges for the future are to build on the practices and innovations already introduced and establish technology as a normal part of the mainstream provision of processes and practices.

2.55. The Programme has developed local initiatives to tackle digital exclusion on a county basis. The Programme has worked with key local stakeholders to develop partnership agreements which support each local initiative. This has been particularly successful in achieving stakeholder buy-in to help secure the sustainability of the initiatives.
Welsh Government – Written evidence (DSC0123)

3. What are the main challenges for economic growth as the UK (and Wales) transitions to a knowledge-driven economy?

3.1. A fundamental and key challenge facing the ICT sector in Wales is the need to address the increasing shortage of qualified, time-served ICT professionals across all sectors in Wales. With ICT playing an increasingly important role in the growth of other sectors, a shortage of the right skills will have a far reaching impact on the economy of Wales.

3.2. Industry believes that future market opportunities will be led by developments in new services, platforms, data and networks and the ability of all sectors of the economy to be able to take advantage of commercialisation opportunities.

3.3. The pace of change through the daily development of new and emerging technologies is driving a greater need for Wales to remain competitive on a global stage. The Welsh Government therefore agrees that ICT skills must keep pace with these technological advancements as a strong ICT sector is critical to Wales.

3.4. The digital skills requirement is predicted to evolve rapidly and in response to those changes, the Welsh Government has considered the range of skills that would be required by the ICT sector, skills for the digital economy and social skills that can be applied when technology changes.

- Scale of activity (complex, national model)
- Supplier and contract management
- Sustainability
- Variation in use of digital technology in education across Wales
- Delivery partner and stakeholder management
- Resource challenges (internal and external)

Annex 1

Policy Statement on Skills and Skills Implementation Plan

The Policy Statement on Skills, launched on 30 January 2014, sets out a vision for employment and skills policy in Wales over the next 10 years and the responsible action needed by all stakeholders to develop a resilient, responsive and sustainable post-19 skills system. It also recognises the tough choices ahead if Wales is to deliver the skills needed to raise productivity levels and reduce barriers into employment.

A fundamental commitment within the Policy Statement was to publish a Skills Implementation Plan (SIP) focused on the key actions to be taken forward by the Welsh Government working with employers, individuals, trade unions and delivery partners. The SIP was launched on 15 July 2014 with the key aim of supporting Wales’ evolution into a highly skilled nation and to create the conditions which will allow businesses in Wales to grow and flourish.

Our ambition remains to develop a skills system in Wales that supports our future competitiveness, helps us evolve into a highly skilled society as well as tackle poverty, and is sustainable against the backdrop of ever scarcer resources. Our primary focus will continue
Welsh Government – Written evidence (DSC0123)

to be on increasing productivity, reducing barriers into work and supporting people into sustainable employment.

The actions described in the SIP set the foundation for developing a sustainable skills system in Wales capable of responding to an increasingly global market for skills. It also prepares the ground for conditions beyond the next round of European funding.

Higher levels of skills will be important to our future competitiveness as a nation. In reviewing intelligence available from the UK Commission for Employment and Skills Working Futures series, the indications are that, over the next decade, jobs in Wales will become more highly skilled with a reduction in the number of jobs requiring low or no skills.

Our focus is therefore on raising skills levels across the board and developing competencies in higher levels of skills. This includes raising skills levels from level 2 to level 3, for example, and is about supporting individuals to progress into higher forms of employment.

To monitor progress, we have put forward a range of indicators that will underpin the delivery of the SIP. Published in September 2014, these ‘Skills Performance Measures’ are focused on the following four key areas:

- **Jobs and growth**: Improvements in employment and productivity levels;
- **Equality and equity**: Providing equality of opportunity for individuals in accessing post-19 employment and skills support;
- **Financial sustainability**: Ensuring an appropriate and sustainable balance of funding is available to support the skills system sourced from government, employers, individuals and European funding; and,
- **International skills benchmarking**: Improving the skills profile of Wales to ensure we remain competitive as a nation.

In addition, it is recognised that if Wales is to close the gap with other parts of the UK in terms of employer investment in skills, it is important that we take steps to ensure that more employers are investing in the skills of their workforce.

Our co-investment framework, published in November 2014, recognises the varied and wider range of investments being made in skills and thus focuses action on three areas:

- **Influence** – detailing the action that government can take, working with employers, providers, unions and other stakeholders, to influence the investment decisions being made by employers.
- **Investment** – defining the collective responsibility for skills investment (co-investment) and the investment principles which will drive areas of government and employer intervention.
- **Impact** – linking and evaluating investment decisions with Skills Performance Measures highlighted above, and ensuring that there is appropriate performance accountability factored within relevant areas of policy and programme delivery.

11 December 2014
Environmental, social issues with regard to developing the UK knowledge based economy and digital infrastructures

The broadcasting and connected digital media industry is now the fastest growing uncontrollable and unmonitored expense to both industry and the environment. From TV to telecoms and the Internet, the industry has now expanded into every walk of life from online shopping to banking to gambling, offering society some benefits but also some problems often hidden. The UK is concerned that with rapid digital information developments in countries such as China and India, that our younger generations and UK Inc. must be able to compete to ensure a stable economy. It is essential that the UK considers all the impacts of encouraging even further exponential growth of this industry.

Allow me to explain my concerns which address the environmental, physiological, social and psychological impacts of focusing on further digital fluency across all sectors.

Background to my concerns:

Digital technology is promoted as “clean” technology. For many consumers, only the device energy is apparent. Manufacturers making devices promote new low energy devices but that is not where the energy stops. How connected devices are used has a much greater impact on energy. It takes power to move data packets around the Internet, stream videos, store data and energy to cool the devices storing the data. UK society is creating enormous volumes of data as are other countries. We are encouraged to consume content anywhere anytime and on a plethora of devices. According to the EMC report\(^{560}\) our demand for data creation and storage is growing. The average family generates enough data to fill 65 iPhones each year but by 2019 this will be 325 iPhones (32GB). Much of this data is stored on the “Cloud” yet currently available storage capacity is 33% but in 2020 will reduce to 15%.

Not only are we using greater numbers of connected devices but many of them are switched on and in 2013 the report states the world’s networked devices used 616TWh but two thirds was digital waste. Estimates are 400TWh was energy from standby mode thereby wasting electricity equivalent to the energy consumed in the UK and Norway. In the recent IEE report\(^{561}\) from the IEA “The proliferation of connected devices brings many benefits to the world, but right now the cost is far higher than it should be,” said IEA executive director Maria van der Hoeven.

Marketing has driven society to be device hoarders as new devices do not replace old ones but rather duplicate existing data. Data takes storage and storage requires energy.

Only 30% of the world is currently connected but the remaining 70% wants to be.

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The chart below shows the internet data input use and the rapid growth all of which requires energy.

If industry, educational establishments and the general public continue to create and consume content at the rate they currently do so, society will hit a brick wall where there is no more space for data storage or we will continue to increases CO2 emissions when the UK government has signed up to CO2 reductions. The internet will likely become for the rich and not a right for all but a privilege. The amount of data in the digital universe in 2012 was 1.9 zettabytes. This year there are 4.4 zettabytes. Put simply that is the data in iPad airs stacked two thirds the way to the moon. By 2020, it is predicted this will be 44 zettabytes. Storage requires energy and energy is predominately derived from fossil fuels hence exacerbating climate change. With increasing pressure to expand the digital universe where what is the true cost?
What will be the implications for the Government?
Quite simply blackouts and more extreme weather unless we create truly “clean” energy.

I am currently working with the EU funded project, Climate KIC at UNIBO in Bologna and at my previous placement was at Warwick University. This summer, I was tasked with calculating the carbon footprint of IT services on the campus. For years the estates department has managed to reduce electricity consumption year on year as I am sure Parliament has but since mobile connected devices became mainstream, the energy bill has soared. Just to charge student cell phones is costing Warwick £66,000 per year. My surveys show few students read books despite research showing more is retained from a physical book/paper than from digital media. Many students are distracted with their digital devices in class.

Considering the exponential growth of data and the energy requirements to support data traffic, increasing supplies of energy will be required. However, the Government must consider the implications of using fossil fuels, in particular shale gas, not just as a quick fix but the environmental impact of doing so.

Is the Government prepared for these changes?
I am not sure the UK Government is prepared for the negative impacts of focussing on the development of digital skills. If focussing is to only compete in the global digital arena, then if climate change continues as we are now experiencing there will be no economy as such. Are infrastructures going to be in place to provide societal support from banking to shopping to education when we start experiencing power outages? How will bills be paid, how will trading in stocks continue etc during anticipated future scenarios?
Are schools, further and higher education, businesses and other sectors ready for the implications of the changing digital landscape?

Well this depends how. Sustainable development and impacts of digital development both at the product and service end and the downstream consumer end should be included in every faculty discipline to ensure digital development does not progress at a cost to the environment. If professors such as at Glasgow University distribute posters with instructions how to tweet in lectures then we are increasing further the energy drain from non essential Internet use.

Current use of connected digital technology is affecting our students. I urge the digital skills committee, to have a conversation with a variety of lecturers and discover how we are struggling with many psychological and sociological changes on students.

- Reduced attention spans
- Students who believe everything in Google
- Students who are having problems of addiction, isolation\textsuperscript{562} and losing social skills of conversation. The latter is of concern in the workplace.
- 50% students are connected to social media in class and are texting not listening to professors. Students need to be prepared that when working their bosses will not appreciate a 50% performance.
- Children are already spending more than the recommended time in front of a screen.\textsuperscript{563} Pre-school, infant and junior school children will pick up digital skills as needed but adding hours in the already tight curricula to teach coding at a young age risks creating a generation of isolated individuals that have more of a relationship with a device than with fellow human beings. Furthermore, in light of the changing global landscape it is the author’s opinion that more important subjects such as mitigation and adaptation should be included in the curriculum.

Many of these problems are due to an overwhelming lack of knowledge about how to live sustainably. In my work I find most people know we have a planetary problem but most do not see their life-styles as being responsible for many of the problems. In addition, many people have misinformed assumptions about the digital world. In schools and universities across the UK, there is evidence of disconnection between taught disciplines. E.g. I might teach environmental economics including circular economies yet an Economic’s professor might only be teaching traditional economics. An environmental scientist might lecture on e-waste and resource scarcity yet the Business studies professor talking about marketing will stress the importance of supply and demand, finding new and ever increasing markets yet not consider the resulting waste.

\textsuperscript{562} In a student survey carried out this month by the author, showed 25% students noted concerns about loneliness and isolation due to excessive screen time.

\textsuperscript{563} [2006] Christakis Dr. Dimitri, Director of the Centre for Child Health, Behaviour and Development Seattle Children’s Hospital and Frederick J. Zimmerman

The Elephant in the Living Room: Make Television Work for Your Kids.
Does the UK have the infrastructure to remain competitive with these new technologies when compared to other countries?

Copying China is not the answer but neither am I saying we should stop technological development. Rather than concentrating on the digital universe, we need to be

- developing carbonless technology
- developing substitutes for elements such as indium used in touch screens, neodymium used in headphones
- devising new ways to recycle electronic devices to avoid gold, platinum and palladium returning to China
- mitigation and adaptation strategies for the inevitable problems we are already seeing with climate change
- business models that ensure digital infrastructures take not only responsibility for their in-house impacts but also the downstream carbon impact for those using their services.
- battery technologies to store energy from renewable sources
- methodologies/technology for combating cyber crime

All of the above outputs will have a global market for UK businesses.

If you are familiar with Erhlich’s IPAT equation of \[ I = P \times A \times T \], you will appreciate that technology cannot be the answer and the Internet of Things is a dream potentially more damaging to society than beneficial. When I was at the BBC in 2012/2013 (BBC R&D working on sustainability of broadcasting technology) we urged management to retain analogue transmitters for wind-up radios. In times of blackouts from flooding, exceeding the grid capability or other catastrophes, digital technology will not work and the government needs to know how to communicate with the people. In Bologna, yesterday the storms shut down the wifi and internet connections during a massive storm.

What is the pace and change of the future digital technology landscape over the next five, 10 and 15 years? What are the leading innovations?

In 33 years we are forecast to run out of copper and in only 17 years for silver. More research is required for new materials.

2k high definition television is set to be replaced by 4k and 8k or television with 16 times the resolution is planned for the consumer market in 2020 in Japan. It is expected that tablet and Smartphone screens will also be built with 8k screens. To achieve such high resolutions requires energy and apps that are developed will be transporting potentially more than the current 100 hours of video uploaded onto YouTube each minute.

I was at the IBC (International Broadcasting Conference) show in Amsterdam in September and 4k (the next generation of 2k high definition television is available in shops. But NHK were showing the TV set for the home expected in 2020. MY Samsung TV set pulls about 55W from the grid, a little more if I watch Strictly Come Dancing but these new 8k sets will

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565 [2012] IIB Stock Check Estimated remains of the world’s non renewable supplies. With data from Worm etc al London Metal Exchange
require 2.52KW. If UK families buy these there will not be enough power to make them work. 8k will not only impact TV’s but also the mobile devices will adopt 8k and again we increase the e-waste and the grid demand.

Graphene adoption has the potential to generate many new energy applications.

**What are the main challenges for economic growth as the UK transitions to a knowledge-driven economy?**

Questions need to be asked e.g. are we following the rest of the world or are we going to find our British innovation to address environmental issues and allow our businesses to survive longer than those in the rest of the world? The UK has the potential to solve environmental problems if technological research is directed appropriately.

**How are schools preparing to deliver the new computing curriculum in an innovative way?**

As recently suggested for junior school curricula, teachers are going to teach coding then they must be taught how to teach efficient coding rather than coding for coding’s sake as inefficient coding uses more device power. They must also teach the need to moderate time spent coding. Many dyslexic students find coding relatively easy due to their heightened spatial awareness, strong visualization, strong kinaesthetic thinking abilities and creative problem solving. Teachers are conscious that not all students will learn in the same ways but with dyslexic students this may need careful attention. However, there are issues and not all teachers may be aware of these with respect to coding. There are various forms of dyslexia but where some students have problems with text, choosing an individual’s suitable coding language might be beneficial to accurate coding. Using colours to help separate lines/text in code editors might be an option.

**How can the education system develop creativity and social skills more effectively?**

As an educator, I strongly feel we need to do this but not necessarily only with technology. My surveys show that 68% students at university want to interact with a professor and not just a digital device. Studies are now being published regarding the impact of excess screen time, from reduced exercise to isolation and the assumption that a Facebook “friend” has meaning.

Students need to learn what has value and what doesn’t. Social media to announce using a video you are eating a pizza has no meaning yet consumes energy in the device, in the internet and for streaming the bytes. Besides digital fluency, students need to learn about energy management, recycling, re-using, re-manufacturing techniques, repairing. The latter could provide a generation of kids with apprenticeships and future employment when resources become scarce.

**How does the current post-16 system inspire and equip students to pursue careers in the future workforce in occupations that may not yet exist? How can this be improved?**

My summer project with Climate KIC was to forward and back cast to 2025 the current UK education system with regard to the use of digital technology. Many people assume that digital is the only way forward. There are assumptions from media articles etc that digital

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[566] [2004] Powell N., et al Dyslexia and learning computer programming Leeds Metropolitan University
means “environmentally clean”. Data must be published to support this and reduce the perceptions on which business decisions are being made. Take for example the pharmaceutical industry where I once sat on an ethics board in Canada advising how they test drugs on humans. New drugs do not get to the market without massive testing and yet we allow digital technology to be thrown towards developing minds with little thought about the impact.

**How can the digital sector be supported in the short- and medium-term? What is the role for higher and vocational education, national colleges, industry, and industrial policy?**

It is important to analyze the impact positive or otherwise regarding the use of digital technology in the learning space before adopting it based on the perception it is the way forward.

Policy makers need to understand the environmental implications of initiatives. I was quite offended by the recent reply from the conservative Education minister’s assistant saying we needed to have digital technology for the economy first.

**Is there an inclusion agenda in relation to digital skills in the workplace? How are groups with protected characteristics such as older people, those with disabilities, and women, being engaged? How can this be improved?**

- More education is required to alert all sectors of society about the impacts of digital technology.
- More needs to be done developing internet skills for the blind.

I asked a senior executive from a major broadcasting supplier, "... what was his strategy for the shortfall of rare earth elements that would impact his equipment production line." His reply was that his procurement department would always find something. However, when the fridge is bare there is not food if the floods have wiped out the crops and the animals.

**What are the barriers for businesses, particularly small and medium enterprises (SMEs) preparing to operate in a knowledge-driven economy? How are these best overcome?**

The biggest barrier is lack of sustainability knowledge and awareness followed by lack of financial support to develop small scale digital support rather than at the large scale capability of the major blue chip companies. Education is required regarding the impact of business actions along the entire value chain.

There are potential opportunities for SME to develop cottage industries for repair, re-manufacture and re-use or alternative use.

**Does the UK understand the psychological and physiological impacts of increasing our use of digital technology?**

There is a major lack of awareness and a further expense to the NHS. Doctors are treating neck and back problems from holding connected devices in abnormal ways for extended periods.

Psychologists are treating loneliness in teenagers when supposedly social media should prevent this. We are also raising a generation of children who have never had a debate or structured conversation with a friend or adult.
How can businesses help equip the workforce with new skills in a rapidly changing environment?

Help engage staff to work with management to understand life-cycle thinking, design for the environment in new product development and develop adaptation strategies for climate change, resource depletion and water scarcity.

To conclude, I would be delighted to address the committee to explain some of the issues including:

- the global watching of one viral video – Korean pop star Psi’s Ganyam style required device, streaming and internet energy to the tune of 350GWh or 68 wind turbines providing power for 200,000 homes.
- a paper newspaper is better for the environment if you read it for more than 30 minutes when compared to reading on a tablet
- whether the Government appreciates that data protection is not adequately managed such as the constant auctioning of personal computer IP addresses to generate advertising
- stimulation of continuous networking has escalated the intolerance for boredom.
- reduced creativity and addiction
- Isolated individualism
- Fewer hours for self reflection
- Limited exposure to experiences out of comfort zone

The latter point was well illustrated by Professor Brian Cox recently at the IBC 2104 conference in Amsterdam. Bored as a teenager, he returned home from school slouched on the sofa and switched on the TV. Carl Sagan’s 1980 program *The Cosmos* on cosmology inspired him to do the work he is so well known for. I would hate to see the next UK generations become robots having only consumed content at an early age in their comfort zone, be unable to deliver verbal presentations and engage an audience.

Following disasters such as Thalidomide, pharmaceutical companies are obliged to thoroughly test the impact of new drugs on humankind. I urge the UK government to consider all the environmental impacts in developing digital skills and not just consider the economical ones.

15 October 2014

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567 2012 Bitterlin Professor Ian, Emerson first calculated the energy impact in 2012 when there were only 1.7 billion viewers.
The Wikimedia Context

1. **Wikimedia UK** is an independent registered charity in England and Wales. It is the UK chapter of the global Wikimedia movement which works to support and promote Wikipedia, the free online encyclopedia (in many languages). The Wikimedia projects include: An encyclopedia (Wikipedia); dictionary (Wiktionary); a quotation repository (Wikiquote); a textbook repository (Wikibooks); original texts, often public domain books (Wikisource); a news site (Wikinews); a learning resource and course site (Wikiversity); a directory of species (Wikispecies); software to facilitate collaborative authoring, including all of the Wikimedia sites (Mediawiki); a machine readable structured database (Wikidata); a media repository (Wikimedia Commons); and a travel resource (Wikivoyage). The Wikimedia movement is a global movement whose mission is to bring open educational content to the world.

2. Wikipedia is the fifth most visited site on the internet according to ComScore, and currently receives around 21 billion page impressions a month from around 520 million unique users. It and its sister non-English encyclopedia sites are of significant importance to global education. Their collaborative creation and maintenance, and open licensing, are significant in the context of 21st century digital skills which is the subject of this consultation.

3. Wikimedia UK exists to collect, develop, promote and distribute openly licensed knowledge. We do this by supporting volunteer editors and contributors – Wikimedians – and by working in partnership with cultural and educational institutions. Wikimedia UK’s mission is to help people and organisations build and preserve open knowledge to share and use freely. Our long-term vision is open knowledge for all.

Contributors to this evidence

- **Simon Knight**, Vice Chair of Wikimedia UK board of trustees.
- **Michael Maggs**, Chair of Wikimedia UK board of trustees.
- **Charles Matthews**, Wikimedia UK volunteer and educational content contractor.
- **Martin Poulter**, Jisc Wikimedia Ambassador.
- **Toni Sant**, Wikimedia UK Education Organiser.

4. This evidence was openly drafted on the [Wikimedia UK Wiki](https://wikimedia.co.uk) and builds on The WMUK response to European Commission copyright consultation and The WMUK Education Strategy pages

The Wikimedia movement and Education

5. We have significant experience in the area of cultural and educational heritage. We regularly work with some of the UK and Europe’s important cultural and educational institutions, and help and encourage them to share their resources and archives under open licences. Current and recent partners include The Royal Society, The British Museum, The British Library, The Science Museum, The Natural History Museum and The National Library of Scotland.
6. Educational content that is released under open licences can be used on Wikipedia and other projects, making them available to others to use, reuse, distribute and adapt for other purposes, including commercial uses. The Wikimedia projects are working to facilitate open access to the sum of human knowledge. They are widely used by other resources and the structured nature of the data has facilitated innovations in how we access and consume knowledge on the internet (including, for example, in Google’s Knowledge Graph).

7. In addition, the movement is engaged in direct educational outreach to give greater access to the Wikimedia projects, particularly to those who would otherwise have limited access to educational resources, for example:

- **Wikipedia Zero** is a project in which mobile carriers agree to 'zero rate' traffic to Wikipedia, rendering such access free to the end user.
- **Kiwix** provides a fully downloadable copy of Wikipedia and its embedded media which can be delivered over a local wireless network, thus making available an ‘offline’ copy for fast access in places lacking internet access (such as rural areas, or countries with slow or uneven internet coverage), schools (where vetted copies may be provided), and prisons (again where vetted copies may be provided, and internet access is otherwise restricted).

8. The movement has also worked to engage students in the practices around Wikimedia projects through the **Education Programme**. Such programmes typically involve students learning about a subject, by creating and editing content about it (sometimes in a second language), often for course credit. There has been recent interest in Israel and Serbia around introducing the projects to school aged students and teacher education courses.

1. Educational context

9. Our responses in this section primarily relate to prompts 4, 5, 7, 8 and 14. We are interested in the digital skills required by all citizens (4), and the ways such skills can be (and are) taught (5), including with regard to lifelong learning (8) inclusive of workplace learning (14). The Wikimedia projects have a particular focus on the social element of learning (7), being a community driven set of projects, each with their own norms and practices, and each striving to release our cultural heritage as open knowledge for all.

1.1 Skills education for the future workforce

10. As Wikimedia contributors, we think of wikis as both a resource and a process. The education sector deals with the same distinction between resources and processes. What makes the Wikimedia projects distinctive is they provide not only content, but practices. In the global Wikipedia community such practices produce, review and improve a work that digests the state of published knowledge. Wikipedia is just one example of an Open Educational Resource (OER), but the only one that is a household name.

11. The **JISC/HE Academy-funded UKOER programme** is now in its third phase, and has put millions of pounds into a wide variety of OER projects. The term **Open Educational Practices (OEP)** has been coined to cover the context and use of OERs: the practices teaching staff, learners, institutions, and policymakers need to get right if they want to **reap the benefits of open education**. Educators are moving forward from simply putting out content. The Wikimedia community has a head start in the added factors, such as opening up educational
resources, on the one hand making them accessible and remixable with appropriate formats, licences and data, and on the other making familiar the edit button, with its chance of meaningful and rewarding collaboration. From resources, we can learn the biography of a historical figure, the source of a quotation or the meaning of an unfamiliar word. From engaging with an online community and its practices, we may learn about collaboration, about bias, about fact-checking, and about accepting and giving criticism. The saying "the important thing is to take part" may have a sporting origin, but it also explains the educational value in wikis. This is particularly true given the increasing need for online, 'always on', and lifelong learning. It is common ground that developing general information literacy is important for the future.

12. The Wikimedia projects, a valuable and widely-used resource, can shed light on educational issues, and there are half-a-dozen strands, going beyond learning factual information. How to make best use of projects such as Wikipedia; how to reuse their material; how to write in a concise, clear style (through working on the Simple Wikipedia); how to acquire foreign language skills? (through comparing multiple Wikipedias); how best to interact with an online community; how to respect copyright and plagiarism as problems, when widespread online sharing of information and multi-media are culturally embedded.

13. The 2009-2015 PISA definition of reading indicates that: “Reading literacy is understanding, using, reflecting on and engaging with written texts, in order to achieve one’s goals, to develop one’s knowledge and potential, and to participate in society” (OECD, 2013, p. 9), recognising the importance of authentic situations, including multiple (often conflicting) documents, for developing literacy. In short, literacy is not just a matter of being able to say the words aloud. The cited skills are exactly those involved in Wikimedia projects. They cover: finding, corroborating, synthesising and judging the significance of claims; working critically with others in a digital environment; following a set of community norms and practices. Systematic engagement with Wikipedia offers a set of key skills, especially through classroom assignments for article writing/editing and related activities. These skills include the ability to: to produce data for the web (rather than merely consume it); take advantage of the benefits of crowdsourcing knowledge; and the ability to distinguish between reliable, less reliable, and unreliable sources, as well as other critical thinking skills.

1.2 Teaching to inspire for the jobs of the future

14. Despite these fresh definitions of literacy, the English and Welsh school assessment systems have been increasingly returning to offline, end of year, high stakes assessments. The impact of such changes permeates the whole curriculum and pedagogy, with teachers encouraged to teach to the style of response students will be expected to reproduce in examinations. There is a need for innovation in assessment, to focus on authentic problems. While in Denmark, to give an example, for four years now at least some students have had access to the internet during examinations at both the school leaver and university level, the English and Welsh systems remain largely paper based, closed book, and examination focused over problem based learning or coursework focused. The performance of the knowledge practices we hope to bring our students in to is still largely neglected.

15. In the Wikimedia context, “more than 7,000 students” have participated in the Wikipedia Education Program around the world. Students engage in editing Wikipedia articles, typically for course credit. There is a technical aspect, and students have for example to learn how to
use a markup language, to insert images or references. But the more important focus is around their literacy and subject knowledge – students have to absorb the practices of Wikipedia, place a particular subject in context, and write neutral, accessible material citing reliable sources while respecting copyright. They contribute live to public understanding, with work of value. The American Association for Psychological Science (APS) now runs a Wikipedia Initiative, and supports university lecturers in setting psychology based Wikipedia writing assignments. The authentic nature of the task of editing Wikipedia, especially the fact that students see their work as real contribution, offer a broad lesson on bringing assessments into the 21st century.

1.3 Informal and workplace learning

16. It is also essential to provide the opportunity for future workers to understand how the most popular non-commercial source of online information is produced, to enable them to make best use of this resource in the context of their own work-related endeavours. The points made above all apply to the lifelong, informal, and workplace learning contexts too. With the rise of 'always on' technology has come an increasing need for 'always on' educational resources and courses. This is seen in the growing interest around Massive Open Online Courses, and developments in 'edutainment' including the TED talks. What is striking, however, in such developments is that many build in community elements: discussion forums and comment systems, local events, and social recommendations. There is a need for technical support and legal reform to facilitate innovation in this area.

2. Legal and social context

17. Our responses in this section primarily relate to prompts 1 and 2. The Wikimedia projects have been widely used in innovative contexts. That includes reuse of content where innovation comes as a new form of content delivery, filtering, or remixing (1), and, for example, where open licensing allows data mining techniques, and so a better understanding of our knowledge base and cultural heritage (1). There are still limitations to such innovations, in particular around intellectual property. The legal position has not kept up with technological change (2).

18. We believe that open licensing which facilitates the use, remixing, and reuse of materials (including software), and provides scope for collaboration, leads to innovation and economic impact. All Wikimedia websites create teaching materials that can be used across all borders. They benefit from the excellent work on cross-border licences done by Creative Commons; but editors and re-users of Wikimedia content still may not be able to benefit from such consistency in using existing educational materials. Access to educational resources is increasingly online, and via personal devices such as tablet computers. Yet there are barriers to such access.

19. Wikimedia UK looks at cultural and educational institutions: libraries, museums, galleries, universities and schools. Our argument is that, through such changes, society will benefit. The breadth of materials available to authors, creators and innovators works to improve resources for those who wish to learn. The UK must recognise the value of knowledge building. There is an alternative to constant re-invention of the educational wheel, namely building on our existing achievements and knowledge, and collaborating broadly.
20. There are, however, a number of impediments to this vision at present. Legal and social challenges acting against digital innovation should be considered more closely. They include:

- Copyright: Open licences facilitate collaboration, use reuse and remixing, and innovation
- Technical infrastructure: Open infrastructure through open source software favours collaboration, and new data mining ideas
- Cultural change: Towards open release, particularly by public institutions

21. These points cover copyright, as well as technical and cultural restrictions on how materials may be accessed.

2.1 Copyright

22. Open licences facilitate collaboration, reuse and remixing, and innovation. Educational institutions should be able to provide access to all of their collections (whether in or out of copyright) over the internet, with appropriate technical safeguards for copyright-protected content.

23. There is an existing though extremely limited exception that allows institutions to make works in their collections available. The terms are ‘for the purpose of research or private study, to individual members of the public by dedicated terminals on the premises’ (article 5(3)n). This scope is no longer aligned with the reasonable expectations that where individuals have lawful access to content, they can access that content from anywhere. For example, no access for those who cannot travel (which might be because they are disabled, or because they lack the economic means to do so).

24. Provision of full text search should be permissible in all cases. It should be unlawful for publicly funded institutions, or those that take up public funding for digitisation projects, to charge fees for digital access to public domain content well above true costs. It should be unlawful for institutions to require a re-user of a digital copy of public domain content to agree to use limitations by contract, as a condition of providing the copy. It should be mandatory for institutions to provide public access (with technical protections against misuse if required by the copyright owner) to digitised content that has been digitised in reliance upon a preservation or an archive-related copyright exemption.

25. We would like to see all research produced directly by government and their agencies exempted from copyright altogether so that it falls automatically into the public domain, as is the case in the USA. As a matter of principle, we believe that the results of all research financed wholly or in part by public funding should be freely available, though retaining moral right protections for the authors.

26. The UK’s commitment to the Open Government Licence (OGL) has been an excellent start; continuing to release documents and data at all levels of government alongside a commitment to open licensing in government funded work (including research) is an important next step.

2.2 Technical infrastructure, the details

27. Technical barriers prevent innovation and collaboration, reduce access to materials, and restrict the vast potential innovations in areas such as data mining.
2.2.1 Restrictions to data mining

28. Our volunteers regularly attempt to mine data sources on the internet, the contents of which are freely licensed or entirely in the public domain, only to find that technical measures have been put in place to prevent or hinder automated access. Publicly-funded educational institutions, and those have received government or EU grants to enable digitisation of out of copyright (public domain) holdings, should be required to make such holdings available to the public via the internet free of charge and free of technical restrictions on downloading (that go beyond restrictions to protect the servers). Innovation is being built on mining such data sources.

29. While technical measures may have a practical justification, we often find measures that have no apparent purpose other than to frustrate and hinder. Examples include publicly funded museums and galleries that supply public domain images online but that protect them by the use of captchas, or that split such images up into extremely small tiles that are served up separately. Wikimedia websites, by contrast, are some of the most widely mined and analysed data sources on the planet. Their information is made freely available, on principle.

30. The principle that "the right to read is also a right to mine" should be enshrined in legislation. This is now required to prevent attempts to create, by physical possession and by technical means, new de facto rights which Intellectual Property law simply does not recognise. Recent changes in the UK to permit the non-commercial mining of databases are a step forward.

31. Legislation should not, however, differentiate between commercial and non-commercial activities, as such a differentiation is not proportionate in the public interest. We would like to see a repeal of the EU Database Directive. Wikimedia's experience shows that change would lead to a variety of new uses and means of delivery within the EU and across its boundaries.

2.2.2 Restrictions to use of personal devices

32. As a charity, we support the right to access information anywhere, on any device. Existing frequent use of Digital Rights Management (DRM) software cuts across such rights, to 'protect' e-lending materials, by restricting access far more tightly than the law requires. For example, DRM frustrates the ability of users to make personal copies for educational use, a copyright exception which has been upheld repeatedly in a variety of court cases in the EU and the US. It also typically prohibits the creation of open source readers and tools.

33. We believe that as an ethical and practical matter DRM should be prohibited for e-lending from public institutions like libraries. It may not be technically feasible to construct DRM systems that allow for the exceptions and limitations that are necessary for an ethical and creativity-enhancing system of copyright. to read and create content. Access and creativity are being restricted and denied.

34. In any event, the law should be clarified. It must be made clear that it is legal to create and distribute tools that allow educators, researchers, the disabled, and others to remove DRM, when that is necessary to exercise their legal rights, including using the exemptions to access material over the internet. Recent changes to UK copyright legislation go some way to
addressing these issues. However, they may put a variety of artificial constraints on
digitalization, such as allowing non-commercial use only. This seriously limits how libraries
and museums can reliably archive and publish preserved materials. It further limits the
ability of our Wikimedia volunteers, who aim to put all of our cultural treasures online for
education and reuse by the entire world, to help such institutions unlock their collections.

35. Under the current EU copyright rules, cultural heritage institutions are dependent on
permission from rightholders in order to make protected works in their collection available
online. This makes no sense. Particularly so since the majority of works held by these
institutions are not commercially available, because of their age or lack of commercial
interest.

36. The enormous potential of mass internet access is currently being held back by copyright
rules that unnecessarily restrict how cultural heritage institutions can exercise their mission
in the online environment.

2.2.3 Cultural change: Towards open release, particularly from public institutions

37. Many libraries and archives now charge excessive fees for providing a digital copy of an
out of copyright image or a page of text from an old newspaper, magazine or book. This is an
example of tendency of some institutions to use physical ownership a substitute for
copyright.

38. Fees often bear no relation to actual costs, and generally a contract has to be signed at
the same time confirming that the copy will be used only for research or private study. Some
institutions even attempt to apply DRM to public domain content. Attempts to control
access to the public domain, and to regard public domain material as a profit centre, should
be controlled by legislation. Institutions should instead be encouraged to share and
collaborate on resources. Competitive models between public institutions which penalise
open access, and collaboration, are also problematic where they lock up cultural resources

39. Legislation should reduce incentives to lock up the public domain. It should ensure that
public domain material is free for anyone to use, for any purpose, on payment of (at most) a
reasonable copying, scanning, or reproduction fee. Incentive systems must not penalise
specific institutions, as the so called Gold Access author-payment publishing route may.

Conclusion

40. There is an expectation that the fostering of digital skills in the 21st Century will take
place in an 'always on' open environment. For the potential of such developments to come
to fruition, legislative change around the opening of cultural heritage, and innovation around
education design both need support. 'Open' practices are not simply about copyright reform
and open licensing of public materials; they embody the kinds of literacies – informational
and digital – required in the digital environment, and as such deserve consideration as
important 'digital skills'.

3 September 2014
Dr Jane Winters, Adam Crymble and Professor Tim Hitchcock – Written evidence (DSC0021)

Submission to be found under Adam Crymble