HOUSE OF LORDS

SCIENCE AND TECHNOLOGY SELECT COMMITTEE

EU Membership and UK Science

Oral and Written evidence

Contents

The Academy of Medical Sciences – Written evidence (EUM0029)

Summary

- Research is a global enterprise, underpinned by a skilled and mobile workforce. Alongside strong connections with all parts of the world, membership of the EU brings a wide variety of benefits to the UK research base and provides access to a large pool of talented researchers.
- The UK consistently capitalises on its world-class excellence to attract disproportionate levels of EU research funding and talented individuals. If institutions did not have this funding, they would lose a substantial contributor to their income and, at a time of change within the UK research landscape, the stability and scale of EU funding streams has helped bolster the UK community.
- Regulatory harmonisation provides a strong platform for collaboration and commercialisation in health research. Fellows who provided input on this topic broadly felt it was valuable to engage with policy development to ensure that final outcomes were appropriate, and that the burden of this engagement was justified by the benefits. The voice of the UK community carries weight in EU discussions and has a history of achieving its objectives.
- There remain areas for improvement, including greater transparency and a reduction in unnecessary administrative burden within grant application and monitoring processes. Questions remain on whether access to EU funding programmes, and talented individuals, could be achieved through affiliation, rather than membership, and what uncertainties this might introduce.
- The provision of science advice remains a developing topic of interest for the Academy. We continue to support the need for advice to inform EU policymaking, and are actively engaged with the development of the new Science Advice Mechanism.

Introduction

The Academy of Medical Sciences promotes advances in medical science, and campaigns to ensure that these are translated into healthcare benefits for society. Our elected Fellowship includes experts drawn from a broad and diverse range of research areas.

We welcome the opportunity to respond to the House of Lords Science and Technology Committee inquiry into the influence of EU membership on UK science, and its efforts to evaluate the impact on the UK research environment. We are not advocating any position with respect to UK membership of the EU, but take this opportunity to present views on the current situation, with a focus on the medical sciences.

Our written evidence has been informed by engagement with our Fellows, from across the disciplines and sectors we represent. We would be pleased to provide further evidence, and our previous relevant outputs, if required.

The UK National Academies have previously submitted evidence to the Department for Business, Innovation and Skills Balance of Competencies Review relating to the EU.[1] We stated then, and continue to believe that 'the European Union has not only provided significant and vital funding to the UK for research and innovation, complementing the UK's funding landscape for research (from public, private and philanthropic sources), but has also created and amplified opportunities for international collaboration and has increased the reputation, competitiveness and attractiveness of the UK as a centre of global excellence in research and innovation. National systems that become isolated from the stream of global knowledge exchange lose their vigour and excellence. Working at a European Union level is a vital element of this and adds value to the UK's own national effort to promote and enrich its research base and research excellence, and to leverage its innovative capacity'.

Q1. What is the scale of the financial contribution from the EU to UK science and research, and vice versa?

The UK is disproportionately successful in securing EU research funding, and the figures outlined here are intended as illustrations of this success. We would direct the Committee's attention to a forthcoming report from the Royal Society, 'UK research and the European Union: the role of the EU in funding UK research', which will address the architecture and scale of EU research funding in a more comprehensive manner.

Resource investment
Based on the proportional contribution to overall EU finances, the UK contributes around 11% of the EU research budget and receives around 16% of the allocated funding, making it a substantial net beneficiary.[2] Data on allocations under Framework Programme 7 (FP7), which ran from 2007-2013, are almost complete and offer a reliable indication of performance. These interim data suggest the UK received approximately €7bn of research income under FP7 (see Table 1), marginally behind the top recipient, Germany. For the health category, the UK was the top beneficiary, securing a total of €947m and leading approximately 20% of all health-focussed projects.[3]

This success stems from a high number of applications from UK researchers and SMEs, and an above average success rate (see Table 1). Preliminary data suggest a continuation of this trend under the current Horizon 2020 programme (2014-2020), with the UK securing approximately 15% of allocated funding so far, and reporting a higher participation rate than any other member state.[4]

Marie Curie Training networks are now embedded as a core part of the doctoral training landscape within the UK. Although the UK attracted substantially fewer direct awards than

[1] Joint National Academies, Submission to BIS Review of the Balance of Competences between the United Kingdom and the European Union, 2013.
[2] http://www.bbc.co.uk/news/science-environment-25961243
[3] http://eurpub.oxfordjournals.org/content/early/2013/06/25/eurpub.ckt075.full
[4] European Commission (2015). *Horizon 2020 first results.* https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results.pdf

comparable nations (see Table 1), data indicate that the UK is a major destination for Fellows from across the EU, and the funding that these mobile, talented individuals bring.[3]

	Germany[5]	UK[6]	France[7]
Number of applications to EU funding schemes	17950	17379	12463
Total value of secured awards (€m)	7082.37	6880.53	5068.66
Number of SME participants to EU funding schemes	3300	3051	2191
Total value of SME awards secured (€m)	956.01	1098.57	603.23
Number of Marie-Curie fellows awarded per nation	2171	1142	1854
Value of MC awards (€m) per nation	2027.38	802.19	1830.25

Table 1: Interim figures from FP7 for UK and comparable nations.

Examples in Box 1 further demonstrate the importance of EU financial contributions to UK institutions, and at a time of real-term decreases in public research funding in the UK, the amount of EU funds dedicated to research have increased substantially. The seven year EU funding cycle also provides a level of stability for the community which is not currently replicated in the UK landscape.

Box 1: The role and synergies of EU funding for UK institutions

- EU funds are an increasingly significant source of investment for UK institutions – the EMBL European Bioinformatics Institute (EMBL-EBI), centred in Cambridge, received £5.7m in EU grants in 2014, compared with £3.3m from the UK Research Councils.
- EU funding operates synergistically with UK funding sources – an EU-funded project has developed a technique that identifies tumours via their metabolic profile, based on research done by a former Marie Curie fellowship holder, and hosted by CRUK.[8]

Under FP7, 5 of the top 10 most successful institutions were UK-based, and 13 of the top 25.[9] In 2013/2014, the Russell Group universities received more than £473m of income from EU sources, representing around 13% of their total research income.[10] This performance is

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[5] https://ec.europa.eu/research/fp7/pdf/country-profiles/germany/country_profile_and_featured_projects.pdf
[6] https://ec.europa.eu/research/fp7/pdf/country-profiles/united_kingdom/country_profile_and_featured_projects.pdf
[7] https://ec.europa.eu/research/fp7/pdf/country-profiles/france/country_profile_and_featured_projects.pdf
[8] http://ec.europa.eu/programmes/horizon2020/en/news/saving-time-saving-lives-monitoring-cancer-treatments
[9] European Commission, Seventh Monitoring Report 2013, March 2015: http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf
[10] http://www.russellgroup.ac.uk/uploads/Russell-Group-response-to-Balance-of-competences-Research-and-Development-consultation.pdf

driven by the geographical and disciplinary breadth of excellence present across the UK, further reinforcing the value of a broad and interconnected research base.

Capital investment
EU capital investments target both individual facilities and distributed infrastructure projects (see Box 2), and membership has anchored many such investments in the UK. Under FP7, 107 EU research infrastructure projects were supported in the UK, of which 69 (64%) were outside the 'golden triangle' of Oxford, Cambridge and London universities.

Box 2: The coordinating role of EU funding

- EU capital investments reduce duplication - the European Mouse Mutant Archive which unites mouse repositories including the MRC Harwell unit, provides a single, standardised source of mouse breeding lines to researchers.[11] This collaboration has reduced duplication and costs, and streamlined access for researchers.
- EU investment leverages further funding - the UK-based ELIXIR project manages and safeguards publicly-funded research data, and was established with EU funds which subsequently leveraged funding from the BBSRC, MRC, NERC and Wellcome Trust.[12]

The EU has also backed resources which the UK has access to, including the European Spallation Source in Sweden (a facility for structural studies, which will support medical science and the pharmaceutical sector), and the BBMRI-ERIC Biobank.

Unresolved issues
It remains unclear whether access to these resources could be achieved through collaboration, rather than membership, under models such as that used by Switzerland. Although not an EU member state, Switzerland has historically maintained 'affiliated' membership status of EU research funding programmes, providing Swiss researchers with the same access as colleagues from member states.[13]

Switzerland contributes to research budgets at a fixed rate, relative to its GDP.[13] Due to its affiliated membership status, final figures for FP7 have yet to be released but under FP6, Switzerland contributed CHF 775.3m (€718m, as of November 2015) and secured back CHF 794.5m (€735m) in EU funding, giving a net return of CHF 19.2m (€17m).[14]

Significant disruption was introduced in 2014 when Switzerland adopted mass migration legislation which violated the Horizon 2020 terms of agreement.[15] This resulted in a loss of status, and a 'partial affiliation' has now been agreed which restricts Swiss researchers to 'third country' status in many of the funding streams outside Horizon 2020.[13] National measures have been drawn up to temporarily cover funding gaps created by this move, and the Swiss Federal Council has a stated aim of restoring full affiliation status before the expiration of the current status in 2016.[13] There have also been sources of uncertainty for

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[11] http://www.emmanet.org/
[12] https://www.elixir-europe.org/
[13] http://www.sbfi.admin.ch/h2020/02455/index.html?lang=en
[14] State Secretariat for Education, Research and Innovation (2013). *Swiss Participation in the EU's Seventh Research Framework Programme Interim Report 2007-2012 Facts and Figures.*
[15] http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-hi-swiss-part_en.pdf

full members, including the disruption and reputational damage created by the withdrawal of allocated Horizon 2020 funds to support the European Fund for Strategic Investment.

There may be value in a proactive discussion around the long-term impact of the UK's disproportionate success in excellence-based schemes, in the context of capacity building across other member states. In this regard, it is important to note that support for research extends beyond the Horizon 2020 budget, and we would direct the Committee to the submission from the Royal Society, which examines the role and allocation of research-directed funds from the EU Structural Funds as part of a capacity-building agenda. Such evidence may be helpful in discussions around the long-term trajectory of European science, and we would welcome greater transparency on EU figures relating to this broader view of research investment.

Q2. How effectively are funds managed in the EU, compared to the management of science funding in the UK?

The majority of our Fellows were broadly supportive of the management of EU research funding, though grant application and monitoring processes would benefit from greater transparency and reduced administrative burden. Several Fellows reported significant strides towards simplifying application processes in recent years, but were concerned that part of this reduced burden was driven by adaptation within institutions, many of which had taken on dedicated staff to support EU grant applications. Such a trend may be masking continued inefficiencies in the process.

Due to its improved recognition for distinct work packages with identified leaders, the EU grant system is to be highlighted in an upcoming Academy report as a model that encourages and facilitates Team Science.[16] It was also highlighted that UK researchers actively engage in the oversight of EU funding, including the European Research Council, with Professor Dame Janet Thornton DBE FRS FMedSci (EMBL-EBI, UK) recently appointed to the ERC Scientific Council.[17]

Q3. What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

Research is a global enterprise, underpinned by a skilled and mobile workforce. Alongside strong connections with all parts of the world, membership of the EU brings a wide variety of benefits to the UK research base and provides access to a large pool of talented researchers.

The UK is highly collaborative in its participation with EU funding programmes, with a higher level of involvement in successful grant applications than any other EU member state.[18] EU

[16] Team Science report, Academy of Medical Sciences, due spring 2016.
[17] https://www.ukro.ac.uk/aboutukro/Documents/150624_2015_annual_report.pdf
[18] Universities UK (2013). *Briefing on the EU's Horizon 2020 programme and its importance to UK universities in the context of negotiations on the EU Multiannual Financial Framework.* http://www.universitiesuk.ac.uk/highereducation/Documents/2013/BriefingHorizon2020Budget.pdf

support for collaborative working has simplified the process of establishing large-scale, complex transnational and interdisciplinary collaborations, and it now represents one of the largest funders of international networks globally. Some of our Fellows noted that being awarded EU funding carried significant professional esteem at a global level, and that EU funds provide a significant source of indirect cost recovery (funding paid to host institutions to cover infrastructure costs) currently set at 25%.[19]

Our Fellows also highlighted specific research areas in which EU membership had added value by supporting research at a scale that goes beyond the capabilities of single nations, as reflected by Box 3. This includes the SHARE (Survey of Health, Ageing and Retirement in Europe) project, which coordinates the critical mass needed across several member states to support research into rare diseases.[20]

Box 3: EU as a platform for funding and facilitating multi-national research

- GRACE (Genomics to combat Resistance against Antibiotics in Community-acquired LRTI in Europe) consortium at University of Oxford, which is conducting research into antibiotic resistance.[21]
- HURAPRIM (Human Resources for Primary Health Care in Africa) consortium, which is conducting research on human resources to deliver primary care in Africa.[22]
- European and Developing Countries Clinical Trial Partnership, which is linking the EU and African nations to develop treatments for poverty-related diseases.[23]

These funding streams also play a major role in identifying and networking regional excellence, providing capacity-building across EU member nations. An example of such pan-EU collaboration benefiting the UK is the NABATIVI (Novel Approaches to Bacterial Target Identification Validation and Inhibition) initiative to discover new antibiotics, which draws on regional pools of talent in the UK such as the University of Nottingham.[24]

Q4. How is private investment in UK science and research influenced by EU membership?

This is an important issue. Published data demonstrate that UK SMEs are active participants in EU research programmes – the UK ranks third for total SME applications to Horizon 2020, with a success rate of 11% against a 7.3% average.[25] These data indicate that EU funding sources are important for UK SMEs, and if proposed changes to UK innovation funding go ahead, these may be the major source of grant-based, rather than loan-based, public investment available to private partners.

Industrial Collaborations

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[19] http://ec.europa.eu/research/horizon2020/pdf/press/fact_sheet_on_rules_under_horizon_2020.pdf
[20] http://www.share-project.org/home0.html
[21] http://www.grace-lrti.org/portal/en-GB/homepage
[22] http://www.phc.ox.ac.uk/research/pcdw/projects/huraprim
[23] http://www.edctp.org/
[24] http://www.nabativi.org/
[25] European Commission (2015). *Horizon 2020 first results.* https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results.pdf

A number of Fellows reported mixed views on whether EU membership had altered the course of their industrial collaborations, but broadly supported the prominence that industrial collaboration was given in the structure of EU funding mechanisms. This was particularly important for small and dispersed pockets of excellence across Member States, which benefitted from working cooperatively (see Box 4). It was felt that this drive to link research-intensive SMEs with the research community would deliver positive economic impacts in the long-term by connecting basic research to organisations with expertise and capacity for translation.

Box 4: EU programmes network UK researchers and businesses

- EU funding and harmonisation has helped network the UK hearing implant research community with EU business, such as MED-EL, a manufacturer based in Austria.[26] Across several framework programmes, MED-EL has built up research collaborations with UK-based centres of excellence, including Southampton and Manchester.

Some Fellows highlighted the value of the €3.3bn Innovative Medicines Initiative (IMI), a major public-private initiative which aims to foster collaboration among universities, industry, patients, and medical regulators to accelerate the development of medicines.[27]

Broader research environment

A number of Fellows felt that EU membership brings significant benefits to the UK's research environment, creating favourable conditions for industries of all sizes and sectors. The value of harmonised market regulations has been noted by industry representatives as 'a key reason for global biopharmaceutical companies deciding to establish their European HQ in the UK and invest in R&D activities'.[28] If the regulation of health research (e.g. clinical trials) and of medicinal products and diagnostics were not harmonised, the significant additional administrative burden could be a major disincentive for such industries to base themselves within the UK.

It was also noted that EU patent and regulatory centres (e.g. the European Medicines Agency and EU patent appeals court with responsibility for life sciences) had chosen to locate in London, providing a level of proximity which was valued by industry and the academic community.[28] For commercialisation, the combined weight of EU markets was a major factor in securing trade settlements which open up new markets for UK research outputs (outlined in Box 5).

Box 5: EU membership opens new markets for the UK

- EU trade deals have provided UK business with greater access to over 50 foreign markets, including a recent EU-South Korea Free Trade Agreement, which has led to significantly increased levels of trade.[29]

[26] http://www.medel.com/uk/
[27] http://www.imi.europa.eu/
[28] BioIndustry Association, UK Life Sciences Manifesto 2015-20 (2014)
[29] CBI, Choosing our Future, October 2015

Q5. What contribution does EU membership make to the quality of UK science and research through the free movement of people?

The joint National Academies statement, Building a Stronger Future, called for Government to proactively promote the UK as a destination for researchers and students and minimise unnecessary barriers to the flow of talented researchers.[30] We continue to support this message, and believe that research is an international endeavour and the UK's research base benefits from being connected to the international pool of talent.

Fellows broadly felt that freedom of movement for researchers greatly benefited the UK research community, and data demonstrates that the UK is an extremely attractive working environment for both fellowship awardees and employed researchers. The UK currently acts as a hub for global researchers, attracting more university-educated EU citizens than any other member state, and resulting in 20% of the UK academic community being made up of EU nationals.[31,32] These talented and motivated individuals frequently come with externally funded salaries, and continue to attract further resources after arrival, with >30% of 2014 ERC grantees in the UK being non-UK EU nationals.[33] This exchange is also an important source of future global collaborations.

The low administrative barriers to entry provided by EU membership generate a zero-cost advantage for UK institutions competing for talent against American counterparts. This is particularly critical for emerging research areas where expertise is scarce, and provides a level of agility which helps to minimise skills shortages (see Box 6).

Box 6: Freedom of movement supports the recruitment of valuable researchers

- In 2014, the UK EMBL-EBI site had 512 members of staff of which approximately 200 were from EU nations besides the UK, many with highly sought-after skills.

Q6. Does EU membership inhibit collaborations with countries outside the EU?

We did not receive any reports from our Fellows that EU membership had inhibited their ability to establish or maintain non-EU collaborations; with American and Australian research partners extremely common. Non-EU nations are able to participate broadly within Horizon 2020, a situation which has improved significantly in recent years. As such, EU funds are a significant source of support for global networks which extended beyond solely EU nations, and the main inhibition for further non-EU collaborations was the availability of specific funding for this purpose.

Q7. Which EU regulatory mechanisms greatly affect the science and research community in the UK, and how? What would be the impact of no longer being bound by them?

30 http://www.acmedsci.ac.uk/policy/policy-projects/joint-academies-statement-building-a-stronger-future/
31 http://www.theguardian.com/uk-news/2014/nov/05/uk-magnet-highly-educated-migrants-research
32 https://www.hesa.ac.uk/index.php?option=com_content&view=article&id=1898&Itemid=634
33 http://erc.europa.eu/sites/default/files/document/file/erc_2014_cog_statistics.pdf

In the previously referenced joint Balance of Competencies submission, the National Academies stated that: 'the introduction of EU legislation and regulation across the 28 Member States can also help to foster cross-border collaborations by harmonising the procedures under which research is conducted. Directives and Regulations can help to improve and harmonise research conduct across the EU as long as they are carefully designed so as not to be unnecessarily prohibitive for research'.[34]

Several of our Fellows felt that the collaborative potential created by harmonisation, including its support for the exchange of people, ideas and data, warrants the burden of engaging with regulatory processes. However, many Fellows acknowledged the complexity of achieving consensus across diverse member states, citing several examples of recent policy topics with which the Academy has engaged:

- EU General Data Protection Regulation aims to provide greater clarity around data protection, a principle welcomed by the Academy for its support for research using personal data to improve our understanding of society, health and disease.[35] However, amendments introduced by the European Parliament in 2014 put established uses of research data at risk (e.g. biobanks and disease registries). The Academy has warned of the potential damage to several research areas, and supports the 'Personal Data Saves Lives' campaign, alongside our European network, the Federation of European Academies of Medicine, among other partners.[36]
- EU Regulation on Clinical Trials on Medicinal Products for Human Use, which seeks to further harmonise the approval and monitoring of clinical trials. This provided an opportunity to improve on the preceding clinical trials Directive, which had several weaknesses and complexities that had concerned the medical research community. The Academy worked alongside UK and EU partners to inform the new Regulation and address key issues such as streamlining approval for multi-centre trials and administrative burden which may have been causing a decrease in trial initiation.[37]
- EU Directive on Animals Used for Scientific Purposes, which aimed to harmonise animal research standards and practices across Europe. The directive received a broadly positive reception following substantial efforts across the sector to inform its development and transposition into UK law. A number of Fellows noted the leadership shown by the UK on this issue, and the wider impact it had on animal welfare across the EU.

Other EU-level policy processes which impact the UK include European Citizens' Initiatives, popular petitions to raise EU Parliamentary debates, and judicial outputs from European Court of Justice cases, such as *Brustle vs. Greenpeace*, which recommended that certain inventions relating to human embryonic stem cells should not be patentable.[38] There are also ongoing debates in the UK around tax rules on joint public-private research buildings, which are partly restricted by European-level legislation, preventing the wider zero-rating tax status called for by the research community.

[34] Available from: http://www.acmedsci.ac.uk/viewFile/5395d8ad94d4e.doc
[35] http://www.acmedsci.ac.uk/policy/policy-projects/european-data-protection-regulation/
[36] http://www.datasaveslives.eu/
[37] http://www.acmedsci.ac.uk/policy/policy-projects/test-clinical-trials-regulation/
[38] http://curia.europa.eu/juris/liste.jsf?language=en&num=C-34/10

Fellows who responded to this question broadly felt it was valuable to engage with these policy-making processes to ensure the final outcomes were appropriate. They felt the burden of this was justified and has stemmed, in part, from the high level of UK engagement with such issues, and it was noted that the UK voice carried weight within EU discussions and had a history of achieving its objectives. Many Fellows remained highly engaged with regulatory issues, particularly those associated with their own fields, and felt able to channel their voice via institutions including the National Academies, learned societies and charities.

A number of Fellows cited examples where EU scientific advice had driven positive policy changes within underserved areas of the UK environment, including the establishment of a UK policy on rare disease research which was pioneered at EU level.

Agenda setting

Several Fellows discussed the value of a 'seat at the table' on EU regulatory matters, noting that non-member affiliates, such as Norway, were required to align to such regulations as a condition of access, but without full access to the development processes of legislation. Membership also amplified the UK's voice on an international level – the Carnegie Group of G8+05 Science Advisers includes both UK and EU representation, lending extra weight to UK influence.

Q8. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK?

The appointment of a Chief Scientific Adviser by the previous President of the European Commission was welcomed by the research community as a way of improving the status of evidence-based advice within European policy-making. However, the new Commission President has not retained this post and concerns were expressed in a joint letter from the European Academy networks, which noted the value of the role in providing independent, high-quality and transparent advice.[39] The post is to be replaced by a Scientific Advice Mechanism (SAM) based around a High Level Group of experts, alongside input from networked Academies from member states. This mechanism remains at an early stage of development, and the Academy continues to engage to ensure the final structure is able to operate effectively to inform policy-making.

It was recognised that establishing a broadly supported mechanism against a background of diverse capabilities and approaches within Member States presents a challenge. However, a number of Fellows welcomed the transparency of the current development process for the SAM, and hoped the success of the mechanism would be evaluated at regular intervals.

Declaration of interests

The Academy has not received any direct funding from EU sources, however, many of the Academy's Fellows who contributed to this response have received benefit, either directly or indirectly, from EU research funding programmes. Further details are available on request.

[39] http://www.acmedsci.ac.uk/download.php?f=file&i=29923

This response was prepared by Dr Ben Bleasdale (Policy Officer) and informed by members of the Academy's Fellowship.

20 November 2015

The Academy of Medical Sciences, the Royal Academy of Engineering and the Royal Society – Oral evidence (QQ 25-40)

Transcript to be found under The Royal Society

Academy of Social Sciences, Learned Society of Wales and British Academy – Oral evidence (QQ 41-52)

Transcript to be found under Learned Society of Wales

ADS Group – Written evidence (EUM0023)

ABOUT ADS

ADS is the premier trade association advancing the UK's Aerospace, Defence, Security and Space industries. ADS comprises over 900 member companies across all four sectors, with over 850 of these companies identified as Small and Medium Size Enterprises. Together with its regional partners, ADS represents over 2,600 companies across the UK supply chain.

The UK is a world leader in the supply of aerospace, defence, security and space products and services. From technology and exports, to apprenticeships and investment, our sectors are vital to the UK's growth – generating £56bn a year for the UK economy, including £31bn in exports, and supporting 800,000 jobs.

INTRODUCTION

1. The UK's productivity, growth and economic prosperity depends on its ability to innovate. Investment in science, research and innovation strengthens our global competitiveness, generates long term, well-paid, skilled jobs and helps to develop high-tech exports.

2. The EU is an important source of R&D and innovation funding for UK companies. The EU uses funding mechanisms called Framework Programmes to provide research grants in all sectors across Europe. The potential gains for UK companies are significant – the seventh Framework Programme (FP7) awarded almost €50bn worth of R&D grants between 2007-2013 and Horizon 2020 (the eighth Framework Programme) is investing some €80bn from 2014-2020.

3. As individual government budgets decline, the EU becomes an even more important source of funding for research, development and innovation. In addition to the monetary assistance the Framework Programmes provide, the collaboration and exposure opportunities for businesses are also valuable.

4. Earlier this year, working with KPMG, ADS published an assessment of how membership of the EU impacts our sectors.[40] We also surveyed our members on key aspects of EU membership. The overwhelming response from our industries is that membership is good for business. The survey found that 86% of ADS members believe it would be better for their business if the UK remained in the EU.

5. The government is committed to holding a referendum on the UK's membership of the EU by the end of 2017. The outcome of this referendum matters to ADS members. Their global competitiveness depends on the UK having unhindered access to customers, supply chains, people and investment from around the world and particularly the EU.

[40] http://blog-adsgroup-org-uk.wp.web1.ads.strategiesuk.net/wp-content/uploads/sites/8/2015/06/ADS-REPORT-UK-Aerospace-Defence-Security-and-Space-Industry-and-the-EU.pdf

6. The UK's membership of the EU positively influences science, research and innovation in several ways. It provides access to R&D funding which allows the UK to remain globally competitive. EU R&D funding bolsters national programmes and provides companies with the opportunity to collaborate and raise their profile. Having a government that is listened to on European regulations and standards is an advantage for UK industry to design global products and technologies.

7. As well as identifying the significant benefits to our sectors from the UK's EU membership, the ADS/KMPG report – whilst not calling for specific reforms as part of the UK's on-going negotiations – does include a call for the UK to maximise the value of EU membership for the benefit of British businesses. This includes proactively working within the EU to secure increased EU funding for UK firms to invest in research, development and skills. In our survey, 76% of ADS members identified this as an important priority.

SCIENCE, RESEARCH AND INNOVATION IN THE UK

8. Investment in science and innovation is critical to economic growth and the long term development of our economy. Backing innovation attracts international talent and global companies, which results in further advances in both new knowledge and exploitation.

9. By working in partnership, the UK government and industry have helped to stimulate technological development through successful industrial strategies. These industrial strategies have provided clarity on business challenges and market opportunities, allowing government and industry to overcome barriers, join up the supply chain, identify investment priorities and strengthen UK capabilities.

10. The Aerospace Technology Institute (ATI), born out of the Aerospace Growth Partnership (AGP), is an excellent example of how industrial strategy has allowed collaboration and partnering to develop technology. By aligning research and technology investments with a long term strategic view for the UK, establishing new opportunities for collaboration, using projects to help create stronger UK-based networks and developing the research infrastructure, the ATI has achieved higher levels of technological and economic impact than otherwise possible. Industrial strategies changed global perceptions of the UK as a place to invest, with companies looking favourably at the AGP and ATI when considering investment decisions.
11. Measures such as the ATI and industrial strategies have allowed the UK to be a highly productive, collaborative and efficient research nation. Relative to government investment levels we have high research outputs with the UK at the top of the G8 in article citations per pound spent.[41]

12. Although innovation is inherently risky, innovative businesses grow at twice the rate of non-innovative ones, benefiting the UK economy by creating new jobs, new products,

[41]Treasury and Department for Business, Innovation and Skills, 'Our plan for growth: science and innovation' https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387780/PU1719_HMT_Science_.pdf

new export markets and attracting inward investment. It is this investment in R&D that drives productivity – between 2000-2008 one third of productivity growth was attributable to changes in technology that resulted from science and innovation.[42]

13. Investment in science, research and innovation is vital for UK industry as we compete against other industrial nations in an increasingly competitive global market. Through investing in innovation UK businesses are able to develop better products, more efficient manufacturing techniques as well as a more highly skilled workforce, enabling the UK to remain globally competitive.

ACCESS TO EU R&D FUNDING

14. The EU is an important source of R&D and innovation funding for UK companies, with the UK's aerospace, security and space sectors winning around £100m of funding in 2013. Access to this funding not only helps the UK to boost productivity but also to develop new technologies and remain globally competitive.

15. With constraints on public spending, EU funding for R&D is even more important. For the UK to compete globally, continued investment in high-value design, skills, innovation and capacity is vital. Support from both the UK government and the EU will be critical if investing in the UK is to remain a globally attractive business proposition. In 2007-2012 (the most recent year we have comparable data for countries across the EU), the UK won around 14% (or €4.7bn) of the total €33bn funding available to all sectors of the UK economy, from aerospace and security to social sciences and health research.

16. UK companies also derive great value from the access to partnerships and networks that EU R&D funding projects offer. Businesses, particularly SMEs, are able to raise their profile with both European partners and end users giving them more exposure to a larger customer base.

17. Involvement on collaborative EU projects provides the dual benefit of allowing UK businesses access to state of the art technology and high-skilled people – this can be seen through demonstrator projects. In order to bring research and technology to market, large-scale technology demonstrators are usually required in order to prove performance in realistic environments. However, the scale and complexity of these demonstrator programmes mean they require significant amounts of investment, which is often beyond the reach of a single country's technology programme.

18. EU R&D funding is fundamental to bringing such demonstrators to market. European programmes such as CleanSky (aeronautical research programme) include a number of these large scale aerospace technology demonstrators that suitably de-risk and mature technologies prior to the product development phase, allowing the supply chain to come together to jointly develop technologies in a collaboratively funded programme.

[42]Treasury and BIS, 'Our plan for growth'

19. National programmes, such as the ATI, should align with European programmes to seek to maximise opportunities from EU funding. By providing component technologies, national strategies enable participation in these demonstrator projects.

20. Whilst it is clear that the UK is successful in winning R&D funding from the EU, there is additional funding that we could secure. Industry and the UK government should work proactively within the EU to influence R&D funding decisions and secure increased funding for investment in innovation.

INFLUENCING REGULATIONS AND STANDARDS

21. The majority of ADS members are operating in regulated global markets – these regulations will continue to apply irrespective of the UK's continued membership of the EU.

22. As a member of the EU, the UK has significant influence in setting and amending aviation and aerospace regulations and standards at both a regional and global level. This is particularly important for the aviation and aerospace sectors which are governed, appropriately, by stringent international safety, airworthiness and environmental regulations.

23. Alongside the US Federal Aviation Administration (FAA), the European Aviation Safety Agency (EASA) is one of the main agencies which drives the new development of safety regulations. As an EU member, the UK has voting rights on EASA's decision making body – ensuring it is able to influence regulatory developments which protect and support the views of the UK government and industry, and continue to ensure high standards of safety. By leaving the EU, the UK would still have to follow the same European safety regulations outlined by EASA, but would be less able to shape their development.

24. The ability of the UK to influence EU decisions around standards which impact the global aerospace industry, from certification to chemical regulations, is a key factor when making investment decisions for both EU and non-EU investors into the UK. Having a government that is listened to in Europe on regulations and standards is an advantage for UK industry and for attracting inward investment. This also enhances the UK as a destination to design and develop new products and technologies that can be exported and used globally.

25. Membership of the EU provides an important source of R&D and innovation funding for UK companies. Access to European programmes bolsters our own national funding and provides opportunities for businesses to collaborate and develop their pan-European profile. The UK's future growth and prosperity depends on our ability to innovate – it is therefore vital that we see continued investment in science, research and innovation so that the UK can strengthen our global competitiveness, generate well-paid, long-term, skilled jobs and develop high-tech exports.

20 November 2015

Association of Innovation, Research and Technology Organisations (AIRTO) – Written evidence (EUM0064)

Introduction

This response is from AIRTO (the Association of Innovation, Research and Technology Organisations). AIRTO's members comprise representatives from:

- Public Sector Research Establishments (PSREs)
- Non-profit distributing member and non-member based Research and Technology Organisations (RTOs including Catapults)
- Privately held research and technology companies (including Contract Research Organisations - CROs)
- Universities (Enterprise/Technology Transfer Departments)
- R&D (research and development) departments of industrial companies
- Business support (including Access to Finance) and early stage technology-based venture capital companies

AIRTO's members generally operate in the private sector, but with varying degrees of interaction and financial involvement from the public sector. All are to a significant extent involved in aspects of the translation of ideas, research and technological advances into the commercial arena, for clients in both the private and public sectors.

Overview

AIRTO welcomes the House of Lords Select Committee inquiry into 'The Relationship between EU Membership and the Effectiveness of Science, Research and Innovation in the UK'. Organisations in the Innovation, Research and Technology (IRT) sector play a pivotal role in driving economic growth and innovation, frequently acting as the aggregator of scientific and technological demand from businesses and markets. Such organisations typically work at the mid-level technology readiness levels (TRLs) and are well placed to understand company and sector-based innovation strategies, where they are optimally positioned to facilitate interactions involving academic partners, SMEs and large organisations to approach challenge-led innovation projects.

Britain has a large and thriving IRT sector, which contributes significantly to our national capabilities[43], with the economic impact for UK plc now estimated to stand at £32-36 Billion pa. The Research and Technology Organisations (RTOs) that AIRTO represents are a significant component of the UK's innovation ecosystem, but differ from universities in their primary objectives, strengths and capabilities, which are centred on commercial translation of applied research. In its 2011 'Innovation and Research Strategy for Growth', BIS recognised the sector as an 'under-utilised asset'[44]. RTOs have a vital role to play in leveraging EU funded research to drive economic growth. The best outcomes for the UK

[43] The impact of the Innovation, Research and Technology Sector on the UK Economy; Oxford Economics, November 2014

[44] Innovation and Research Strategy for Growth; BIS, December 2011

will be achieved by supporting RTOs and universities to work together, with businesses, to exploit opportunities presented by EU funding and collaboration. RTOs are well equipped to help companies seeking mid-TRL research capabilities, either on a self-sufficient basis or in conjunction with university partners.

AIRTO's response to the specific questions posed is as follows (with combined answers being offered to some questions):

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

and

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

The UK makes up about 12% of the EU population and contributes 11.5% to the budget[45]. Science and innovation funding is awarded based on research excellence, meaning the UK punches above its weight, winning an estimated 16% of all the EU research funding under Framework Programme 7[46], and even more in some areas such as health (leading 20% of all projects[47] and winning 20% of the prestigious European Research Council funds[48]). The UK Government's investment in science is £4.7 billion annually (resource spend)[49]. The EU's budget for science is €10 billion per annum, 16% of which if won by the UK make at least an additional 24% on top of our total domestic science budget (public and private). This is large enough to make a significant contribution to the UK's resource and success. In addition, the EU Structural Fund, which this estimate does not take into account, contributes to our innovation resource and research infrastructure, as does our access to procurement programmes, e.g. the Galileo and Copernicus space infrastructure programmes. On balance, the UK extracts proportionally more than it invests in the EU for science and innovation. EU programmes also provide access to the outcomes from the totality of projects in which UK organisations engage, typically on a scale some six times larger than the financial quantum contributed from the UK. This permits the UK to share cost and risk on projects that would not be affordable on a national basis.

The evolving UK science and innovation and EU landscapes may position the UK to exploit EU funding opportunities even further in the future, e.g. through smart specialisation initiatives across the regions, offering a channel for further EU Structural Funds to innovate in the UK.

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[45] http://www.russellgroup.ac.uk/uploads/Russell-Group-response-to-Balance-of-competences-Research-and-Development-consultation.pdf
[46] *Ibid*
[47] http://eurpub.oxfordjournals.org/content/early/2013/06/25/eurpub.ckt075.full
[48] http://www.russellgroup.ac.uk/uploads/Russell-Group-response-to-Balance-of-competences-Research-and-Development-consultation.pdf
[49] House of Commons, Science and Technology Committee: The science budget – First Report of Session 2015–16

Such a clustering of specialisations, e.g. in science parks, brings benefit beyond the financial contribution to UK research and innovation capacity, amassing cumulative concentrations of essential skills.

In the other direction, UK science and research leads Europe and contributes to the quality and competitiveness of European partner organisations to the benefit of the EU community and its place as a market for UK exporters.

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

The UK's management of funds, whilst robust, remains less burdensome for applicants and recipients of funding. Some bureaucracy is, of course, necessary for effective management and EU programmes are necessarily more complex because they are mainly aimed at international collaborations. Although some simplification has taken place with Horizon2020, the balance between heavy financial audit and in-project technical and business level monitoring and support could still be further improved. However, it is vital to note that the benefits overall and the particular benefits for those participating in programmes that are EU funded are generally felt to far outweigh the drawbacks.

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

The UK currently receives considerable funds and partnership opportunities from the EU through programmes like Horizon 2020 (which will invest 70bn Euros across Europe from 2014-2020).

Science has always benefited from cross-border collaboration and exchange of ideas. The EU programmes provide a framework for facilitating such science-based research collaborations. Furthermore, EU funds act as a mechanism to 'gear up' national resources (both public and private) available for science and collaboration stimulates innovation, application of research outcomes and drivers for new research.

Research outcomes, applications and impact are maximised by collaborations which are designed to include broad industry representation from multiple countries and market areas; and industry participation is assisted by the presence in consortia of science, research and innovation organisations such as RTOs, PSREs and universities.

EU programmes provide the UK with opportunities to lead large multinational collaborations that contribute to the infrastructures needed for international interworking and trade. A case in point is the EURAMET programme hosted by NPL. This is because science and innovation is globally competitive and basic science outputs from the UK measures well against competitor nations, with many of the world's top 200 research universities being British.

Furthermore, the UK now ranks second in 'The Global Innovation Index (GII)', placing the UK above the USA, Singapore and Germany for the third year running[50]. However, remaining competitive requires investment to sustain infrastructure, skills and expertise. European countries which are also important competitors and partners of the UK, like Germany and France, strive to maximise their investment in science and innovation via EC funds in addition to funding available from their domestic budgets.

EU funds provide for large scale activities and combinations of expertise across multiple countries, which Innovate UK and other domestic sources of funding cannot accommodate. Engaging in collaboration on this scale is not without challenges. Identifying non-UK partner companies to engage with can be difficult. However, the alternative of not being involved in would result in diminishing UK engagement in key strategic collaborations in sectors such as aerospace, medicine, transport, energy and agri-food, to the detriment of the nation's competitive performance.

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

Considerable investment in science and innovation comes from private investment, including in start-up and other businesses trading on skills, generic knowledge and intellectual property from universities and other publicly-funded science. Participation in EU science and research programmes contributes to the research knowledge base, and hence the potential for private investment in collaboration with universities and other scientific research organisations which do engage with these programmes.

The EU overall has been successful in securing direct co-financing and other types of support from big businesses and industries for EU projects with a strong research and innovation dimension, but the UK private sector has not participated to the same extent as seen in many other EU member states. Part of the problem in the UK is poor understanding of the programmes and the opportunities, together with apprehension over collaboration with potential competitors and possible leakage of their IP. The level of effort required to apply and significant oversubscription are also deterrents. The official UK response has been to arrange workshops and meetings. This is not of itself sufficient and sometimes not adequately or correctly targeted. Exceptions to this are to be found in the engagement of some of the major multinational companies; however, there are relatively few of them in the UK in the main areas of interest to the EU's programmes. This reflects the makeup of UK industry. It should be recognised also that there is a hierarchy of credibility associated with some funding sources amongst private investors - UK Government funding (e.g. Innovate UK grants) are better regarded.

To be effective, proposals for research and innovation support should be configured with exploitation of the outcomes as the main driver. This means ensuring that there will be paths for attracting further investment and pulling through exploitation in directions that will deliver the desired uptake, contributions to achievement of European Union (EU) objectives

[50] The Global Innovation Index 2015. http://www.wipo.int/edocs/pubdocs/en/wipo_gii_2015.pdf

and growth, and jobs. Industry must be considered the main exploitation route for achieving this. To engage industrial interest there must be strong prospects of:

- Significant market potential for new products and services;
- Opportunities for securing a competitive edge (based on technology, a novel business model or the equivalent - opportunities for significant cost reduction in non-core areas can also be attractive to some companies and organisations);
- Securing protectable intellectual property;
- A perceived match to existing corporate strengths or the opportunity to develop desirable new strengths;
- Access to sufficient resources, skills and finance to undertake exploitation;
- Minimal complexity, bureaucracy and restrictions.

Trying to achieve the above whilst also seeking to encourage joint working between different entities in different EU states can complicate matters and dilute attractiveness to industry if the drive for collaboration is not handled carefully.

Not being involved in the EU, would however, lead to an increasing risk of funding and capacity being out of step with demand for innovation in the UK because:

- There would be a greater dependence of fewer streams of public funding, i.e. those from the UK Government only, with added uncertainty therefore from the impact of pressures on domestic budgets;
- It would deny a significant route for spreading risk for UK organisations engaging in science, research and innovation;
- The UK would lose the ability to influence European programmes – where efforts are being made increase engagement the result can be very positive, e.g. UK involvement in EU funded space programmes, where concerted efforts are being made by industry and Government working together.

Therefore, moving out of the EU would create greater reliance and pressure on domestic and private investment for science and innovation, and also increased risk and fewer options for risk mitigation for investors. It should also be understood that sources of funding combine over years to establish the centres of excellence and capability, often in universities, that attract private sector participation. Some of the established collaborations between universities, RTOs and industry could be seriously undermined or even unravel if EU funds were not available to underpin them, in the aerospace/space sectors, for example.

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

Participation in the creation and operation of international facilities within Europe are greatly enhanced by EU membership. Many such projects would not be eligible to UK organisations from outside of EU membership.

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

The ability to join forces and resources to facilitate British involvement in big co-located projects, e.g. via ESA or CERN, is important, and the EU is a key mechanism for facilitating such collaborations. Keeping the UK central to such programmes enhances skills and enriches the UK's IRT sector with opportunities for collaboration and career development, stimulating the interworking of scientists and engineers with other EU countries and, in many instances, an influx of talent to the UK. This movement of is arguably a positive factor is helping the UK to remain internationally competitive, as it contributes to enriching the experience, creativity and skills of the IRT sector workforce. An example of reliance upon skills from across the EU is seen from within our own membership where a number of organisations benefit from employing significant numbers of staff from the EU (excluding the UK), e.g. The National Physical Laboratory (NPL) currently employs 11% of its workforce from the EU (non-UK). Other high technology businesses are also increasingly dependent on recruitment from outside the UK to operate. The dedicated mobility programmes, like Marie Curie which supports transnational, intersectoral and interdisciplinary mobility, enhance international development opportunities for postgraduates and are therefore very helpful to both host partners and seconding organisations.

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

and

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

EU membership does not inhibit collaborations with countries outside the EU, and indeed it can encourage such collaborations as non-EU organisations can join EU projects on a self-funding basis. However, by being an integral part of the EU, the UK can to be involved in shaping and directing research and innovation strategy and investment decisions on future programmes and sectors. Furthermore, through some programmes, the UK acts is a particularly attractive partner for other countries wishing to become involved in EU programmes (China and the USA, for example).

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

Regulatory mechanisms (including the UK's research excellence and other framework e.g. from BSI) can be a mechanism for stimulating research. Regulations from the EU are not necessarily more severe than from the UK, but in both instances it is necessary to ensure

that rigorous and robust methodologies can be implemented to check compliance and in many instances new research is required to underpin this aspect of new regulation.

State aid rules within the EU do, however, impact on our ability to conduct translational research with the private sector, on allowable mechanisms for supporting commercialisation from the public sector and thereby on industry's willingness to take on the risk and cost of exploiting research outcomes.

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

AIRTO does not offer a view on this question.

12. How is the innovation landscape affected by EU membership?

Innovation is frequently a product of engagement and partnership with other organisations from diverse backgrounds, which participation in such programmes with other EU member states and organisations helps to facilitate.

Furthermore, the UK innovation landscape in some areas, space for example, is intimately connected to EU research, development programmes and procurements. UK industry's competitiveness vis-à-vis other European member states could in this context be significantly affected if the UK were to be absent from EU policy formulation and procurements, particularly where developing critical infrastructure is concerned, for Europe in particular, but also where there is potential relevance for other parts of the globe.

Note also that many of the larger players in the industry are multi-nationals headquartered outside the UK. Their R&D is largely concentrated on sites located in EU member states. The UK's membership of the EU strengthens the case for their inward investment in UK R&D, without which such R&D might well be undertaken elsewhere.

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

and

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

EU consultation processes are quite comprehensive. The UK does not always translate the opportunities for consultation into effective national engagement with such processes. There are UK consultations for gathering views but they seem to focus on bureaucracy and mechanics rather than politics and programme content. The UK industry stakeholder communities in particular seem weak at understanding how the EC's strategic advice and

consultation processes operate, at getting involved, and at making the effort to make a difference. There are exceptions to this in some sectors, such as aerospace. These exceptions are usually based on the large companies getting involved and influencing programme content accordingly, often through involvement in committees. More could be done to support and stimulate UK involvement in such decision making structures.

Improvements could be based on increased levels of resourcing and engagement within BIS and greater communication/transparency of the Commission's processes and workings into the private sector by BIS (but that will cost more in the public sector).

In general, the EC should undertake its own independent research into the needs of the market, remaining objective and mindful at all times that those who are consulted do not represent more than a modest fraction of those who will eventually be affected for 5 or even 10 years into the future. Generally, at least a year will elapse between the input from stakeholders and a call for proposals, at least another year between the publication of the call and projects starting and at least another three to four years between then and the start of commercialisation. Having over-prescriptive calls is therefore a recipe for potential obsolescence of the resulting end-products. Many EC proposals in the past have veered into prescriptiveness, attempting to define how results should be achieved instead on concentrating on defining broad areas in which research could profitably be undertaken.

Experience varies from sector to sector but, in some areas, the input of stakeholders can, if anything, have too much weight; this leads to calls for proposals which are too obviously biased towards special interests, too short-sighted and too narrowly defined, not just in terms of what needs to be done but also in terms of how to achieve those aims. The consultation process should not be simply a mechanism to generate the call text by a 'cut-and-paste' process which adds up all received contributions; instead, it needs to start with a principled set of long and medium-term aims and use consultations to clarify those aims, extending them or re-formulating them as needed but without succumbing to short-termism and special interests. The EC could therefore usefully make a more determined effort to assess the needs of the market and the lacunae in knowledge independently; it should stay at all times above the potential influence of lobbying activities and ensure that consultation helps steer the process of defining proposals but does not commandeer it.

The scoring for selection of projects for funding within current frameworks is perceived as somewhat random by commercial organisations when receiving feedback on submitted proposals. The high cost of preparing proposals therefore tends to favour larger organisations that can take a statistical perspective on the probability of securing funding over a large number of project applications. The implication of this is that true innovation is not the driving factor for success, but rather the skill of a lead organisation in attaining the requisite shape for a consortium, and using the appropriate key words in proposals. There is a need to increase involvement of industry scientists in the evaluation processes for proposals.

Overall the UK is better at utilising advice for public policy than the EU (in our opinion). However, the existence of large programmes can add huge weight of validity to the evidence produced to inform public policy. In contrast, the larger the community that is targeted for

influencing regarding policy formation, the more complex the task becomes – e.g. on climate change – the sheer volume of stake holders makes the task of influencing policy highly complex and lengthy.

26 November 2015

Declaration of interests

This submission is made by the Association of Innovation, Research and Technology Organisations (AIRTO). The organisation represents research and technology organisations operating in the space between the academic research of universities and the commercial needs of industry. AIRTO members undertake research and development, and knowledge and technology transfer. This submission does not necessarily represent the views of individual member organisations. AIRTO currently comprises organisations, employing more than 40,000 scientists and engineers1, with a combined annual turnover in excess of £5billion (AIRTO Ltd. is a company limited by guarantee registered in England No. 1217006 Register office address: National Physical Laboratory, Hampton Road, Teddington, Middlesex, TW11 0LW). AIRTO is a not-for profit organisation funded by membership subscriptions, and managed under contract by NPL Management Ltd. The members of AIRTO currently are:

AFRC
AHPA
AMRC
Axillium Research
BCIS
BHR Group
BMT Group Ltd
BRE
BSRIA
Campden BRI
CIRIA
City University London
CPI
Digital Catapult
C-Tech Innovation
East Malling Research
Fera
FloWave TT
Fraunhofer UK Research
Fripp Design & Research
Future Cities Catapult
Health & Safety Laboratory
High Value Manufacturing Catapult
HR Wallingford
Institute for Sustainability
LGC
Lucideon Limited

Manufacturing Technology Centre
Medilink (Yorkshire & Humber)
HORIBA MIRA
National Composites Centre
National Institute of Agricultural Botany
National Nuclear Laboratory
National Physical Laboratory
National Non-Food Crop Centre
Nuclear AMRC
Offshore Renewable Energy Catapult
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PA Consulting
PERA Technology
QinetiQ
Satellite Applications Catapult
SATRA Technology Centre
Science and Technology Facilities Council
Smith Institute
Thatcham
The European Marine Energy Centre
The Scotch Whisky Research Institute
Transport Systems Catapult
TWI
University of Greenwich
University of Surrey
WMG

Association of Medical Research Charities (AMRC) – Written evidence (EUM0052)

The Association of Medical Research Charities (AMRC) is a membership organisation of the leading medical and health charities funding research in the UK. Working with our members, we aim to support the sector's effectiveness and advance medical research by developing best practice, improving public dialogue about research and science and influencing government to ensure the best research can go ahead and be translated into new treatments. Medical research charities exist because the public choose to donate their money to support research to develop new treatments and cures; 7.6 million people donate in a typical month. In 2014, AMRC members invested over £1.3 billion in health research in the UK.

We are grateful for this opportunity to contribute to the Committee's deliberations on this topic.

We are taking this opportunity to respond in order to lay out the facts for the research environment in the UK, and how this currently relates to EU membership. It should not be interpreted as a position statement on whether the UK should remain a member of the EU.

QUESTION 1 What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of GDP, for instance, population, GDP, scientific strength or any other relevant indicators?

1. €4.4 billion was invested in the UK from FP7 from 2007 to 2012.

2. The Horizon 2020 First Results report found that the UK is the EU member state with the highest number of eligible applications; the UK is also in the top 10 EU countries in terms of success rates[51].

3. The UK obtains the second highest financial contribution across all EU member states from Horizon 2020, with the exception of Germany.

> The Alkaptonuria (AKU) Society and the Royal Liverpool University Hospital led a pan-European Consortium which bid successfully for a £4.6 million FP7 grant to conduct clinical trials of the drug nitisinone for the rare disease alkaptonuria. The public-private consortium included 13 partners from patient groups, hospitals, universities, pharma and independent labs.

4. The financial contribution that AMRC members receive from the EU will vary, although EU funding is an important part of their funding mix. Over the period from 1st January 2012 – 31st December 2014, researchers funded by 13 AMRC member charities received over £260 million in further funding from the European Union, covering disease areas from arthritis to Parkinson's disease.

[51] Horizon 2020 First results

5. Cancer Research UK for example does not receive any Government funding at UK or EU level. However, in 2014/15, the charity's institutes across the UK received £7.5 million income from EU grants; this was nearly 7% of their total research funding. This can have a big impact on individual labs in these institutes. For example, a Group Leader at the charity's Beatson Institute received a European Research Council Advanced grant in 2012, which is funding around a third of her lab's research.

There are various examples of how Alzheimer's Research UK funding has led to multi-million Euro collaborative funding from the European Commission research funding frameworks.

- Prof Simon Lovestone is the co-coordinator of the €48 million Innovative Medicines Initiative - European Medical Information Framework which came as a result of over £850,000 from an Alzheimer's Research UK major project grant on combinatorial biomarkers for dementia prodromes, prediction, pathology and progression.
- An Alzheimer's Research UK pilot study granted to Prof David Allsop to investigate alpha-synuclein in plasma as a possible diagnostic marker for synucleinopathies led to further funding to participate in the EU-wide project NEUROSCREEN - Early, differential and progressive blood and cerebrospinal fluid test for neurodegenerative dementia – and Marie Curie Training Network NEURASYN - Alpha-synuclein-related brain diseases - worth a total of €7,570,000.
- An Alzheimer's Research UK grant awarded to Dr Richard Wade-Martins in 2007 to buy vital equipment for his lab, a microscope for live cell imaging and a plate reader, helped the group to secure a total of €1.3 million from the European Commission to work on stem cells as models for biological assays of new drugs and predictive toxicology.

6. Between 2011 and 2014, researchers funded by Arthritis Research UK went on to secure more than £18 million of European funding for research into musculoskeletal (MSK)/arthritis, which counts for 11.5% of all further funding reported[52].

7. For Alzheimer's Research UK, the European Commission is the 4th largest funder by incidence of further funding for all of the charity's grants and 7th largest funder ranked by size of grant.

8. **The benefits of financial contribution derive not just from the contribution itself but how this finance is structured.** It is important that long-term recovery in Europe, including the UK, is accompanied by a long-term plan for investment in research and innovation. Long-term framework programmes offering consistent, long-term funding like Horizon 2020 are an important part of this picture.

QUESTION 2 What is the scale of the contribution from the UK to the EU that supports science and research activities?

[52] This data is only for grants reported through Research Fish and so excludes centre grants

9. The EU's investment in research is vital for bolstering investments made by individual EU member states like the UK.

10. AMRC's members contribute by co-funding EU studies. For example, the Medical Research Council and Cancer Research UK co-fund the European Prospective Study into Diet and Nutrition alongside the European Commission and several other funders both in the UK and across Europe.

11. Beyond research studies, AMRC members also co-fund broader pan-EU initiatives. Cancer Research UK funds The European Organisation for Research and Treatment of Cancer (EORTC) which develops, conducts and coordinates translational research in Europe. The initiatives bring together researchers and institutes from across Europe. The EORTC is a key founding member of the International Rare Cancers Initiative alongside Cancer Research UK.

12. Through a €500,000, 3 year Support Action grant from the European Commission awarded in 2013 via the Framework 7 programme, Asthma UK is leading a 12-strong consortium of European patient organisations, the pharmaceutical industry, academics and healthcare professionals called the European Asthma Research and Innovation Partnership (EARIP). This Partnership will identify and publish the priorities for asthma research to drive investment in the most promising new treatments, technology-enabled self-management platforms and accurate and accessible diagnostic tests that would transform asthma outcomes across Europe.

13. Because of the strength of the voluntary sector in the UK, many AMRC member charities funding research into rare diseases play roles of leadership in coordinating the activity of smaller organisations and other partners across Europe and developing cooperative research partnerships. As an example, the Ataxia-Telangiectasia Society has led the establishment of an international A-T clinical research network and clinical research conference series, and has recently obtained funding for a European A-T patient registry.

14. The UK Government and other UK stakeholders are also involved in EU Joint Actions, for example the Joint Action on Rare Cancer.

Dr John Diffley – Francis Crick Institute
John Diffley is one of the world's leading experts in studying how cells grow and make copies of themselves - a process that goes wrong in cancer. Dr Diffley's discoveries will form the foundations for new ways to diagnose and treat cancer in the future.

John's world leading research has benefitted hugely from the European Research Grant (ERC) funding he was awarded in 2009. To date, this funding has supported 11 of his peer-reviewed research publications. This year he has successfully won another prestigious ERC Advanced Grant providing him with £1,455,294 for further research.

> *'The ERC is a fantastic scheme and has transformed my lab. The research I was able to carry out with the ERC grant enabled my lab to enter a new area of science, which would otherwise have been closed to us. It has had an enormously positive impact on our science.'*
> Dr John Diffley

At any one time around 50% of the scientists in John's lab are from non-UK EU countries. Two of the current 15 are funded through the Marie Skłodowska-Curie actions - Research Fellowship Programme. This fellowship, which is part of Horizon 2020, encourages researchers to move between EU countries to conduct their research, sharing their knowledge and skills as they go.

Over the years, John has established strong collaborations with labs across Europe. Some of these have been the direct result of EU funding. Dr Monica Segurado was able to come and work in John's lab thanks to an EU Network Grant, awarded in 2002. Since establishing her own lab in Spain, Monica and John have continued to collaborate and have jointly published research.

QUESTION 4 What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Centre?

15. As outlined above, the financial contribution of the EU to UK science and research through participation in the EU's various funding programmes is significant. More than €770 million has been used to encourage key players from across Europe and beyond to join forces in collaborative research projects[53].

16. Participation in EU collaboration gives visibility to the UK's first-in-class science and research offer. In June 2015 British researchers were awarded the highest number of grants from the European Research Council's Advanced Grants programme. The UK will also host the greatest number of this programme's projects[54]. Beyond merely their

[53] http://ec.europa.eu/unitedkingdom/about_us/office_in_northern_ireland/2013/13_46_en.htm
[54] https://erc.europa.eu/sites/default/files/press_release/files/erc_press_release_adg2014_results.pdf

financial benefit to UK researchers, ERC grants – awarded based on scientific excellence – offer prestige owing to the broader pool of peer reviewers. The reputation of the UK's scientific sector is therefore bolstered by success in programmes such as Advanced Grants, and may be harmed by an end to our participation.

British Heart Foundation (BHF) Professor Andrew Newby – University of Bristol
"I was co-director of an EU Framework 6 Network of Excellence called European Vascular Genomics Network. It was a wonderful experience that raised the profile and potential of everything we did thanks to the collaborations that resulted. More important, however, we got to know Paolo Madeddu and Costanza Emanueli who were then in Sardinia. They are now the most productive members of our department at the Bristol Heart Institute and Costanza was recently awarded a BHF chair. These kind of connections just wouldn't happen without EU initiatives. They massively benefit UK science as a result."

17. Collaboration – both pan-EU and, more broadly, international – is fundamental to research. Where EU grants facilitate collaboration it can help EU member states to achieve better results than if they were acting in isolation. In some instances, collaborative research is vital. For example in the case of rare cancers it is often necessary to recruit patients from multiple countries in order to conduct trials with sufficient numbers of participants.

18. The MICROCALS[55] trial is an example of where European Commission funding has been the only source of support for cross-border collaboration in rare diseases, bringing together the right mix of expertise. This trial has been awarded €6 million in EC H2020 funding for an innovative biomarker-based drug trial in Amyotrophic Lateral Sclerosis / Motor Neuron Disease. This award will not only allow a large number UK and French clinics to collaborate in recruiting incident (newly diagnosed) patients for this trial - a particular challenge with a rare disease - but it has also brought in unique expertise from Italian, Swedish and UK research teams with considerable skills and knowledge from outside the ALS/MND world (including Alzheimer's disease, immune diseases and diabetes). The award has not been sufficient to support the whole study (total cost about €7.5 million) but the MND Association and French government have provided complementary funding.

19. Grants that enable such collaboration will help bring benefits patients to the UK, across Europe and worldwide. Working across the EU-28 also means that studies have access to a broader talent pool of researchers. Research that is supported by multiple funders and a diversity of funders is essential for healthy research and innovation landscape.

[55] http://cordis.europa.eu/project/rcn/193232_en.html

Asthma Case study: MyAirCoach
myAirCoach is a project which has received €4,581,378 of funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation under grant agreement no 643607. The 3 year project started on the 1st of January 2015 and aims to develop an asthma monitoring system using personalised mobile health technology (mHealth) by creating a predictive self-management tool for asthma. AMRC member Asthma UK is a partner of the project and is supporting the project by facilitating engagement particularly around patient involvement to ensure what is developed is fit-for-purpose for people with asthma.

QUESTION 6 How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU funding affect the growth of research-intensive UK companies?

20. EU investment in UK research leverages further private investment: €4.4 billion invested in the UK through FP7 from 2007 to 2012, secured an additional €1.1 billion from other sources to meet total project costs of €5.5 billion.

21. The Innovative Medicines Initiative (IMI) is Europe's largest public-private initiative aiming to speed up the development of better and safer medicines for patients[56]. It is funded jointly by the European Commission and the pharmaceutical industry association, the European Federation of Pharmaceutical Industries and Associations (EFPIA). In IMI2 (2014-2024), the €1.6 billion contribution from Horizon 2020 has leveraged €1.4 billion from EPFIA companies. IMI has strong links with charity-funding research in the UK. For example, IMI is the tenth largest funder of further funding for Alzheimer's Research UK's grants, and JDRF have recently partnered in a new IMI2 award with a combined value of €35 million.

22. In the UK, there is extensive evidence to show that government funding leverages industry and charity investment. Research commissioned by the Campaign for Science and Engineering (CaSE) has shown that universities that receive much higher levels of government funding generate more research income from other sources, including from industry and overseas. Furthermore, a recent report by the Department of Business, Innovation and Skills found that each £1 of public funding gives rise to an increase in private funding of between £1.13 and £1.60[57].

23. As mentioned above, EU membership helps to drive the quality of the UK's research outputs and highlight the existing quality of our research base. These attributes help to attract private and overseas investment.

QUESTION 8 What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

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[56] http://www.imi.europa.eu/
[57] Economic Insight, What is the relationship between public and private investment in R&D?, 2015

24. International collaboration – including pan-EU – and researcher mobility are core to the maintenance and further development of the UK's world-leading position as a research nation. The mix of UK, European and international researchers within our research community is vital for the sharing of best practice, expertise and skills and to promote important international collaborations. **Nearly 50% of the UK's scientific publications have non-UK authors and the impact of these papers is significantly higher than the average impact of UK papers[58].**

> **BHF Professor Andrew Baker – University of Glasgow**
> Professor Baker coordinates two EU FP-7 Marie Curie Action Consortia - an Innovative Training Network (ITN) and Industry-Academia Partnerships and Pathway (IAPP) – and holds an ERC grant. ITNs bring together universities, research centres and companies from different countries worldwide to train a new generation of researchers, giving PhD students the opportunity to train across Europe.
>
> IAPPs aim to strengthen links between academia and industry, with a focus on commercialisation of research. The IAPP network coordinated by Professor Baker focuses on gene therapy technology and brings together partners from across Europe, including the UK, Sweden and Hungary. Marie Curie Actions were designed to promote mobility of scientists and our membership of the EU allows us to be part of this.

25. The UK's ability to attract the most talented scientists from around the world boosts our overall research output. The Francis Crick Institute currently employs people from 65 nationalities and considers its international reputation and competitiveness to be dependent on the continued flexibility to recruit the very best from around the globe both within and outside of the EU.

26. EU and international researchers both contribute to the quality of UK life science, yet existing free movement rules mean that is easier for researchers from the EU to enter the UK, easier for EU students to undertake exchanges and easier for EU researchers to collaborate without the need for visas. Numbers of non-EU researchers are limited, for example, through the existing points-based system and pay thresholds for new entrant and experienced workers.

27. The extent of the contribution of EU researchers to UK science should not be underestimated. Researchers from the EU make up a significant proportion of the workforce at Cancer Research UK institutes across the UK. For example, in Cancer Research UK's Beatson Institute, roughly 50% of the researchers are from the EU, compared to 20% from the UK and 28% from the rest of the world. The Group Leader of this lab believes she would not be able to recruit the same level of talent if she was restricted to a UK-only pool. Given the extent of the contribution of EU researchers, any changes to free movement rules are likely to have a significant impact of charity funded research in the UK.

[58] Elsevier, International comparative performance of the UK Research Base, 2013

QUESTION 10 What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

28. Many issues that are important to the medical research community are affected by legislation at EU level.

29. The European Clinical Trials Regulation has now been passed, but is not likely to be implemented until late 2017. Once implemented this new law should harmonise how clinical trials are conducted across Europe.

30. Once agreed and implemented, the Data Protection Regulation will impact how researchers in the UK conduct research. The UK research community is working hard to ensure that the final text best serves the UK research community as well as UK data subjects.

31. The In Vitro Diagnostic Medical Devices Regulation is currently being revised in order to account for scientific developments and provide a regulatory framework for in vitro diagnostic medical devices that is fit for purpose. The sector has expressed concerns with the amendments adopted by the European Parliament to the proposed Regulation, which could have damaging effects on the provision of genetic tests for patient benefit and could potentially limit the uptake of new healthcare innovations.

32. Rare diseases are an important area in which the EU has had an impact. European level legislation in this area includes the EU Regulation on Orphan Medicinal Products, the EU Regulation on Paediatric Drugs (which will be reviewed in 2017), the EU Regulation on Advanced Therapies, the Commission Communication *Rare Diseases: Europe's Challenges*, the Council *Recommendation on a European action in the field of rare diseases*, the EU Directive on Patients' Rights in Cross-border Healthcare, and others. In particular, the *UK Strategy for Rare Diseases* came about as a direct response to the Council Recommendation on a European action in the field of rare diseases.

QUESTION 11 If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example in data regulation, VAT on shared facilities, and on the use of the precautionary principle?

33. In principle, the harmonisation of legislation across member states is beneficial to UK medical research. In areas such as clinical trials, the use of personal data in research and medicines approval, such legislation supports scientific collaboration across EU member states and potentially streamlines approval for large studies.

34. There have been examples of EU regulations that have not best served UK science and research. An example of this is the 2004 European Clinical Trials Directive (CTD). The CTD significantly increased the administrative burden and cost of running academic trials; it also saw a reduction in the number of global trials taking place in Europe. The new Clinical Trials Regulation, expected to come into effect in 2017, is a considerable improvement on the CTD, introducing a streamlined applications process and proportionate approach to the monitoring and safety reporting of clinical trials. The UK

health and research community, including AMRC members, played an important role in influencing these improvements.

35. The Data Protection Regulation in Europe continues to be a concern for the medical research community in Europe. It is vital that the final text of the regulation does not inhibit the use of research using personal data. Although harmonisation to appropriate standards would be desirable to promote research collaboration, we recognise the challenges of harmonisation at the present time and the need for flexibility to allow Member States to implement culturally and socially acceptable solutions.

36. The UK science and research community engages in policy debates around the proportion of the EU budget that should be allocated to science. As a sector, we were concerned by the European Fund for Strategic Investment (EFSI) proposal. Although the final agreement was less damaging to research, it is important that the EU's science funding instruments are safeguarded.

37. There is scope for EU regulations to serve science and research better both in the UK and across Europe, in particular by ensuring evidence is incorporated into every stage of the policymaking process. However, the inherently collaborative and cross-border nature of research means that the UK would be obliged to comply with EU regulations that impact the European research environment even if it were not a member of the EU. If the UK were not a member of the EU it may be harder for the UK government and UK organisations to inform the EU policymaking process. We would retain the potential challenges and disadvantages of pan-European legislation, while losing our ability to influence and improve this legislation to ensure that we are able to benefit from it.

QUESTION 12 How is the innovation landscape affected by EU membership?

38. EU membership supports the innovation landscape in three ways:
    - Free movement of researchers across EU countries that fosters collaboration and sharing of ideas.
    - EU funding that is assigned to science and research, which can be far greater than funds that are available at national level.
    - Capacity of the EU to pool expertise and know how across member states, particularly important in relation to rare diseases.

QUESTION 13 How does the quality and effectiveness of scientific advice on matters of public policy compare between the UK and the EU? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

39. Balancing differing cultural and ethical approaches across 28 member states can mean that European legislation can at times result in proposals that do not match the UK's approach to medical research. A robust mechanism for embedding scientific advice into policymaking is crucial for mitigating the impact of these cultural differences, although we envisage that – given the culturally diverse nature of the EU – it will remain a challenge.

40. The AMRC and its membership were supportive of the post of a Chief Scientific Adviser (a similar model to the UK) to the European Commission President, and welcomed the contribution of Anne Glover. We will monitor carefully the new model for scientific advice to assess its effectiveness, although we do have initial concerns that none of the seven-strong scientific panel has a life sciences background. We are keen to ensure measures that guarantee the mechanism's transparency and accountability.

41. European Citizens' Initiatives allow one million EU citizens to participate directly in the development of EU policies, by calling on the European Commission to make a legislative approval[59]. We feel that these initiatives often lack science and policy evidence and provide a challenge to the sector.

42. Science and research organisations have always worked hard to ensure evidence-based arguments are fed into the policy-making process and work with equivalent organisations across the EU-28 to ensure a pan-European sector approach.

QUESTION 14 To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

43. EU membership enables UK scientists to inform and influence EU public policy. They can inform and influence directly as individuals or through organisations (AMRC's membership advocates on behalf of researchers and UK research more broadly.)

44. There are various ways in which EU membership enables UK scientists and their associated organisations to influence. First, the UK government has a seat at the table at Council of Ministers discussions; the Government has a good record of listening to the views of scientists and the research community as they go into these discussions. Second, UK MEPs across parties welcome the views of scientists and the science community.

45. Scientists and the research community are able to, and indeed do, talk to MEPs and Council representatives from outside the UK, but the natural champions for UK science and research issues are invariably from the UK.

46. EU membership also brings UK scientists together with scientists from other EU countries (see points made above on collaboration). They are therefore well-placed to share policy knowledge and build alliances across Europe's research community; these coalitions are impactful in influencing EU policy.

47. Well-respected UK scientists are occasionally invited to participate in high-level events in the EU institutions. These opportunities enable them to share their views and ensure support.

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[59] http://ec.europa.eu/citizens-initiative/public/welcome?lg=en

Association of the British Pharmaceutical Industry (ABPI) – Written evidence (EUM0017)

Introduction

A.1. The Association of the British Pharmaceutical Industry (ABPI) represents innovative research-based biopharmaceutical companies, large, medium and small, leading an exciting new era of biosciences in the UK. Our industry, a major contributor to the economy of the UK, brings life-saving and life-enhancing medicines to patients. Our members supply 90 per cent of all medicines used by the NHS, and are researching and developing over two-thirds of the current medicines pipeline, ensuring that the UK remains at the forefront of helping patients prevent and overcome diseases. The ABPI is recognised by Government as the industry body negotiating on behalf of the branded pharmaceutical industry, for statutory consultation requirements including the pricing scheme for medicines in the UK.

A2. The ABPI welcomes the opportunity to submit evidence to the Select Committee's inquiry into the relationship between EU membership and the effectiveness of science, research and innovation in the UK. Sustained public investment in research, innovation, infrastructure, universities and training is vital if the UK is to maintain and build on its position as a world leader in biopharmaceutical discovery, development and manufacturing.

A3. Out of all the industrial sectors, the pharmaceutical industry is the largest investor in research and development (R&D) in the UK. The pharmaceutical industry represents 22% of all expenditure on R&D in UK businesses, roughly twice as much as the next biggest sector (Office for National Statistics 2014; Haskel, Hughes, and Bascavusoglu-Moreau 2014), and brings in an annual trade surplus of over £3 billion (HMRC, UK Trade Info 2013, Office for Health Economics (OHE) calculations from HM Revenue and Customs, UK Trade Info, released February 2015). Industry R&D expenditure in the UK represents 9% of the global R&D investment (National Trade Associations) and provides for 73,000 jobs of which 23,000 are highly skilled R&D roles (OHE calculation of ONS Annual Business Survey data 2013). This investment in the UK is predicated on the favourable and supportive environment for R&D, e.g. quality of the academic science base, high-tech skills and fiscal incentives.

A4. The UK is a world-leader in scientific research. It produces 16% of top quality published research findings with less than 1% of the world's population (Elsevier 2013) and ranks second in the world for the quality of its scientific research institutions (Schwab and Sala-i-Martín 2014). The strength of the UK's position encourages inward investment and international collaboration. A significantly higher proportion of the UK's R&D funding (20%) comes from overseas compared with peer countries. Funding of research conducted in UK HEIs from overseas sources is more sensitive to public funding, compared to that from UK businesses or charities (Economic Insight 2015). Nearly 50% of the UK's scientific publications have a non-UK co-author and the impact of these papers is significantly higher than the average impact of papers with UK only authors (Elsevier 2013). Within the broader scientific arena, the life sciences sector is a strength of both the UK and EU, and has been a strategic area of focus for growth within the EU, particularly in a climate of austerity in EU member states. This sits against a backdrop of historically low EU-28 investment in research – 2% GDP (Eurostat 2015), a shortfall against the Lisbon target of 3% GDP.

Funding and Collaboration

1. The biopharmaceutical industry increasingly operates in a complex R&D ecosystem with a number of different stakeholders involved in funding and delivering R&D at different points in the value chain. As the R&D model evolves, companies are increasingly participating in collaborative public-private research partnerships, particularly in precompetitive R&D. These public-private partnerships often help leverage investment in research and innovation and enhance the global competitiveness of a geographical region.

2. There are several EU programmes of relevance to the biopharmaceutical industry. For example, the Innovative Medicines Initiative (IMI-1) was a flagship PPP funded jointly by the European Union (represented by the European Commission) and the European pharmaceutical industry (represented by EFPIA, the European Federation of Pharmaceutical Industries and Associations), totalling a joint investment of €2 billion over 7 years from 2007. It was estimated that midway through the IMI, projects had generated 1,500 jobs in the EU (Report of the Independent Expert Panel 2012). IMI funding supports the participation in its projects of organisations including universities, research organisations, patient organisations, small and medium-sized enterprises, and (under IMI-2) mid-sized companies. Large pharmaceutical companies that are members of EFPIA do not receive any EU funding through IMI. By 2012, across member states, UK organisations had won the largest proportion of IMI funding (€140 million), with the greatest number of participating organisations. The UK has therefore secured substantial value from IMI-1. This success is also reflected in UK dominance in Framework programmes; the UK won 16% of research funding from the recent European Framework Programme (FP7) with only 12.7% of the EU-28 population (National Academies 2015). Scientific publications from IMI-1 had a citation impact almost twice the European average and, similarly to in the wider science landscape, publications with authors from more than one country had a significantly higher citation impact than single country publications (IMI, prepared by Thomson Reuters 2014).

3. The success of IMI-1 has led to the creation of a second Innovative Medicines Initiative. For the **IMI-2** programme (2014-2024), the **total budget is €3.276 billion**, of which: **€1.638 billion** (half the budget) comes from the Health, Demographic Change and Wellbeing Societal Challenge of Horizon 2020, the EU's framework programme for research and innovation; **€1.425 billion** is committed to the programme by **EFPIA companies; up to €213 million** can be committed by **other life science industries or organisations** that decide to contribute to IMI-2 as members or Associated Partners in individual projects. Based on the UK's previous success in securing funding from FP7 and IMI-1, it is likely that UK research organisations will benefit significantly from IMI-2 funding. It is worth noting that according to our sister trade association, since the 2014 referendum in Switzerland, following which Swiss participants could no longer receive EU funding for research, Swiss participation in IMI collaborative consortia has fallen.

4. The UK also participates in a number of European research infrastructure initiatives of relevance to the life science sector and biopharmaceutical industry. Examples include Elixir, for the coordination and integration of biomedical research data, and BBMRI, for the coordination of human biobanking resources across Europe. These initiatives provide

members with access to a broad network for developing research infrastructure across the EU, and can attract high quality scientists and research funding to participating countries.

5. A recent survey of the recruitment concerns of pharmaceutical, biopharmaceutical and contract research organisations by the ABPI has shown that several skill areas are still major concerns for UK based biopharmaceutical companies developing new medicines, despite UK-initiatives to increase the supply of people with the required skills. An example is clinical pharmacology/translational medicine. Other emerging areas such as bioinformatics, health economics and data mining suffer from a shortage of well qualified and skilled candidates for vacancies that arise in the UK (ABPI 2015). It is essential that research-led science based companies are able to recruit the specialists that they need to drive innovation and for the sector to thrive. Any restriction on movement for key roles would have a major adverse effect on the scientific and economic health of companies based in UK and should be strenuously opposed.

6. Companies appreciate opportunities for secondment/job rotation as a tool for career development, talent management, helping with retention and sharing best practice. The unique or rare skills and experience of workers brought in to the UK under both intra-company transfers (ICTs) and external recruitment drive the development of UK employees who work for, manage, or work in teams or external collaborations with such colleagues. Any reduction in the ability to move people in to the UK would reduce these opportunities for upskilling the UK workforce and mean fewer career development opportunities for UK employees outside of UK. This would impact on the continuous development of UK employees and could ultimately stifle innovation and deprive the company of international skills and experience without which the company could not be world-leaders in their field.

Regulation and Scientific Advice

7. The research, development, manufacture, pharmacovigilance and marketing of medicines are governed by a complex set of UK, EU and global regulatory frameworks and mechanisms. A full listing of the EU legislative frameworks that are followed by organisations involved in various aspects of medicines development can be found here (http://ec.europa.eu/health/documents/eudralex/vol-1/index_en.htm) but encompasses Directives, Regulations, Non-legislative Acts and Miscellaneous. This is in addition to broader EU legislation that impacts specific types of research which play a role in the research and development of new medicines, such as the use of animals in research (Directive EU2010/63/EU), the proposed Data Protection Regulation (2012/0011(COD)), the Balai Directive 92/65/EEC and REACH (EC 1907/2006). As a global industry we support better regulation in medicines development and are supportive of harmonisation across geographical areas.

8. We also draw the Committee's attention to the presence of the European Medicines Agency, a decentralised agency of the European Union, located in London since 1995. The Agency is responsible for the scientific evaluation of medicines developed by pharmaceutical companies for use in the European Union. Co-location with the UK Medicines and Healthcare products Regulatory Authority (MHRA) has reinforced and further enhanced the engagement and thought leadership that MHRA plays in European and global regulatory development. Many of the new novel proposals to advance regulatory science and our

approach to medicines evaluation in Europe and abroad are fostered in the UK, by the MHRA and the scientific and industrial community with whom they are engaged. If disconnected from that European platform provided by the EMA, it would be inevitable that the MHRA would lose some of its ability to influence regulatory innovation.

9. Multinational biopharmaceutical companies have invested substantially in the UK, in many cases making it their European headquarters. The UK has been selected as the European headquarters for a number of companies based in Japan and the USA. The UK benefits from this investment, not only in terms of direct benefits to the UK economy, such as the generation of job opportunities for UK nationals, but also from development of a stronger understanding of the UK and European region when individuals move to senior roles in the home country of the organisation.

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References

Association of the British Pharmaceutical Industry 2015 “Bridging the skills gap in the biopharmaceutical industry. Maintaining the UK’s leading position in life sciences” London: Association of the British Pharmaceutical Industry

Economic Insight. 2015. "What is the relationship between public and private investment in science, development and innovation?" London: UK Department of Business, Innovation and Skills.

Elsevier. 2013. "International Comparative Performance of the UK Research Base – 2013." edited by Innovation & Skills UK Department of Business, 118. London: Elsevier.

Eurostat. 2015. “Research and development expenditure, by sectors of performance” accessed 25/08/15 http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsc00001&language=en

Haskel, Jonathan, Alan Hughes, and Elif Bascavusoglu-Moreau. 2014. "The Economic Significance of the UK Science Base: a report for the Campaign for Science and Engineering." edited by UK Innovation Research Centre, 56. London: Imperial College Business School

Innovative Medicines Initiative 2015. “Bibliometric analysis on ongoing projects. 6th report”. Prepared by Thomson Reuters

Office for National Statistics. 2014. "Business Enterprise Research and Development, 2013." edited by Structural and International Statistics, 61. London: Office for National Statistics.

Report of the Independent Expert Panel. 2012. “Accompanying the Commission report. Assessment of European Innovative Medicines Initiative 2. A Joint Technology Initiative Under Horizon 2020” accessed 15/11/15 http://ec.europa.eu/research/health/pdf/imi-ppp-expert-panel-report_en.pdf

Schwab, Klaus, and Xavier Sala-i-Martín. 2014. "The Global Competitiveness Report 2014–2015." *Insight Report*, 549. Geneva: World Economic Forum.

UK National Academies. 2015. “Building a stronger future Research, innovation and growth” London: Royal Society, Academy of Medical Sciences, British Academy and the Royal Academy of Engineering

Astronomy ESFRI and Research Infrastructure Cluster (ASTERICS) – Written evidence (EUM0059)

Declaration of interests:

1. ASTERICS is a €15 million Horizon 2020 project aimed at addressing the cross-cutting technological synergies and common challenges shared by the Astronomy facilities in the European Strategy Forum on Research Infrastructures (ESFRI, chaired by the UK). These facilities are:
   - the Square Kilometre Array (SKA), an international radio observatory being built in South Africa and Australia with its headquarters in the UK, and a capital expenditure cost of €650 million in its first phase;
   - the Cherenkov Telescope Array, a ~€200 million international gamma-ray observatory being built in Spain (La Palma) and Chile;
   - KM3NeT, an international next-generation neutrino observatory with an initial budget of~€200 million, being built at the seabed of the Mediterranean;
   - the European Extremely Large Telescope (E-ELT), a ~€1 billion international observatory being built in Chile by the European Southern Observatory (an inter-governmental organisation in which the UK is a member state). This will be the largest optical/infrared telescope ever built.

2. ASTERICS aims to help these research infrastructures solve common big data challenges and technological problems, so they can operate as an integrated facility. ASTERICS directly engages and collaborates with industry and specialised SMEs.

3. This is the response of the ASTERICS Executive Board to the Committee enquiry. In framing this response, we acknowledge that the EU has funded ASTERICS in Horizon 2020, but the ASTERICS goals are not dependent on future funding bids to the EU or elsewhere. We offer our perspective as to whether similar objectives for multiple world-leading international research infrastructures could be met in future with the UK funding the activities from outside the EU (assuming this can be negotiated). We restrict our response to the Committee questions that are directly relevant to this perspective.

Response to the Committee questions:

What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council? How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

4. There are no restrictions in the creation and operation of international astronomy or astroparticle physics facilities outside the EU as a consequence of the UK's EU membership. Instead, EU membership confers many advantages. For example, EU membership has allowed the UK to participate in technology and infrastructure development for major international research facilities with a wide European interest

(such as through ASTERICS), but in which the facility membership extends beyond the EU. If the UK were not an EU member, it might not have been possible to participate in strategic trans-national research infrastructure investments such as ASTERICS. Note that ASTERICS is not supporting EU facilities; all of the Astronomy or Astroparticle Physics ESFRI facilities are separate entities from the EU with different national memberships to that of the EU.

5. Science research investment and facility planning are intrinsically long-term, both in space and in ground-based observatories and laboratories. World-leading research facilities are now also frequently too large for any single nation to build and run, including all the Astronomy and Astroparticle Physics ESFRI facilities. This long-term international focus makes trans-national strategic planning necessary. In astronomy, the EU has facilitated this planning through ASTRONET, a collaboration of 33 European national funding agencies. The ESFRI roadmap and the long-term plan of the AStroParticle European Research Area (ASPERA, now operating as the APPEC consortium) have fed into the ASTRONET Science Vision.

6. It is sometimes argued that it may be possible in principle for a UK outside the EU to negotiate access to EU research projects, under some terms to be decided. For example the UK might contribute its own funds to EU research infrastructure projects (e.g. as a third country not funded by the EU). Even assuming UK roles can be successfully negotiated there is still a risk that this would expose the UK's long-term research investments to greater fluctuations. The timescales for ESFRI planning are much longer than those of UK spending reviews, for example. Participation in Horizon 2020 allows the UK to be part of strategic trans-national infrastructure investments such as ASTERICS, regardless of the shorter-term budgetary constraints within the UK.

7. The UK also consistently has much more than its pro-rata share of success in ERC grants, securing about one in five of all awards in 2014[60], during a period of severe contraction in the grants lines of UK research councils. This is another example of improved funding stability due to EU membership, greatly enhancing the UK's international competitiveness in research.

Does EU membership inhibit collaborations with countries outside the EU?

8. We know of no evidence for such a position in astronomy or astroparticle physics. The success of the EU-funded COST actions (European Cooperation in Science and Technology) in fostering trans-national networking and capacity building would suggest the opposite, since the COST member countries and cooperating states extend beyond the EU.

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[60] Source: UKRO 2014 report, https://www.ukro.ac.uk/aboutukro/Documents/150624_2015_annual_report.pdf

Professor Heiko Balzter, University of Leicester – Written evidence (EUM0002)

Funding

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

This summary article provides data and references:
http://www.theguardian.com/news/datablog/2012/nov/22/eu-budget-spending-contributions-european-union

Interactive budget graphs per country can be made here:
http://ec.europa.eu/budget/figures/interactive/index_en.cfm

Over 17,000 research organisations from the UK (counting multiple successes as separate counts) have received funding from Framework Programme 7 and thus is one of the 5 top grant winners in Europe: https://ec.europa.eu/research/fp7/index_en.cfm?pg=country-profile

Detailed funding success statistics can be found here:
http://www.mirris.eu/Downloads/MIRRIS_Scoping_Paper_vs_16.5.14_Part_1.pdf

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

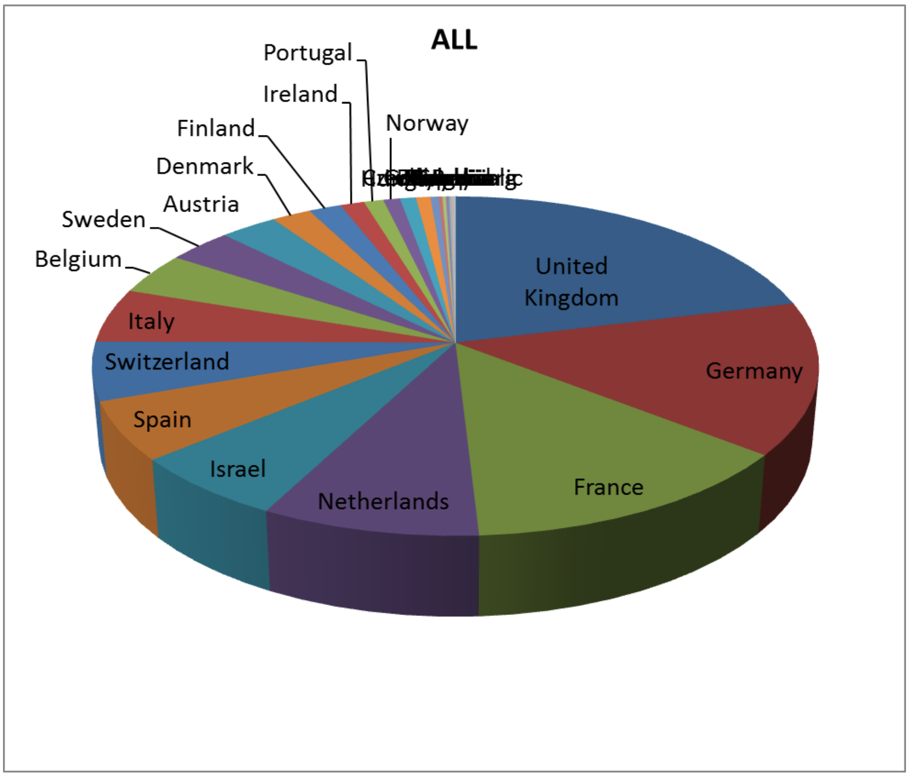
The UK contributed £6.88 billion to Framework 7.
https://ec.europa.eu/research/fp7/index_en.cfm?pg=country-profile

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

The UK has won 571 ERC grants out of 2707 to date, making it by far the most successful country in the ERC. This has an important structuring effect on the UK science landscape and its international reputation and competitiveness.
Data source http://erc.europa.eu/projects-and-results/statistics



5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

Yes, not least thanks to the ease of mobility of researchers within the EU, which means that expensive and drawn out visa and immigration processes are not inhibiting transnational mobility.

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

The lengthy recruitment processes for non-EU nationals make it practically impossible in

many cases to consider non-UK researchers for fixed-term research positions, due to the length of time and the uncertainty around decision making by the Home Office. Without EU membership, recruitment would be even more limited in many cases, where the project timeline dictates a rapid recruitment.

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

No.

Regulation
10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

The European Charter for Researchers has a positive impact on research in the UK.
http://ec.europa.eu/euraxess/index.cfm/rights/europeanCharter

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

12. How is the innovation landscape affected by EU membership?

Britain's rank as the second most innovative country in the world (Global Innovation Index) is enhanced by the EU membership, which makes it easy for the UK to attract innovators and entrepreneurs from all across Europe.

Innovation is also directly financially supported by the EU. For example, over 150 small and medium-sized enterprises in the UK receive funding from the SME instrument in Horizon 2020 alone to date, not counting SME involvement in other calls.
https://ec.europa.eu/easme/sme-instrument-beneficiaries

Scientific advice
13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

Scientists are acting on many European committees, for example I am a member of the European Space Sciences Committee. Scientists directly influence EU policies in such roles.

13 October 2015

BioIndustry Association (BIA) – Written evidence (EUM0046)

1. The UK BioIndustry Association (BIA) welcomes the Committee's inquiry and the opportunity to comment on the relationship between European Union (EU) membership and the effectiveness of science, research and innovation in the UK.

2. We are aware that a number of policy thought leaders and membership organisations in the UK science sector will be submitting responses to this inquiry that will cover issues such as funding and free movement of skilled workers. Therefore our submission here focuses on areas of particular relevance to the BIA's membership base in the UK life sciences industry.

EU-level regulation and legislation

3. The biopharmaceutical sector is one of the most highly regulated industry sectors in the world, and the majority of the UK legal framework governing medicines – including that relating to clinical trials, marketing authorisation, license to manufacture and pharmacovigilance – is based in EU legislation.

4. It is seen as beneficial for the UK's life sciences industry, and illustrative of the UK's position as a global leader in life sciences, that we have two key organisations based in London: the European Medicines Agency (EMA) and the life sciences appeals division of the new Unified Patent Court (UPC).

5. The EMA is the European regulatory agency in charge of providing EU institutions with scientific advice on medicinal products. To guarantee the highest possible level of public health protection and secure the availability of medicines to UK and EU patients, all medicinal products must be authorised by the competent authorities. Much has been achieved in medicine regulation and governance since the first European Pharmaceutical Directive in 1965, including the development of rigorous safety regulations and approval mechanisms, incentives for innovation and licensing flexibilities for faster approval of medicines.

6. Regulation (EC) 1394/2007 on Advanced Therapy Medicinal Products, the 'ATMP Regulation', is another example of an EU level regulation important to developers of advanced regenerative medicine products such as cell and gene therapies, cutting edge new treatments that represent one of the Chancellor's 'Eight Great Technologies'. Under this Regulation, all ATMPs come under a centralised marketing authorisation procedure via the EMA, benefiting from the pooling of expertise at European level and direct access to the EU market.[61]

7. Intellectual property (IP) is the lifeblood of the life sciences industry. The new European unitary patent and Unified Patent Court (UPC) aim to facilitate more consistent decisions in patent litigation across Europe and to reduce the costs for

[61] BioIndustry Association (November 2015) *ATMP and Regenerative Medicine Briefing Paper* http://www.bioindustry.org/document-library/bia-briefing-paper-advanced-therapy-medicinal-products

patentees by limiting litigation to a single forum[62]. Signatories to the UPC Agreement and participating EU member states will benefit from being part of a harmonised, pan-EU patent system; it is a requirement for each participating country to be a member state of the EU. The section of the UPC's Central Division that deals with chemical and pharmaceutical patents is currently planned to be based in London.

The importance of the EU single market to industry

8. For the biomedical industry, NHS England represents just 3% of the global market[63], whereas being a part of Europe gives access to the single biggest global market. The European single market gives UK businesses access to the world's largest trading bloc, and this access is a key reason for global biopharmaceutical companies deciding to establish their European HQ in the UK and invest in R&D activities here.

9. From an industry perspective, it is vital that the UK remains engaged in the EU and takes a leading role in shaping legislative and regulatory policy developments affecting the life sciences sector[64].

Enabling industry and voters to make informed decisions

10. At an overarching level, there is a need for more impartial information on the potential effects on the life sciences industry of leaving the EU.

11. In a recent comprehensive survey[65], the Federation of Small Businesses (FSB) found that 37.0% of small businesses do not feel 'informed' about the forthcoming referendum from a business point of view. They reported a clear and widespread desire among FSB members for access to more neutral information about the EU referendum in the run-up to the vote.

12. Furthermore, 41.3% of FSB members felt that leaving the EU would have a negative impact on their business. (Only 17.2% felt that leaving the EU would have a positive impact on their business, with the remaining 33.6% anticipating no impact on their business.)

13. The UK Government is committed to an in/out referendum on UK membership of the EU, which has led to questions and increased uncertainty about fundamental legal and regulatory cornerstones of our highly regulated and long-term sector. If the UK were to leave the EU, available options would be to continue to closely follow EU legislation but with less influence over it, or to detach the UK's regulations from the EU's, bringing increased burden of regulatory compliance for companies that operate in both markets.

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[62] Schofield, I., SCRIP (September 2015) *The Brexit Effect: What Would It Mean For Europe's Future Patent System?* http://www.scripintelligence.com/home/The-Brexit-Effect-What-Would-It-Mean-For-Europes-Future-Patent-System-360636

[63] Wolff, J., UCL (2011) *Pharmaceutical Cost-Control* https://www.ucl.ac.uk/european-institute/analysis-publications/analysis/healthcare/Jo_Wolff.pdf

[64] BioIndustry Association (October 2014) *UK Life Sciences Manifesto 2015-20* http://bia.me/Manifesto2015-20

[65] Federation of Small Businesses (September 2015) *A study of FSB members' views on the UK's membership of the European Union* http://www.fsb.org.uk/policy/assets/fsb%20eu%20research%20project%20-%20september%202015.pdf

14. To provide clarity, the BIA calls on the Government's Office for Life Sciences to publish a document setting out the practical implications for life science businesses of a) the UK staying in a reformed European Union, and b) how, and when, it would approach the legal and regulatory implications of any vote by the UK to leave the EU to ensure the continuation of medicine supply and future medicines development in the UK. In particular this should include how it would expect to handle the European Medicines Agency and Unified Patent Court potentially leaving London, how medicines would be approved and regulated, and an assessment of the impact on inward investment in the UK life science sector[4].

20 November 2015

About the BIA

Established in 1989, the BioIndustry Association (BIA) is the UK trade association for innovative bioscience enterprises. BIA members include emerging and more established bioscience companies, pharmaceutical companies, academic research and philanthropic organisations, and service providers to the UK bioscience sector. The BIA also runs specialist industry groups in two of the 'Eight Great Technology' areas identified by the Chancellor George Osborne, namely synthetic biology and regenerative medicine.

Our members are responsible for over ninety per cent of biotechnology-derived medicines currently in clinical development in the UK and are at the forefront of innovative scientific developments targeting areas of unmet medical need. This innovation leads to better outcomes for patients, to the development of the knowledge-based economy and to economic growth. Many of our members are small, pre-revenue companies operating at the translation interface between academia and commercialisation.

BioIndustry Association (BIA) and Syngenta – Oral evidence (QQ 69-76)

Transcript to be found under Syngenta

Professor Paul Boyle, University of Leicester, Diamond Light Source and the Royal Society of Chemistry – Oral evidence (QQ 9-24)

Evidence Session No. 2 *Heard in Public* *Questions 9 - 24*

TUESDAY 15 DECEMBER 2015

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Kakkar
Baroness Manningham-Buller
Lord Maxton
Baroness Morgan of Huyton
Baroness Neville-Jones
Lord Peston
Viscount Ridley
Lord Vallance of Tummel

Examination of Witnesses

Professor Paul Boyle, President and Vice-Chancellor, University of Leicester, **Professor Andrew Harrison**, Chief Executive, Diamond Light Source, and **Professor Dominic Tildesley**, President, Royal Society of Chemistry

Q9 The Chairman: Welcome to our second session. We are grateful to you for joining us today. We are being broadcast. For the record, please would you introduce yourselves? If you would like to make an introductory statement, please feel free to do so. Would Professor Tildesley like to start?

Professor Dominic Tildesley: My name is Dominic Tildesley. I have spent 18 years working as an academic in the UK, followed by 14 years in industry working as chief scientist for Unilever's home and personal care division. Currently, I am working in Switzerland for a pan-European organisation in the area of computational modelling in chemistry with 18 members. Today, I am representing the Royal Society of Chemistry as its president and its 53,000 members across the world.

Professor Paul Boyle: I am Paul Boyle, currently vice-chancellor at the University of Leicester. Previous to that, I was the ESRC chief executive for four years and, during that time, I was the international champion for all seven of the research councils in the UK.

During that time, I also became the president of an organisation called Science Europe, which represents 52 of the funding agencies across Europe with an annual budget of around €30 billion. During that time I also sat on the board of the Global Research Council, which is an organisation set up to represent funding agencies across the world.

Professor Andrew Harrison: My name is Andrew Harrison. I was a professor of chemistry at the University of Edinburgh until 10 years ago, when I went to be a director of an international research institute in Grenoble that is co-owned by the UK, France and Germany. Two years ago, I came back to the UK to run the Diamond Light Source, which is a national research infrastructure with a very large international component. I am also one of the two UK delegates on ESFRI, the European Strategic Forum for Research Infrastructures, which advises the Commission on strategy and policy for RIs.

Q10 The Chairman: Thank you very much. Perhaps I could start with a question about determining research funding priorities. To what extent do you feel that EU research funding priorities align with those of the United Kingdom? How much say does the United Kingdom have in deciding these priorities? What are the formal mechanisms?

Professor Dominic Tildesley: I will begin by saying that there is a good alignment between the major research priorities that you see in Europe and in the UK—for example, research into climate change, energy, antimicrobial resistance and healthcare. All these are strong priorities in the UK, but are equally strong in Europe. Although these are strong priorities, in some senses they only guide the programme; they do not determine the research programmes either in the UK or in Europe, which are determined essentially by the scientific excellence of the applications.

In relation to input into this, working as a scientist within Europe at the moment, I find myself working on a number of European commissions and committees to evaluate and think about the quality and direction of these kinds of programmes.

Professor Paul Boyle: I strongly agree with that. I think the priorities are aligned. Indeed, if you look outside Europe, similarly, you will find some of the big questions, such as antimicrobial resistance, energy and other things, matched in funding programmes in the United States, Australia, and elsewhere. It is not surprising that some of the key grand challenges are likely to be repeated across different funding regimes. It is also absolutely clear that the UK has had a strong role in helping to shape what those challenges should be in Europe. Our voice is very strong in the discussions prior to the decision-making around what the different priorities should be. We have had a very influential role in helping to shape those decisions.

Professor Andrew Harrison: I would echo that as well. In my experience, in ESFRI, we have a seat at the table and are very much part of the discussion. One of the results of this is that the UK has been remarkably successful in winning back funds from Europe, which again indicates a strong alignment between what the UK is doing in science and what the various instruments in Europe are funding.

The Chairman: The scientific community in the United Kingdom cherishes what is often described as the Haldane principle, although I think a historian would say one of the Haldane principles—in other words, scientists should ultimately determine the research programmes for themselves and not have politicians interfering. To what extent, at the EU level, where

we are talking Council of Ministers or the European Parliament, about which you may have just heard some trenchant criticism, does this principle operate?

Professor Dominic Tildesley: I think it operates to about the same extent as it operates in the UK.

The Chairman: Do you mean it does not operate at all?

Professor Dominic Tildesley: I mean that positively. You can see this through the work of recent Universities Ministers and Science Ministers. You can see directions in research. For instance, you can see a strong push in computational infrastructure or in healthcare. That is very different from the day-to-day determining of the research programmes. What I do not see in the UK is interference in the day-to-day determining of the research programmes and, frankly, I do not see that in Europe either.

Professor Paul Boyle: Thinking of my research council days I would say that the Haldane principle is something we all buy into, although defining and explaining what it is exactly is a bit of a challenge. Do not forget that in Europe, similar to the UK to an extent, individual DGs have their own research budgets to a degree, so things that they want to focus their research on, they can. Horizon 2020 and other pots are much more general pots designed to allow researchers to come together to bid. The allocation mechanisms are based, as they are in the UK, on peer review and excellence and, therefore, the decision-making about what will be funded in any particular programme, in the end, comes down to academic peer review, which helps us understand the quality of the work that is coming through.

The Chairman: Did you want to come in, Professor Harrison, otherwise I will move straight on?

Professor Andrew Harrison: Just very briefly to say in my experience with European RIs there have been one or two major funding decisions where the advice has been based on research excellence. I will give you one example of research excellence and the local climate that would support that. The example that springs to mind for me is the siting location for the European Spallation Source in Lund, where the recommendation came from an external body of scientists, and its recommendation was based primarily on where science would most thrive among the potential sites.

Lord Peston: Professor Tildesley, you gave us some examples of research priorities, and I think you mentioned climate change and health and medical. There was a third one, but I have forgotten it. Did you say they were good priorities?

Professor Dominic Tildesley: Yes, I think they are good priorities.

Q11 Lord Peston: I have two supplementary questions. Is not one problem with them that they are headline areas of research, they appeal to the public, and so on? I remember reading a research paper years ago saying we spend far too much research money on cancer. It was ridiculous how we overspent on cancer. Can you give us an example of where we have got our priorities wrong?

Professor Dominic Tildesley: Where we have got our priorities right?

Lord Peston: Wrong. My experience of life is you get some things right, you get some wrong. Can you give us an example of where we are wasting some money at the moment for some

reason—maybe the Haldane principle not working—or is everything perfect at the moment in our research priorities?

Professor Dominic Tildesley: The first thing to say is that not everything is perfect. I believe that the kinds of strictures that we have, both in the UK and Europe, regarding peer review and making sizeable bets in good quality areas, mean that, on the whole, we do not do work that is rubbish. I am finding it difficult to think of a really good example of something that I would not have funded in the way you have just described.

Lord Peston: In my own subject I could give you a list a mile long.

Q12 Lord Hunt of Chesterton: Many people comment on the fact that, over the last 10 years, the number of companies owned by the UK has gone down. I visit France and other places with an absolutely clear drive for research, for the French to have a rocket, the French to have airbus, and in Germany the same. We are not talking about the same approach at all. I used to run the Met Office at the time when research was important. Surely there is a big difference in how research has fed into technological projects and, finally, industrial products and industry. They are very different, are they not?

Professor Dominic Tildesley: I find the question slightly hard to answer because most of the companies that I know and have been involved with in the UK are not what you would call UK companies. There are small to medium-sized enterprises, which are primarily UK, but most of the big companies are really quite multinational and will have research bases in the Netherlands, in the UK, sometimes in the States, often in China and India, and they will pull on the best that they find in those countries to their benefit.

Q13 Baroness Manningham-Buller: I want to move to the question of scientific infrastructure. As you know, we are focusing on what damage or advantage there would be to science in the UK if we left the EU. All of you have been associated, or are currently, with big infrastructure projects. We heard in the earlier session about preferred access. May I ask Professor Harrison to begin with, at the synchrotron, who gets preferred access to the beamlines?

Professor Andrew Harrison: We allocate beam time purely on the basis of scientific excellence through peer-reviewed proposals.

Baroness Manningham-Buller: So nationality, membership of the EU, American, whatever, GSK, is not a consideration?

Professor Andrew Harrison: That is not a consideration. The reality is that about 80% of the beam time that we give out is to UK-based people and approximately 20% beyond the UK.

Baroness Manningham-Buller: That is as it happens?

Professor Andrew Harrison: That is as it happens.

Baroness Manningham-Buller: It is not a principle?

Professor Andrew Harrison: Our principle is based on scientific excellence. At that level we are all part of an international network and there is free movement of ideas, proposals, and so forth. There tends to be a bias towards the local facility, because people are most closely associated between universities and national facilities. However, where there is a strength internationally is in the flow of technological development. For example, Diamond is strong in a range of areas because it has imported technology, if you like, from other synchrotrons

and there is a two-way flow in that, and in expert labour. That is absolutely crucial to the success of national enterprises.

Professor Paul Boyle: May I follow that up from a slightly different angle? In the social sciences, for which I was responsible, we also have what we would regard as infrastructure. The best example is the European Social Survey, a survey that is conducted across the whole of Europe which helps us understand economics, politics and a whole range of different areas. We would not be able to achieve that without collaboration across Europe. One country could not establish it financially, but there is also the question of get the buy in from the various organisations that need to be involved. Similarly, if you are not one of the players, you do not shape and influence the survey questions to anywhere near the same degree as the countries that are contributing through the European collaboration. Although we allow other countries to be involved, inevitably the influence on how that survey shapes up is challenging if you are not one of the funders through the European Community.

Baroness Manningham-Buller: Professor Tildesley, do you have any comments on this particular issue of to what extent we might be disadvantaged with access to infrastructure were we to leave the EU?

Professor Dominic Tildesley: I want to distinguish two cases here. There are some non-EU partners, such as Norway and Switzerland, where there is much more open access in the infrastructure that I am associated with, which is the PRACE infrastructure for European computing, than there is with the US and India in the actual allocation of resources.

Baroness Manningham-Buller: Could you just expand on that? Does that mean that India and the United States have much less access?

Professor Dominic Tildesley: I think that is fair to say, yes.

Baroness Manningham-Buller: In this case, it is not on the merits of their science; it is on their nationality.

Professor Dominic Tildesley: Essentially, the proposals that we get come from Europe, and not from outside. We are not international in the same sense that the synchrotron source is. CECAM is a much more European-based organisation.

Viscount Ridley: I want to clarify something. Both Professor Tildesley and Professor Boyle used the word Europe. Did you mean by that the European Union, or not? Professor Tildesley pointed out that Switzerland and Norway did have preferential access.

Professor Paul Boyle: It will depend, of course, on whether they want to be part of the particular infrastructural programme. You are right—it does depend on whether you mean Europe.

Viscount Ridley: You said the European Social Survey was a cross-Europe collaboration. Did you mean cross-EU or cross-Europe?

Professor Paul Boyle: It is a cross-EU collaboration, but there are some players from outside the EU who invest.

Q14 Lord Cameron of Dillington: I have to declare my interest, which I should have done in the previous session, but somehow failed. I am a trustee at Rothamsted. I am chair of the Strategy Advisory Board of the Global Food Security research programme. I am a chair of an advisory council of the Centre for Ecology and Hydrology. I am also a farmer in receipt of

European Union funding, which may or may not be relevant. My question is: does the fact that it is easier to recruit EU scientists than non-EU scientists put non-EU scientists off from applying for research positions? There are all sorts of implications involved if it does. One of the bits of evidence we received was that the immigration policies that result in an effective bias towards EU scientists over others will weaken UK science. Do you have any comments about that?

Professor Paul Boyle: I am happy to comment. Around 12% of our workforce in academia is from outside the EU and about 15% comes from other EU countries. There is a fairly nice balance across the two. If I reflect on it anecdotally, I recruited an awful lot of Chinese research assistants, as it turned out, who worked in my field and we also, when necessary, recruited people from the EU. The UK is a brilliant research environment. People from all over the world want to come and work here. When you advertise jobs you have a range of applications that comes in. Visa regulations, not just for researchers, but for our students, are serious issues, where clearly it is easier to attract the very best from within Europe than outside Europe.

Lord Cameron of Dillington: Would those percentages be the same under Brexit?

Professor Paul Boyle: It is difficult to judge, is it not? I would suspect that, if the barriers are put up a little we might see some more difficulties arising.

Professor Dominic Tildesley: At the RSC, our industrial members speak frequently about difficulties in recruiting from outside the EU in relation to visas, and also students, particularly at the Masters level, coming into the UK. That situation is difficult. I cannot predict how that would be under Brexit.

Professor Andrew Harrison: The numbers that we have are remarkably similar to those that Professor Boyle mentioned. One of the possible consequences of Brexit would be that we would find it harder to recruit expert scientists and engineers. I have about 15% non-UK staff who are expert scientists and who are from the EU. The skills that you are looking for are fairly rarefied, so necessarily we have to fish in an international market. One of the key things about mobility is that generally these people come not with the intention of coming for ever, but for a fixed period of time, often with a family or a spouse. It is equally important that people within the whole family can move and find jobs. The converse is true as well. The reason why many UK scientists are as trained and skilled as they are is that they have also gone abroad. I am in this position primarily because I spent seven years living in France. I would probably have found that much harder to do had the movement of labour between the UK and France, for my entire family and the ability to work, been harder.

Q15 Lord Kakkar: You might have heard our exchange with regard to the question of regulation in the European Union. To help us better understand that area in relation to the impact on science, innovation and technology, could you identify the most influential area of EU regulation in your own discipline or expertise? Can you help us understand how that might have been beneficial, how the UK standing alone, or developing regulation in that area, might have done it differently, and how the harmonisation achieved by this pan-European approach has been beneficial or caused some anxiety?

Professor Dominic Tildesley: Certainly for chemistry, REACH is probably the most important and influential of the regulations in the way that it affects the availability of chemicals. While REACH, like all regulations, imposes some constraints on us, there are clearly advantages to

a unified regulatory system in this space. Let me take one of the examples you mentioned, which was animal testing for cosmetic uses. I cannot imagine having a separate regulatory position on that from a position where you were trying to sell into a market that was regulated using different legislation. For instance, can you imagine having a separate UK set of regulations for this, and then attempting to take the goods that you produce and put them into the most important marketplace for us in this respect—Europe—which is governed by a different set of regulations?

The point I want to make is that many of our members feel that having separate regulatory systems would not be effective in this chemical space.

Professor Paul Boyle: If I look to my field, the data protection legislation is probably that which I have been mostly closely aligned to. There is no question in my mind, and I think most people in Europe would agree, that it is important to have consistent legislation across Europe, but it has also been a challenge to achieve that. We heard from Kurt about the problems with the Parliament compared to the European Commission. For example, just imagine trying to conduct cross-European research in an area where data protection rules were different. It makes it very challenging for survey work, including clinical studies, if the background legislation to the way that you interact with individuals and protect their information, which must be done, varies considerably. There is strong consensus that a consistent approach is important, but it is also essential that we make sure that the ability to conduct science in a rigorous way is protected. As we go forward with this, you will see that the UK voice has been extremely powerful. The lobbying that we have been able to put forward has been extremely influential. There is still some way to go, but we have had an influence.

Lord Kakkar: Do you think there is a risk in that specific example that research in Europe is stifled as a result of that particular regulation to the advantage of the European research base more generally?

Professor Paul Boyle: With any science-related legislation there is always going to be a risk. If you pay close attention to the debates that have been going on in Europe, you will see that the argument from the science community has been very powerful. I would be very surprised if, at the end of the process, we do not find data protection legislation which fits with what we need to do in science.

Professor Dominic Tildesley: In the area of animal testing, although you can imagine that this could be disadvantageous to companies that wish to market products, what it has done in many ways is to stimulate new areas of research in Europe, particularly the whole area of systems biology, to find non-invasive, non-animal ways of making the same tests on products. In some senses, it has been quite an inspiration in drawing forward areas of research to fit into this legislative framework. I might also add that one has to take into account public understanding of science. It is very important that we adhere to quite strong regulatory frameworks to give the public confidence in these areas.

Lord Kakkar: Just to be clear, is there not a view that the regulation that attends the conduct of scientific research in its European element could be improved if the United Kingdom had designed a regulatory framework itself?

Professor Dominic Tildesley: I would rather say that what needs to be improved is the regulatory framework as designed by Europe, as was discussed with you in the last session.

The Chairman: If we look specifically at REACH, which some would describe as ponderous in the extreme and lacking flexibility, are you really saying that REACH was the best of all possible directives for the purpose, accepting for the moment that a unified approach is clearly desirable? Surely we could have done a better job than REACH, could we not?

Professor Dominic Tildesley: Perhaps we could, but REACH is about achieving a balance between elements such as protection of the environment and human health, and, at the same time, avoiding ponderous impacts on research and innovation. I believe that the disadvantages of REACH can be mitigated by influencing decisions on how REACH is applied here, and that is where we have to concentrate.

Q16 Baroness Neville-Jones: I want to ask a supplementary, but, perhaps before I do that, I should declare an interest as a member of the Engineering and Physical Sciences Research Council and the Foundation for Science and Technology. I want to pursue for a moment what has been said about regulation. In the last session, for which you may have been in the room, we heard rather a strong diatribe against the negative interference which occurs at the stage when the legislation reaches the European Parliament, where certainly it is true that lobby groups that have not been particularly active or influential when the Commission has been drafting come into play and have an effect on the outcome. My question to you is: do you share that analysis? Do you share the implication that if these drafts, which come from the Commission, were left alone and not interfered with, they would be perfectly okay? What view do you take of the quality of the regulatory drafts that come forward? Do you think—on the other thing that was said—that Ministers, when they get to the Council, should be tougher and are well briefed? Do you think more could be done to resist some of the insertions in the legislative process that are unhelpful and could be driven out again if member states and member states' Ministers were more focused and determined?

Professor Dominic Tildesley: I do not have a view on that in addition to the one that we heard in the first session.

Professor Paul Boyle: The nature of its democratic process means that there are checks and balances within it, which means the process of coming up with legislation goes through a series of stages, as it does through the UK. If you look to a number of examples, yes, it is true occasionally that the Parliament can come up with changes that do not suit science. Of course, they come up with proposals that suit other parts of our society perhaps. It is iterative, and during the iterative process we have seen that the Commission can be quite powerful, particularly because of the lobbying that we get from the national states in helping shape what good practice should be.

Baroness Neville-Jones: Does the Commission get it broadly right, in your view, for starters?

Professor Paul Boyle: In general, partly because we interact with the Commission prior to them coming to a view. It is not quite black box. It is not as if the Commission comes up with a view and we have to respond to it. We are very much involved in helping the Commission think about its policy. To be honest, the UK has been particularly influential in shaping areas related to science funding such as research integrity, peer review, open access and a whole range of areas where British science really punches above its weight in helping shape what happens in Europe.

Professor Andrew Harrison: I would echo that. Broadly speaking, at the consultative level that leads to the information or advice that goes to the Commission, the UK is widely

respected. It is widely respected because it is seen to run many areas of science well and to punch above its weight.

This is not perhaps quite the same thing. I strongly welcome the recent move to strengthen the nature of the advisory bodies at a high level. In Europe, this science advisory mechanism, this new high-level group, has been established. The stronger and more prominent the advice given in the decision-making process, the better.

The Chairman: We will come back to advice in a moment.

Q17 Lord Maxton: I should have declared my interests—I do not have any. It is quite simple. It seems to me, on data protection regulation, that the real problem is that the technology does not allow access across the board. If you attend even a local hospital in this country, you will find that they do not have records of you on their data files between different departments of the same hospital. To what extent is technology involved in this? To what extent are the changes in technology, which are taking place all the time, affecting how we regulate and do things?

Professor Paul Boyle: You are absolutely right and your point is well made. A major reason for the need to be very careful about data protection is the growing ability to start linking records across different systems. As we link more and more data together, whether we are doing that for scientific purposes or other purposes of government, it is important to make sure that we can protect people's confidentiality. That can be done, and it is important, therefore, that the data protection legislation recognises that. We could get quite technical, but it is around how you pseudonymise data rather than having to rely entirely on anonymisation. There are very good practices in place in the UK especially for managing that sort of approach, which we need to make sure are included within the data protection legislation.

Viscount Ridley: May I follow up on Lord Kakkar's question and challenge what I think is a little complacency about the effect of regulation with the example of genetic modification? I know it is not your field of expertise, but, none the less, we have seen an evaporation of a very strong field of research in Europe, which we were the leaders in when it started, largely because of opposition across the continent. We have just had an inquiry in this Committee into genetically modified insects, which made it clear that the problem at the moment comes from Europe, essentially. In other words, in Britain there would probably be much greater positivity about this now, but European regulation is not fit for purpose in this area and is discouraging experiments and trials.

Professor Dominic Tildesley: One of the issues I would raise here would be the point of getting really good advice into the European Union and European Commission about these issues. One of the things that we support very strongly is evidence-based decision-making in spaces such as genetically modified organisms and many other areas of science. You have to get the right people advising and supporting the politicians in Europe—indeed, in Strasbourg—when it comes to decision-making in areas of this kind. They need to be informed. I very much welcome the move which has occurred recently in Europe towards broadening out from the influence of one scientific adviser to a panel of scientific advisers. It was good to see David King, our former chief scientist, in a key role in helping to make the decisions about that board. It was good to see the head of the Met Office, Dame Julia Slingo,

being moved into a position where she can give advice on climate, which is another sometimes controversial issue.

Viscount Ridley: The person who lost her job in that respect did so partly because she was so adamantly in favour of trying to improve the regulation on genetically modified crops.

Professor Dominic Tildesley: I could not comment on that. I do not know.

Q18 Lord Peston: To reveal my ignorance, I have a question for Professor Boyle. I misunderstood what you were talking about when you were talking about data protection. I thought you were talking about stealing other people's data, but that was not what you were talking about, was it?

Professor Paul Boyle: No.

Lord Peston: The Rosalind Franklin case is the one that one always bears in mind. She was the one who did not get the Nobel Prize. You are talking about individual people wanting to know when they respond to a survey that people will not know it is them.

Professor Paul Boyle: Yes.

Lord Peston: As someone who has not been terribly well in recent years, I do not give a damn about whether my data are protected or not, because I am much keener for the research to succeed. Do you have much information on what the public at large think about protecting data in your sense?

Professor Paul Boyle: There is an awful lot of research going on at the moment. There are discussions at both the UK and European level about how we may implement legislation which would help allow for exactly the sort of thing you have identified, using individual-level data to help us understand more about disease and other things. Doing it in a protected environment means you can have the added advantage of being able to use people's individual records, but you do not need to know their individual name, address, date of birth, and so on, which allows you to go out and identify people. That is an important principle. We can look back in history at times when individual-level databases have been used for rather daunting reasons. It is important to protect confidentiality, but it can be done. That is exactly the debate we are having in Europe at the moment.

Q19 Lord Vallance of Tummel: I have a general question and then a specific example. The general question is, how does our membership of the European Union affect collaboration with industrial partners? Perhaps you could distinguish between an industrial partner that might be headquartered in the European Union and one that might not, perhaps in the States or wherever. The specific is, what might we learn from a public-private partnership, such as the Innovative Medicines Initiative?

Professor Dominic Tildesley: I will distinguish between those two cases that you mention. Let me take a simple example of Unilever as a company that is established within the European Union. Companies of that kind get a great deal from being able to collaborate easily and well with the partnerships that are set up across the Union. Partnerships between France, Switzerland, Germany and Unilever are common and much welcomed by those companies, I am sure, and prove very stimulating in taking ideas across from the pure academic area into the applications field. For companies such as Dow Chemical, established in the States, with some key European presence, some research in Europe, where those

American companies have a research base in Europe they can gain some access into that, but, on the whole, I think they find that more difficult. Getting those kinds of collaborations is not as well established in the States. That way of working between industry and academy is not as well established in the States as it is in Europe.

Lord Vallance of Tummel: Do you have anything specific on the Innovative Medicines Initiative?

Professor Dominic Tildesley: For me, this is a very good example of a first-class public-private partnership. We have been able to leverage about €1 billion from companies associated with the European Federation of Pharmaceutical Industries and Associations. It is one of many good examples in this space. Another one would be the sustainable processing and resource efficiency initiative, the so-called SPIRE. This anticipated an impact of a reduction of about 30% in fossil energy and a 20% reduction in non-renewables. This is across eight industry sectors, involving partners right across Europe. These are good examples of how EU membership affects collaboration with industrial partnerships to their advantage.

Lord Vallance of Tummel: The bottom line is that EU membership does not constrain such partnerships elsewhere, but is beneficial, is that right?

Professor Dominic Tildesley: To be balanced, I am sure there must be some examples of where a constraint has occurred, but, on the whole, I see this as beneficial.

Lord Hunt of Chesterton: Would you agree that this comment extends well beyond industry partners to government departments? For example, the use of weather radar across Europe did not happen until an EU project was funded to do that. There are many other examples. Do you have any thoughts as to whether that can be done more effectively and what the effect might be of the UK departing from the EU?

Professor Dominic Tildesley: The only thought I would offer on that is I have seen this work to very good effect in the UK in establishing infrastructures in computational science, which can be used both by Government, academy and industry to very good effect. It is a model that has worked well here in the UK; I am trying to see whether it can be established in Europe at present through my organisation.

Lord Hunt of Chesterton: They exist strongly in Europe in my experience.

Q20 Baroness Neville-Jones: I wonder if we could move towards innovation. We have touched on industrial partnerships. Innovation is very much a preoccupation of government policy and a strong focus of the research councils these days. I would be interested to know what the panel thinks about the proposals that have been put forward by Commissioner Carlos Moedas for a European innovation council. Do you think that is likely to be an effective vehicle? How well could it be made to tie up with existing sources of funding for innovation, which occur in some of the other funds open to European institutions for research purposes? Is this moving in the right direction? Does it have the right sort of structure to have a fruitful future?

Professor Paul Boyle: Personally, I think it is early days, because we do not yet know what the proposal is from the Commission, and probably will not know for at least another year or two, so we are a little bit ahead of ourselves. On the other hand, the concept, the idea of embedding innovation more strongly, and aligning that with the research agenda, is

something that the UK has been at the forefront of, so inevitably we are going to be very positive about that. There is no question that Horizon 2020 has already embedded innovation much more strongly than the FP7 did, and the UK's voice in that was very powerful.

Baroness Neville-Jones: You can waste money in this area.

Professor Paul Boyle: You can, that is absolutely true. I am not going to pretend that this is an easy area. We can look to the UK with Innovate UK, and now some proposals to bring that into the research councils, so you can see some similar discussion going on about how best to do this. It is not a simple area. However, I believe that we need to be pushing forward in that area and thinking more about that gap between industry and research.

Baroness Neville-Jones: Do you think the UK is well equipped to take advantage of that, or do you think that is something other countries might be better at?

Professor Paul Boyle: Inevitably, we are well equipped. There is no question but that the UK is ahead compared to most countries in Europe in the way that it is now integrating innovation alongside research.

Baroness Neville-Jones: Germany?

Lord Hunt of Chesteron: Or Italy?

Professor Paul Boyle: Less so. Germany is doing very well, but the UK is ahead of the game. If you look at the Global Innovation Index, the UK is second in the world, which is all about how well we manage to take our research ideas and then put them out into industry.

Q21 The Chairman: If you look at the level of investment from the commercial sector in research in this country and compare it with our European competitors, you will note that we are at a disadvantage in that respect. We have a poor investment record from commerce. Does that not mean that we are likely to be at a disadvantage in this respect of innovation or transferring technology?

Professor Paul Boyle: There are two parts to that question. There is how much we invest as a nation, and you can also make the strong case that we invest too little in publicly funded research in the UK. There is how much we invest, but there is also how well we do it and engage in it for that which we fund. The UK has very good examples. If you look at the funding from HEFCE, it has been extremely successful in levering funding from the private sector into projects that are funded through central government. We have lots of good experience of this, more so than most countries in Europe. To be fair, I take Germany as another good example. It is absolutely right that we probably need more funding in that area, but that is a slightly different question from how well we do once the funding is made available.

Professor Andrew Harrison: If you look at areas such as advanced manufacturing and aerospace, where support has been provided on both sides, clearly productivity has increased in those areas. There are very good examples where this has been done well. Sometimes we beat ourselves up about innovation. I do not wish to sound remotely complacent, because I am not, but in some areas we have done all right. There is far more to be done.

Working closer to the coalface, as it were, in research institutes in Europe and then coming back to the UK, I felt there was a sea change when I came back to the UK two years ago. In academia and more publicly funded labs the culture has changed very widely in the last eight years, in my experience, in that academics genuinely get innovation now. At least, they understand that it is necessary, it is vital to work closely with industry. In that respect, we are ahead of a lot of the rest of Europe. There are exceptions. I am using Europe now in the geographic sense: Germany and Switzerland are notable examples, as are some of the Scandinavian countries.

Lord Peston: You seem to be arguing that productivity could off-set lack of expenditure. Wearing my economics hat, is it not logical that where you are most productive is where you ought to spend most, but the reverse is the case?

Professor Andrew Harrison: The point I was trying to make is that where there has been strategic investment, particularly in infrastructure—I mean that in the broadest sense—you can see that the industries in those sectors, such as certain areas of advanced manufacturing, have really gained.

Professor Dominic Tildesley: In relation to EU innovation, I am pleased by the innovation in the small to medium enterprises stream, which we find in the Horizon 2020 programme. That is already helping a considerable number of UK companies to develop interesting technologies. My example would be the Cambridge-based company Abcodia, which has received considerable funding to develop its early diagnosis for pancreatic cancer. There are interesting examples where companies are benefiting from loans from the European Investment Bank, which is important.

To return to your original question, the proposal by Commissioner Moedas in July to create a one-stop shop to bring together the various European mechanisms is very welcome. In general, for us, the principle links existing mechanisms, so there is strong potential for avoiding duplication and for minimising complexity to applicants. I want to echo that this is early days. I look forward very much to seeing how that develops.

Q22 Lord Hunt of Chesterton: I have a question about science advice. Do you think that the somewhat different approach to science advice in the EU compared to the UK is good or bad? Does it pose a problem? Could you illustrate your point with the difficult science policy issues? We have talked about animal testing, but there are other areas, such as environmental pollution, where there are horrendous difficulties and embarrassments. GMOs have been mentioned as have carbon emissions, nuclear and exchange of scientific data. Do you think these issues are being tackled well in the EU? How is this related to our potential exit?

Professor Andrew Harrison: It comes back to the issue we mentioned 10 or 15 minutes ago about re-establishing a proper advisory presence at the highest levels post-Anne Glover. It was recognised that there was a strong need for high-profile, transparent advice. It is early days again, but there is a real step in the right direction here within Europe. I hate to say this, but I think we have to wait and see, because I do not know if they have formally met yet, having just been appointed.

Lord Hunt of Chesterton: If you look back on these issues, do you think in science policy the EU has mechanisms or attitudes that are good for solving those problems?

Professor Andrew Harrison: I think it recognises that there are things that should have been improved.

Professor Dominic Tildesley: There has generally been a weakness of putting too much pressure and emphasis on one individual as a single chief scientist. I look forward to seeing how this well-established, interesting and diverse group of seven that has been set up will work. It is not that different in the UK. Although we have always enjoyed a government chief scientist, many of the government departments have chief scientists of their own, so the load is spread. For me, the important thing is that I am not so worried about how you do it, as long as all policymakers in the country can take the time and have the opportunity to understand the scientific evidence on a particular question. When a parliament anywhere—here, Scotland—rushes to a decision without taking the evidence first, that is when really serious problems can occur.

Professor Paul Boyle: Just to follow up on that, it was not as if there was a vacuum of scientific advice prior to Anne Glover being put into her position. The European Commission took advice from a range of different areas.

Lord Hunt of Chesterton: The European Parliament, too.

Professor Paul Boyle: The European Parliament, too. Anne was put in a particularly difficult position. The model we use in the UK is to have a single CSA who sits above other structures, but Anne was put in with very little resource, and it was not very easy for her to influence in the way that she needed to. What we have seen with the SAM is not only a group of people, which may have a little bit more weight, but also the fact that there is resource attached to that, a secretariat and so on. All the signs are that they have recognised there is a need for scientific evidence. We all know scientific evidence is one part of the debate, but we need to make sure that goes into the debate.

Q23 Lord Kakkar: Do you think that there is a greater risk of political interference as the scientific advice is made available at European level compared to what happens in the UK?

Professor Dominic Tildesley: I do not. I cannot see why there would be a greater risk.

Professor Paul Boyle: You used the term “political interference”. We have a democracy that has to take decisions and it will base its decisions on advice from a range of quarters, including public opinion; scientific advice is one part of that. As scientists, we like to think it ought to be a particularly important part of the advice, but that does not necessarily equate to everyone’s views. It is essential that whatever system is in place is properly set up to take on board the various pieces of advice that should be presented. There are certain topics that particularly require scientific advice, of course, and in those especially we would hope that that advice is taken seriously. We can point to examples in the UK where you could argue that scientific advice has not been taken by government as strongly as perhaps scientists think that it should. In any democratic system that will inevitably happen. We hope on average, and in the main, scientific advice will be taken seriously and acted on.

Baroness Neville-Jones: I have a point of clarification, Lord Chairman, and please forgive my ignorance. Obviously, the panel has the advantage over one person of having a range of expertise, but to which institutions is it mandated to give advice, and will that advice be public?

Professor Paul Boyle: We have not yet seen the proposals around the governance, and so on, precisely. We can all guess. I think you will find that the advice, if we look at any of these bodies that exist already in nations, is made publicly available. It is independent scientific evidence and, therefore, should be treated as publicly available. As I say, we do not yet know exactly the governance arrangements for how this panel will work.

Baroness Neville-Jones: You do not know if it is mandated to give it not just to the European Commission but also to the other institutions, the Parliament and Council?

Professor Paul Boyle: I am not sure.

Lord Cameron of Dillington: As I understand it, they will only be able to advise only on questions they are asked; they are not allowed to advise on policy. That is what I have read.

The Chairman: We can probably get a brief on this.

Baroness Neville-Jones: I think it would be quite helpful to have a brief.

Professor Dominic Tildesley: May I mention something we talked about earlier, which is, apart from these seven wise individuals advising, the Commission takes advice from a large number of scientists right across Europe, at the stage of the refereeing of proposals, which is often on scientific quality, and at the stage of bringing people into groups—groups around biology, computational science, mathematics, physics—to advise the Commission on the direction of research. In those regular meetings, a great deal of advice is given by ordinary scientists; they give their opinions on how the programmes should be shaped. Apart from this top-down approach, there is also a bottom-up approach to feeding in advice to Europe.

Q24 Lord Maxton: Is there a difference between what I would call computer technologies and science in this field? It seems that the major computer companies are from the USA, not from Europe. They may have a European base, but they are from the USA. Secondly, science is based very much on the research that is done, whereas I remember someone from Microsoft telling me many years ago that the next big breakthrough in computer science would probably be done by some 19 year-old working in his bedroom on his laptop. The major companies may buy him up, but that is where the next idea will come. Is there a difference between these two fields?

Professor Dominic Tildesley: You are right that Intel, IBM and most of the large companies have an American base. France has tried, through the introduction of Bull, to have a French base, and this has been a very interesting experiment in high-performance computing. I think others on the panel would agree that high-performance computing is now so intimately wound up with the way that we do science that it is no longer something I could even think about as being separate. The computational sciences, and the methods of using computers in science to test theories and experiments and to give us new ideas, are now so involved in what we do that I find it very difficult to pull those apart.

The Chairman: Thank you very much. We have come to the end of the questions we wanted to put to you. We are most grateful to you for the patient way you have addressed the issues. There will be a transcript sent to you for any minor corrections. If there is any supplementary evidence you would like to send in to elaborate on any of your answers, please feel free to do so. On behalf of the Committee, thank you very much, Professor Boyle, Professor Harrison, and Professor Tildesley, for your help today.

Brightwake Ltd – Written evidence (EUM0001)

Author: Paul Browning, Head of Regulatory Affairs

1. Executive Summary

a) UK has over 3000 companies employing 76,000 people in medical technology
b) Valued at £17 billion and growing at rates exceeding 6%
c) UK contributes 3.3% of the £118 billion Global medical device market
d) The UK is the second highest employer of medical technology companies, beaten only by Germany.
e) 38 million people contact a medical device every day in the UK
f) European Medical Device regulation offers the best balance between safety & risk, with early access to new innovation.
g) European medical device legislation is recognised across the globe and allows easier and more affordable market access, not just throughout Europe, but in a significant number of countries across the Globe.
h) Leaving the European Union, would have a detrimental effect of UK businesses where EU legislation is used for market access. With the cost of regulation increasing, and the cost of products being forced to decrease, many UK businesses will no longer find it viable to innovate and manufacture within the UK.

2. Introduction

Paul Browning is a clinical scientist, and industry leader in European medical device regulation and quality management. Currently Head of Regulatory Affairs for Brightwake Ltd, an innovative UK based medical technology organisation. Listed as an Expert from the University of Worcester (University of Worcester, 2015), he also participates in UK Parliament Outreach programmes.

3. Funding

Question 1:

The financial support provided by the EU has allowed our organisation to develop test methods, and work in collaboration with UK universities to conduct highly specialised tests, and collaborative work. However, the *Di Minimus* restrictions results in a reduction of the total collaboration possible for UK business – as such use of this valuable resource funding is restricted. But certainly without this funding from the EU our organisation could not bring as many healthcare innovations to the European market, and British citizens as we currently do.

4. Collaboration

Question 7:

Our EU membership through free trade dissemination, has facilitated the creation of a number of sales offices and logistics channels within the EU. As the organisation has expanded, the need for more local distribution of UK made healthcare products within the EU was necessary. Setting up local divisions of our company within the EU, whilst having significant bureaucracy, was not as difficult as setting up similar entities in non-EU countries, in particular China, Middle East, and United States. The EU development of our supply chain

has resulted in more consumers and healthcare professionals having ready access to UK made medical devices, where they need them, when they need them.

5. Regulation
Questions 10, 11 & 12:

a) **EU Landscape for medical device regulation**.

(1) Medical device manufacturers in the UK must comply with the one or more of the following:

- Directive 93/42/EEC for medical devices,
- Directive 98/79/EC for *in vitro* medical devices (IVDs)
- Directive 90/385/EEC for active implantable medical devices (AIMD)

(2) In addition, depending on the nature of the device, other EU legislation may apply – for example, electromechcanical, cosmetic, pharmaceuticals and more. Furthermore, there are a number of European adopted standards which are used to demonstrate, or presume assumption of compliance to EU legislation. These are referred to as Harmonised Standards. A harmonised standard is a European standard developed by a recognised European Standards Organisation: CEN, CENELEC, or ETSI. It is created following a request from the European Commission to one of these organisations. Manufacturers, other economic operators, or conformity assessment bodies can use harmonised standards to demonstrate that products, services, or processes comply with relevant EU legislation (European Commission, 2015). Such standards are published in the Official Journal of the European Union.

(3) These three Directives (MDD, AIMD, IVD) form part of the 21 New Approach Directives which apply to products that can bear CE marking. CE marking is not a quality mark, but indicates to EU regulators that these devices meets all requirements of the appropriate Directive. CE marking is not used solely for medical device manufactures, but applies to many other British industries. Regulation and patient safety are the single biggest drivers across all medical technology organisations (Topham, 2003).

(4) The European Union’s regulatory system for medical devices has proved highly successful, and is recognised as providing the ‘gold standard’ globally; it has demonstrated its efficiency in rapidly bringing the benefits of innovation to people. According to independent studies, people in the European Union on average benefit from advances in medical technology 3-5 years earlier than in Japan and 3 years earlier than in the US, without compromising safety. By avoiding excessive delays, the European regulatory system provides an incentive for innovation. Designers and manufacturers are encouraged to develop better products that address patient and healthcare needs more quickly.

(5) In 2013, over 10,000 patent applications where filed with the European Patent Office in medical technology. 41% of these were filed from European countries (EUCOMED, 2014). In terms of context, in the same period around

5400 application were field in pharmaceutical fields and 5400 in biotechnology (European Patent Office, 2014).

(6) The current economic troubles within European Union members will likely result in slow market growth from 2014-2019, especially within southern European states. With the increased regulatory challenges with recent and forthcoming regulation, medical device manufactures in Britain will face increased cost-containment measures, and focus on smaller areas in order to show business growth. This is at the cost of innovation.

(7) As a result of recent and very public failings (e.g. PIP and metal-on-metal hip), European Legislation has already responded with Notified Bodies affording more control and longer review times – which is paid for by manufacturers. Although you can not legislate to prevent law being broken, the new legislation is set to offer more rigorous, but more transparent review of medical device manufactures where stricter and more detailed monitoring and enforcement activities from both Notified Bodies and National Competent Authorities (like the MHRA in the UK). More stringent approval procedures with additional clinical evidence requirements for high-risk devices will also increase the regulatory burden on manufacturers. Longer and more costly approval procedures threaten to undermine the competitiveness of the European medical device industry, which comprises largely small and medium-sized companies (Klien, 2014) (Topham, 2003).

(8) Intellectual Property is also protected by a single EU catch-all. With single cost and single registration for UK IP, providing protection throughout Europe.

b) UK Landscape for Medical Technology.

(1) In Britain, medical technology companies make a vital contribution to the British economy. With over 3000 companies employing 76,000 people the sector is valued at some £17 billion and growing at rates exceeding 6% (Association of British Healthcare Industries, 2015). The UK is the second highest employer of medical technology companies, beaten only by Germany.

(2) A significant proportion of companies are working closely in partnerships with UK Universities and research institutes resulting in close collaboration and rapid development of ideas into inventions, and subsequently onto market. With significant investment from Government including Knowledge Transfer Partnerships seek to facilitate the cross-pollination of skills from academia to industry and visa versa. Furthermore, our National Health Service is dependent on British business to improve treatments, diagnostics, service enhancements and the like to drive continuous improvements in both budgetary controls and patient wellbeing.

(3) It is estimated that 38 million people contact a medical device every day in the UK (SEHTA). In 2000, the Global market for medical technology stood at £118 billion, with Europe accounting for 25% of that total. The UK medical

device market makes up 12.8% of the Western European market and 3.3% of the world market. The UK market continues to be one of the strongest performers in the region, with growth of around 6.8% per annum forecast to 2018.

(4) There are around 500,000 medical technology products, grouped into 20,000 groups available today (EUCOMED, 2014). These technologies rely on multi-disciplinary experts including; regulatory & legal, electronics, mechanical engineers, polymer science, chemistry, biochemistry, optics, software and more.

(5) United Kingdom exports 5 billion Euros outside of the European Union (Episcom, 2014). American industry supplied 25 percent of imports and accounted for 12 percent of the total $3.4 billion medical equipment market in Britain in 2002 (Topham, 2003). Current market growth has been slow, and the lack of domestic investment in new product development in recent years has created a demand for imported high-tech equipment. Requirements include lasers, endoscopes, medical imagery and dental equipment.

(6) The UK market is dominated by the NHS, which accounts for more than 80% of expenditure (Association of British Healthcare Industries, 2015) (Klien, 2014). The private sector remains small—if well equipped—and largely based in England. The reorganization of the NHS under the Health & Social Care Act 2012 has already seen a structural shift; Primary Care Trusts have been abolished and replaced by Clinical Commissioning Groups, giving general practitioners a greater role in budgeting and, therefore, spending.

(7) The innovation that Britain is famous for, is supported by systems which encourage and support small and medium sized enterprise (SME), for which we all benefit from both in improved health, care and economically. That is not to say, far more needs to be done to improve the efficiency and effectiveness of innovation to commercialisation.

(8) Development of improved medical devices supports improved health in the British population, and good health is a prerequisite for well-being and economic prosperity. These medical technologies help people live longer, healthier, more productive, socially active and independent lives. Including improved employability, where medical technology contributes to ensuring economic growth through improved workforce health.

6. Recommendations

a. Remaining a member of the European Union, will enable UK industry to take advantage of the existing regulatory structure.

b. The current European medical device regulation is already costly and difficult for UK innovation. The draft legislation will increase the control, scrutiny and enforcement, but at large cost to UK industry.

c. Compliance to the appropriate EU legislation via the CE route of conformity, enables unrestricted trade for UK industry throughout Europe.
d. A large number of other countries accept CE conformity for medical devices, allowing a simpler and less financially challenging route to these markets.
e. Emerging countries, starting their journey on medical device regulation are adopting either the basis of EU conformity, or a variation thereof as they recognise the benefit of the risk based assessment of medical technology.
f. The European Medical Device Regulations provide the ideal mix between control and innovation, ensuring citizens of Europe are afforded faster access to new healthcare technologies.

28 September 2015

Bibliography

Association of British Healthcare Industries. (2015). *Manifesto for Medical Technology – 2015.* London: ABHI.

Epicor. (2014). *Eucomed calculations. Manufacturer prices. Medical technology excluding in vitro diagnostics. Europe refers to EU (excluding Cyprus, Luxembourg, Malta) + Norway, Switzerland.* Epsicom.

EUCOMED. (2014). *The European Medical Technology Industry in Figures.* Brussels: EUCOMED.

European Commission. (2015). *Harmonised Standards*. Retrieved Sept 28, 2015, from http://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/index_en.htm

European Patent Office. (2014). *European Patent Office - Eucomed calculations. Medical technology as defined by World Intellectual Property Organization (based on the WIPO IPC-Technology con- cordance as revised in August 2014). European countries refer to EU + Norway, Switzerland. Patents are attributed by the country of residence of the applicant.* European Patent Office.

Klien, T. (2014, October 6). Medtech Market Outlook: Europe Struggles to Recover Momentum. *European Medical Device Technology*.

SEHTA. (n.d.). *SEHTA Our Services*. Retrieved August 26, 2015, from SEHTA: http://www.sehta.co.uk/medical-devices/

Topham, D. (2003). Medical Devices: The UK Industry and its Technology Development. *PRIME Faraday Partnership.*

University of Worcester. (2015). *Meet Our Experts - Paul Browning*. Retrieved August 27, 2015, from http://www.worcester.ac.uk/discover/paul-browning.html

British Academy – Written evidence (EUM0020)

1. The British Academy, the UK's national academy for the social sciences and humanities, welcomes the opportunity to submit evidence to the House of Lords Select Committee on Science and Technology on the relationship between EU membership and the effectiveness of science, research and innovation in the UK.

2. As the UK national academies stated in their joint submission to the Department for Business, Innovation & Skills' call for evidence on research and development as part of the Coalition Government's Review of the Balance of Competences between the United Kingdom and the European Union, "the European Union has not only provided significant and vital funding to the UK for research and innovation, complementing the UK's funding landscape for research (from public, private and philanthropic sources), but has also created and amplified opportunities for international collaboration and has increased the reputation, competitiveness and attractiveness of the UK as a centre of global excellence in research and innovation. National systems that become isolated from the stream of global knowledge exchange lose their vigour and excellence. Working at a European Union level is a vital element of this and adds value to the UK's own national effort to promote and enrich its research base and research excellence, and to leverage its innovative capacity".[66]

3. This submission demonstrates that the UK is receiving significant funding from European Union research and innovation programmes. Furthermore, it shows that, because research and development investment in the UK is lower than the EU average, EU research funding makes an important contribution to overall UK research and development funding.

4. The UK performs very well in obtaining European research and innovation funding. This can be illustrated in a number of ways. Amongst Member States, in all Framework Programme 7 (FP7 - the EU's research and innovation programme from 2007-13) signed grant agreements the UK ranked second in the number of participations with 17,561, and second in the budget share received by FP7 grant-holders with €6,940 million. The UK was second only to Germany, which had 18,088 participations and received €7,136 million in budget share.[67] In terms of 'higher or secondary education' institutions,[68] the UK has 14 institutions in the top 50 best performers in FP7, which is actually 14 in the top 38, 13 in

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[66] Joint National Academies submission to the Department for Business, Innovation & Skills Call for Evidence on Research and Development in the UK Government's Review of the Balance of Competences between the United Kingdom and the European Union, August 2013: http://www.britac.ac.uk/intl/europe.cfm

[67] European Commission, Seventh Monitoring Report 2013, March 2015: http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf

[68] In the European Commission's Seventh Monitoring Report five types of organisation are classified in terms of participation in FP7. These are 'higher or secondary education', private for profit (excluding education)', 'public body (excluding research and education)', 'research organisations', and 'other'. European Commission, Seventh Monitoring Report 2013, March 2015: http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf, p.13

the top 23, and 5 in the top 10. The 14 institutions the UK has in the top 50 is double any other country, with the next best being the Netherlands with 7. In terms of the top 50 best performing regions in FP7, the UK again has more than any other with 8 followed by Germany and Netherlands with 7 each.[69]

5. The UK particularly excels in gaining funding from the European Research Council (ERC) and for Marie Skłodowska-Curie Actions. In FP7 the funding the UK gained via the ERC and Marie Skłodowska-Curie Actions represented an aggregate grant value of 40.3% of the UK's total FP7 grants value overall. This represented the highest two grant value contributions that the UK gained in any FP7 priority area. In addition, 4 out of 10 of the top performing institutions for ERC funding are from the UK, more than any other country.[70] In terms of ERC grants awarded to UK-based academics for the Starting Grants, Consolidator Grants and Advanced Grants across the three domains that ERC awards in (life sciences, physical sciences and engineering, and the social sciences and humanities), UK-based academics lead all other countries in the total number of awards won overall in each of the three grant types and in every domain. In Starting Grants, UK-based academics have won 571 awards over 7 rounds since 2007 out of a possible 2,707. This accounts for 21.1% of all awards granted. German and French-based academics have only won 393 and 365 respectively. If this is broken down by domain UK-based academics have won 19% of awards in the physical sciences and engineering, 17.3% in the life sciences, and more than a third of all social sciences and humanities awards at 33.3%. UK-based academics in the social sciences and humanities have thus won more grants than those in the Netherlands, Germany and France combined, the three countries with the next most Starting Grant awards.[71]

6. In the two Consolidator Grants rounds in 2013 and 2014, UK-based academics have won 21.6% of all awards across the three domains. By domain this is 22% in the physical sciences and engineering, 17.3% in the life sciences and 29.1% in the social sciences and humanities. In the seven rounds of ERC's Advanced Grants since 2008 UK-based academics have won 23.5% of all awards. By domain this is 20.3% in the physical sciences and engineering, 23.4% in the life sciences, almost as an outstanding performance as the Starting Grants with 31.2% of all Advanced Grants awards in the social sciences and humanities.[72]

7. As the UK's national academy for the humanities and the social sciences, the British Academy is understandably pleased with the exceptionally strong track record of UK-based social scientists and humanities scholars in gaining ERC awards at a level even greater than our strong performing UK-based STEM colleagues. This performance of the

[69] European Commission, Seventh Monitoring Report 2013, March 2015: http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf

[70] European Commission, Seventh Monitoring Report 2013, March 2015: http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf

[71] European Research Council website statistics page: https://erc.europa.eu/projects-and-results/statistics accessed on 27 October 2015

[72] European Research Council website statistics page: https://erc.europa.eu/projects-and-results/statistics accessed on 27 October 2015

social sciences and humanities underlines their excellence in the UK's research sector. It also illustrates that these disciplines are truly an area of distinctive UK excellence that is critical to the success of UK research internationally and that UK social science and humanities research is recognised as leading in its field. It indicates that the benefit UK-based academics gain from the ERC as it stands makes an important contribution to the UK research funding landscape, and particularly for the humanities and the social sciences. It also illustrates that the UK is currently seen as an excellent location in which to conduct research and collaborate internationally.

8. This is a positive picture, and the UK's success from FP7 is paralleled in initial results from Horizon 2020 (the EU's research and innovation programme from 2014-2020).The UK performs particularly strongly in terms of 'higher and secondary education' institutions, but fares far less well in terms of 'research organisations', such as the Max Planck Institutes and the Centre National de la Recherche Scientifique.[73] This is largely because in the UK research often takes place in universities whilst in other countries such as Germany and France there is a stronger tradition of non-teaching research institutes. The strength of the UK's universities classified as 'higher and secondary education' institutions is shown by the fact that they received 70.7% of all the funding the UK gained from FP7 in monetary terms. Only 5 other Member States broke 50% in this category and in Germany the respective figure is only 37.7%. The UK's strong performance in FP7 thus relied heavily on UK universities. That funding from European research and innovation programmes is important to UK universities as well is clearly apparent. This can be further emphasised by the fact that out of the 17,561 participations the UK had under FP7 60.3% were by 'higher and secondary education' institutions, compared to Germany's 33.7%.[74]

9. Funding from the European Union makes a significant contribution to UK research and development, particularly in the context of the UK's below-average gross domestic expenditure on research and development (GERD) compared to the average for EU Member States. This is evidenced in two ways:

    (a) The UK's GERD as a percentage of gross domestic product (GDP) as calculated by the European Commission – that is to say its research and development intensity – is 1.85%, the EU average is 2.02%, whilst Germany's is 2.82% and France's 2.27%.[75] At first glance the difference between 1.85% and 2.82% may not seem that daunting; however, in terms of the raw numbers involved it translates as Germany's GERD being more than double that of the UK. In 2011, Germany's GERD was $80.4 billion compared to the UK's $36.5 billion; and with the UK's flat cash settlement since that

[73] Nick Hillman, *Keeping up with the Germans? A comparison of student funding, internationalisation and research in UK and German universities*, Higher Education Policy Institute, Report 77, September 2015, pp.54-55

[74] European Commission, Seventh Monitoring Report 2013, March 2015: http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf

[75] European Commission, Seventh Monitoring Report 2013, March 2015: http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf

year this gap is likely to have widened.[76] This also compares poorly with China and the USA's GERD, which are 5 times ($183.2 billion) and 10 times ($1.14 trillion) more than the UK's.[77] This snapshot is taken whilst the UK's research and development intensity has been declining, compared to other Member States like Germany and France as well as to the aggregate EU27 score,[78] underlining the importance of funding from other sources such as from FP7 and Horizon 2020.

(b) Looking at OECD data from 2014 a similar picture is found. The OECD calculates that the UK's GERD as a percentage of GDP from 2014 data is 1.73% compared to an EU average of 1.98%, as well as 2.29% and 2.98% for France and Germany respectively.[79] The OECD also provides data for publicly financed GERD as a percentage of GDP, which for France is 0.82%, Germany 0.86%, the EU average is 0.68%, and the UK is 0.52%, which is also lower than the OECD average of 0.77%.[80] Using 2014 OECD GDP data the total German spend for publicly financed GERD is almost $32 billion, France's is just over $21 billion and the UK's is merely a little over $13 billion.[81] In percentage terms that means the UK spends just under 42% of what Germany spends in publicly financed research and development and just over 63% of France. In this context funding from FP7 and Horizon 2020 can provide significant added value.

10. The UK's reliance on universities for securing funding from European research and innovation funding needs to be put in the context of a below-average GERD and declining research intensity, as well as a shift in Horizon 2020 to more applied research. In early results, this shift to more applied research is seen to favour increased funding to industry over universities compared to FP7. This illustrates a need for continued engagement in the development of the remainder of Horizon 2020 and future programmes so that they are shaped to support the development of UK research as much as possible.

11. The UK's involvement in European research and innovation programmes is of course about more than the funding secured. As the UK national academies made clear in their recent joint submission to the Migration Advisory Committee's Review of Tier 2, the "UK's

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[76] International Comparative Performance of the UK Research Base – 2013, A report prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS), December 2013, p.15, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf

[77] International Comparative Performance of the UK Research Base – 2013, A report prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS), December 2013, p.15, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf

[78] International Comparative Performance of the UK Research Base – 2013, A report prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS), December 2013, p.16, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf

[79] OECD, *Science and Technology Outlook 2014: Country Profiles – Key Figures, http://stats.oecd.org/ (accessed 10 November 2015)*

[80] OECD, *Science and Technology Outlook 2014: Country Profiles – Key Figures, http://stats.oecd.org/ (accessed 10 November 2015)*

[81] OECD (2015), Gross domestic product (GDP) indicator, https://data.oecd.org/gdp/gross-domestic-product-gdp.htm (accessed on 10 November 2015)

world-leading position in research was built with global talent" and the UK continues to be a place that attracts the very best research minds.[82] It is important that, like comparable countries, the UK has a range of policies that support and encourage researcher mobility. In that submission the UK national academies encouraged the Migration Advisory Committee to focus on removing unnecessary barriers to the flow of global talent given that "internationally mobile researchers have a significantly higher research performance than sedentary researchers"[83] and that "mobile talent contributes to the creation and diffusion of knowledge, and the international mobility of researchers creates lasting connections between research institutions around the world".[84]

12. In addition, the British Academy has in recent years focused particular attention through its international policy activity in aiming to shape and influence the development and then implementation of Horizon 2020. The British Academy's activity has been engendered by the belief that a distinctive contribution can be delivered in raising awareness of the critical need for the humanities and social sciences in framing, understanding and solving today's societal challenges at a European level and ensuring that this is reflected within the work programmes and calls of Horizon 2020.

13. This raising of awareness is not a straightforward task, and nor is it one which can be achieved with one single effort. It requires time, attention, discussion, networking, working with partners, and various other forms of engagement and advocacy on a consistent basis. The British Academy worked with other European academies in 2010 and 2011 to argue that the planned loss of a pillar or challenge focusing on the social sciences and humanities from FP7 to Horizon 2020 should not take place and that this loss would undermine the mission of Horizon 2020 to tackle society's big challenges. This led to the European Commission at first creating a new sixth societal challenge, as mentioned by the then Commissioner Geoghegan-Quinn in a speech at the British Academy in November 2011,[85] and then finally a sixth and seventh societal challenge that partly allayed some of these concerns.

14. The European Commission has aimed to 'embed' the humanities and social sciences in Horizon 2020. The British Academy has consistently raised concerns about this approach to the European Commission as have other UK and European bodies. The need for the Commission to address these concerns has meant it has had to justify and report on the effectiveness of its approach.[86] This proactive engagement with the Commission is

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[82] British Academy argues that UK research needs best of migrant workforce, 29 September 2015, http://www.britac.ac.uk/news/news.cfm/newsid/1326

[83] British Academy argues that UK research needs best of migrant workforce, 29 September 2015, http://www.britac.ac.uk/news/news.cfm/newsid/1326; International Comparative Performance of the UK Research Base – 2013, A report prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS), December 2013, p.25-29, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf

[84] British Academy argues that UK research needs best of migrant workforce, 29 September 2015, http://www.britac.ac.uk/news/news.cfm/newsid/1326;

[85] EU Commissioner announces central role for social sciences and humanities, 10 November 2011, http://www.britac.ac.uk/news/news.cfm/newsid/616

[86] Most recently through a report on the 'Integration of Social Sciences and Humanities in Horizon 2020: Participants, Budget and Disciplines', October 2015,

indicative of the UK's ability through a variety of means to help to favourably shape the EU's research and innovation programme in an effective and useful manner. Arguably the most important site of engagement in this respect is the UK's position and vote on Horizon 2020 Programme Committees that determine the content of its calls.

15. Scientific advice in the EU of course varies between Member States. The UK has a model of science advice that is not shared widely by others. It is important to understand this before assessing how scientific advice operates within the European Commission and the Union more widely. There is no one model, and some Member States (such as Germany) are deeply adverse to the model we are used to in the UK (i.e. a single Government Chief Scientific Adviser). In a Union of 28 Member States, the UK therefore needs to play a constructive role in encouraging the development of institutional frameworks for the provision of excellent scientific advice. The UK's ability to set the agenda and to ensure best practice will depend in part upon its willingness to embrace effective models that may not exactly replicate what we currently have in the UK. One of the aspects that it is important for the UK to stress is the need to understand the term 'scientific' in a broad sense, to encompass expertise from the humanities and social sciences.

16. The current Commission led by President Jean-Claude Juncker chose not to renew the position of Chief Scientific Adviser to the President of the European Commission, which had been held by Professor Anne Glover FRSE under President Barroso. Partly due to the negative reaction provoked by this poorly communicated announcement, Member States and other stakeholders, particularly from the UK, were able to stress to the Commission the importance of putting in place a robust system of scientific advice. This opportunity to engage with the Commission led President Juncker and Commissioner Carlos Moedas to announce the establishment of a new scientific advice mechanism. This is still to be developed and implemented in full; however, it provides a good opportunity for the UK government and the scientific community to engage with the European Commission in the process of designing an excellent framework for the provision of scientific advice.[87]

17. Nevertheless, the quality and effectiveness of scientific advice within the European Union relies upon the quality and effectiveness of the debate on scientific advice within Member States, as our sister academy, the Royal Society of Edinburgh, has been illustrating recently.[88] The importance of evidence-based policy and listening to and acting upon scientific advice where appropriate is critical to the development of effective public policy in both the EU and its individual Member States. The UK Government, with its established structures, is well placed to engage strongly with other Member States to

http://ec.europa.eu/programmes/horizon2020/en/news/integration-social-sciences-and-humanities-horizon-2020-participants-budget-and-disciplines

[87] Five European academy federations are likely to form one part of the scientific advice mechanism. The British Academy is a member of the All European Academies (ALLEA), one of the five. In addition on 10 November 2015 it was announced that Professor Dame Julia Slingo DBE OBE FRS, a Fellow of the Royal Society, would become one of the seven eminent scientists in the High Level Group, another part of the scientific advice mechanism.

[88] The Royal Society of Edinburgh, *The Opportunities from GM and Biotechnology for Scotland*, Advice Paper 15-20, September 2015, https://www.royalsoced.org.uk/cms/files/advice-papers/2015/AP15_20.pdf

lead discussions about how this objective can be best achieved. It is important to stress that policy-making also requires public engagement, social understanding, and cultural and historical awareness, necessitating the involvement of experts from the humanities and social sciences. This is particularly important when the scientific evidence presented is characterised by a high level of uncertainty or when ethical or distributive concerns shape public reactions to the evaluation of management of risk.

19 November 2015

British Academy, Academy of Social Sciences and Learned Society of Wales – Oral evidence (QQ 41-52)

Transcript to be found under Learned Society of Wales

British Academy – Supplementary written evidence (EUM0076)

The European Commission's Scientific Advice Mechanism (SAM)

- **Background**: the European Commission has routinely engaged with the scientific community through its array of some 1200 expert advisory groups. These mostly deal with sectoral policy issues. With the aim of strengthening the arrangements for evidence-based scientific advice the Barroso II Commission experimented by appointing a single Chief Scientific Adviser reporting to the President. The Juncker Commission has decided instead to establish a different Scientific Advice Mechanism (SAM) with three components: a High Level Group of seven; a consortium of European academies; and a strengthened secretariat in the Directorate-General for Research and Innovation.

- **The High Level Group**: the composition of the group was announced in November 2015, after a selection process by an Identification Committee consisting of Sir David King, Professor Rianne Letschert and António Vitorino. The members of the High Level Group are: Professor Janusz Bujnicki, Professor Pearl Dykstra, Professor Elvira Fortunato, Professor Rolf-Dieter Heuer, Professor Dame Julia Slingo DBE FRS, Professor Cédric Villani, and Professor Henrik C. Wegener. It will report to Carlos Moedas, the European Commissioner for Research, Science and Innovation. The terms of reference of the High Level Group specify that it will itself designate, on an annual basis, a chair-person and a deputy chair-person. Its first meeting is scheduled for 29 January 2016. It remains to be determined how in practice it will operate and what the balance will be between work in response to requests from the Commission and 'own initiative contributions'. Much remains to be resolved about relationships with not only the Directorate-General for Research and Innovation but also other Commissioners and services.

- **The consortium of European academies**: this is to provide complementary and supplementary advice on scientific issues, broadly defined as including the social sciences and humanities as well as the natural, life and engineering sciences. The European federations (Academia Europaea, ALLEA, EASAC, Euro-CASE and FEAM) are currently preparing this. It remains to be clarified what the balance will be between responsive contributions and 'own initiative contributions', as well as about which will be required as rapid responses and which in a more medium term perspective. The consortium should start to operate later in 2016.

- **The secretariat**: this is in the process of being established in the Directorate-General for Research and Innovation. It is to be hoped that the 25 staff will include experienced scientists as well as administrators.

- This is an experiment still in its early stages. It is much too early to figure out what its chances are of proving effective. The UK national academies are actively involved in the discussions with a view to promoting a constructive and productive role for the research community in the process.

18 January 2016

British Society for Immunology – Written evidence (EUM0033)

Introduction

1.1 The British Society for Immunology (BSI) is the largest immunology society in Europe. We represent the interests of members working in academia, clinical medicine, and industry. Our main objective is to promote and support excellence in research, scholarship and clinical practice in immunology for the benefit of human and animal health.

1.2 Immunological science underpins many aspects of human health and the progression of disease. The application of immunological research extends across communicable disease and vaccination to the management and treatment of chronic diseases such as diabetes, asthma, allergies, and even cancer. It is also now becoming clear that immune responses are key to the development of many common disorders not traditionally viewed as immunologic, including metabolic, cardiovascular, and neurodegenerative conditions.

1.3 As a nation we are world leading in our immunological research and rank first for research in infection and immunology amongst our G7 partners.[89] Immunological research in the UK therefore makes a vitally important contribution to the European science base and the research of our members is of significant value to the overall health, wellbeing, and economic prosperity of populations across the EU-28.

Summary

2.1 Scientists in the UK are free to compete for several European funding streams, derived through the European Union's (EU) Horizon 2020 framework. As a nation we are extremely successful in leveraging EU grants and are second only to Germany in terms of the total share of available funding secured. This comes at a time when the UK Government's commitment to sustaining public financing of science at present levels remains uncertain. Alternative sources, such as those available through the EU, serve as an important means of rebalancing funding for science in line with competitor nations.

2.2 The principle of freedom of movement allows not only for the unimpeded flow of students, researchers, and highly skilled workers across borders, but also for the fluid transmission of ideas, innovations, and knowledge. It is perhaps the most significant advantage of EU membership and its beneficial influence on the UK science base – and indeed the national economy – cannot be overstressed.

2.3 The EU benefits from having common regulatory, legal, and ethical standards through legal frameworks such as the Directive on the Protection of Animals used for Scientific Purposes. Harmonisation of the regulatory system means that member states can be assured of the competency of research standards and practice throughout the EU.

[89] APPG on Global Health (2015). The UK's Contribution to Health Globally.

Funding

3.1 Membership of the EU automatically entitles researchers in the UK to make use of a variety of funding mechanisms, primarily channelled through Framework Programme 8 (known as Horizon 2020). The EU's largest ever research and innovation programme, Horizon 2020 is a distribution mechanism for €77 billion worth of investment in science and research across a seven year lifespan, starting in 2014. Over the course of 2015/16 alone UK scientists will be able to compete for €16 billion from this pool.[90]

3.2 These funding streams are extremely popular amongst the research community in the UK and more eligible applications for Horizon 2020 funding were made from the UK than any other nation in 2014. We are also very successful in leveraging EU grants, securing the second highest share (15%) of the programme's total available funding over the same time period at 15% (only Germany, at 22%, received more).[91]

3.3 Our members find Horizon 2020 funding streams incredibly valuable, particularly at a time when the future of public funding in the UK remains uncertain. At 1.63%, the UK's total Gross Domestic Expenditure on R&D (GERD) as a proportion of GDP is significantly below the EU-28 average of 2.01% (and indeed the target set by the Horizon 2020 initiative of 3%). Our GERD is also lower than key international competitors, including the United States (2.81%), Japan (3.38%), Germany (2.85%), France (2.23%) and China (1.98%).[92] Science is by its very nature a global endeavour and the availability of funding for research is a fundamental determinant of our international competitiveness. EU sources therefore play a vital role in helping rebalance investment in line with other advanced economies.

3.4 The importance of European funding is underlined by the fact that many UK institutions employ dedicated teams to support researchers in securing grant and fellowship opportunities from EU sources. University College London for example, which received more Horizon 2020 funding than any other university in Europe in 2014,[93] employs a European Research and Innovation Office to "maintain its position at the forefront of European collaboration in science and technology".[94] Imperial College London, the second highest performing university, similarly supports those at the university seeking Horizon 2020.[95] These institutions are by no means alone, and universities throughout the UK adopt similar supportive mechanisms.

3.5 Although membership of the EU does not necessarily preclude access to the Horizon 2020 programme, and "third country" agreements can be made for non-EC states, such as Norway, Israel and the United States, eligibility for the majority of developed countries outside the European Community is not automatic. If a "third country" wishes to utilise Horizon 2020 funding it may only do so as a result of either a specific bilateral agreement or because participation of that country is deemed essential for carrying out

[90] European Commission (Accessed 2015). What is Horizon 2020?
[91] European Commission (2015). Horizon 2020. First Results.
[92] Eurostat (2015). Gross domestic expenditure on R&D (GERD).
[93] Research Europe (2015). One year on.
[94] University College London (2015). European Research and Innovation Office.
[95] Imperial College London (2015). Research Office. European Commission.

the research. Relationships between third country nations and the EU can also change. For example, in following a national referendum in 2014 on imposing immigration quotas, Switzerland had its access to several Horizon 2020 funding streams ended as a reaction to the referendum's outcome.[96]

3.6 Public funding is of course one aspect, but UK science also benefits from close cooperation with corporate entities based both within the UK and in the wider EU-28. As with science, business is a globally mobile enterprise, and private industry may decide to invest facilities and infrastructure in the UK for a variety of reasons. As a member of the EU the UK benefits from favourable trade liberalisation and access to a $16.6 trillion a year single market with a workforce of 500 million people.[97] This, coupled with the UK's world-class basic and applied research base, internationally recognised universities, and unique access to the NHS, is a strong factor in making the UK a good location for R&D intensive industries to locate.

3.7 In particular, the UK has a private R&D focus that is moderately specialised towards pharmaceuticals (pharmaceutical R&D expenditure accounts for 28% of total private R&D spend in the UK).[98] This enables considerable scope for life-sciences researchers, including immunologists, to utilise funding opportunities from private sources. The medicines manufacturer GSK, for example, supports the UK science base right across the spectrum, from discovery to application, as highlighted in their evidence booklet for the upcoming Spending Review.[99] Any disruption of our relationship with the EU would be perceived as negative by UK-based businesses and could destabilise funding relationships between researchers and private enterprises, such as major pharmaceuticals.

3.8 EU instruments also support UK small and medium-sized enterprises (SMEs) through grants and other support services (e.g. business coaching and access to risk finance). The UK has many immunology SMEs who have benefited from EU backing through assistance that spans initial feasibility assessments to commercialisation of new immunological innovations.

Collaboration

4.1 The application of immunological science has the potential to improve the health and wellbeing of all people, regardless of the country they live in. Immunology, as with science more generally, is therefore a collaborative effort, and breakthroughs are often the result of close working between different labs and institutions across the globe. Simple factors, such as geographical proximity, common strategic priorities, and even shared cultural values, play a part in facilitating collaboration between European researchers. These factors are reinforced by formalised directives and frameworks which seek to synergise the scientific output of EU member states, many of which rank among the best in the world for the quality of their science and research.

[96] EURESEARCH (2015). Swiss participation in Horizon 2020.
[97] Confederation of British Industry (2015). Factsheet 2: Benefits of EU membership outweigh costs.
[98] OECD (2015) Health at a Glance 2015.
[99] GSK (2015). CSR Evidence Booklet: GSK and the UK Science and Innovation Base.

4.2 Europe is in itself a scientific powerhouse. In a Thomson Reuters analysis of research output based on Web of Science publications, Europe was responsible for 38% of the world share of citations.[100] Only the United States (at 33%) is able to compete on volume of scientific output. The same paper finds Europe's share of highly cited papers as a function of scientific output slightly lower than the US (at 1.2% compared to 1.8%) but growing at a steady rate in contrast to a flat trajectory for the US. Europe and the US is the traditional bipartite power bloc in international science, although their dominance is being challenged by select nations in Asia (China, India, Japan) and South America (Brazil). Nevertheless, the UK is a senior producer of EU science, demonstrating a leadership role that underlines the global significance of our science profile. Removing ourselves from the Union would be to forego the enhanced global influence that comes as being a key constituent in a powerful community of scientific nations.

4.3 Opportunities for international collaboration are facilitated by joint funding programmes under Horizon 2020. For example, Joint Programming Initiatives (JPI) pool EU resources as a means of tackling issues of pan-Euro interest as set out under a number of Strategic Research Agendas (SRAs). JPI SRAs focus collaborative R&D on major societal challenges, such as Antimicrobial Resistance[101], and enable the European research community to work together and achieve more than would be possible at the level of a single nation state. In an increasingly globalised world, it is important to recognise that many of the challenges contemporary society faces are truly international in scale (for example pandemic infections). Thus, work to overcome these problems requires coordination at the international level. It would be deleterious for the UK as a whole if we were to be excluded from the joint planning, implementation, and evaluation of European-wide research programmes.

4.4 Opportunities for collaboration also exist beyond these large-scale projects. For example, our members make common use of joint funding opportunities that are extremely valuable as the basis for networking and developing relationships with researchers at institutions across the EU-28. Indeed, 80% of the UK's international co-publications are with colleagues across the EU.[102] These partnerships benefit significantly under the inclusive conditions of the EU's "common market" for knowledge and science. A specific example would include work through the European Training & Research in Peritoneal Dialysis (EUTRiPD) initiative. This EU programme funds early career researchers and seeks to bridge the "generation gap" between early and late-stage scientists. It has successfully supported immunologists based in the UK through linkage with peers in Amsterdam, Berlin, Poznan, Madrid, Brussels, Heidelberg, Strasbourg, and Vienna.

4.5 Initiatives such as the Marie Sklodowska-Curie actions, and as an extension of this programme the Innovative Training Networks (ITN) and Individual Fellowships (IF), facilitate researcher mobility throughout Europe, giving individuals experiences in different learning settings and enabling them to try new fields of research. The internationally fluid research community that exists as a product of the conditions

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[100] Thomson Reuthers (2014). The research and innovation performance of the G20 and its impact on decisions made by the world's most influential economic leaders.
[101] MRC (2014). Joint Programming Initiative on AMR.
[102] Universities UK (2014). EU membership and the impact on UK higher education.

provided by the European Union help spread best practice throughout the European Research Area and provides individuals with the opportunity to learn additional transferrable skills from new colleagues. Many of our members have worked throughout Europe and have found their experience both hugely rewarding and extremely beneficial in their own career development.

4.6 Scientific collaboration within Europe is greatly enhanced by the principle of freedom of movement, which allows the scientific workforce to work in different universities, research institutes, and companies with relative ease. Our members identify this as perhaps the most significant benefit of EU membership.

4.7 The UK is a global leader in science and research, a status which has been achieved in large part because we are able to attract the best and the brightest from across the world to work in our institutions. The lack of barriers to workforce and student movement within Europe has greatly enhanced the flow of scientific knowledge and expertise into the UK. Many of our members are themselves non-UK EU nationals and it is not uncommon for them to work in an environment where the majority of their colleagues have come here from countries across the EU.

4.8 In formulating our response to this inquiry, senior immunologists were keen for us to express the great value that able MSc students, PhD students, and postdoctoral fellows from the EU, but based in the UK, bring to our science base. It is reported that many of those who locate themselves here as students often choose to stay for further study or to work and their decision to do so is greatly influenced by the EU's sympathetic arrangements regarding free movement or, additionally, through programmes such as ERASMUS. It cannot be stressed enough the benefit that such individuals bring to our scientific and economic output.

4.9 The value of immigration for science and engineering has been catalogued elsewhere (see BSI submission to CaSE survey on immigration and its impact on UK science and engineering[103]) and the principle of free movement is a key enabler of the unimpeded flow of people and ideas into the UK that is so beneficial in many ways. It would be of serious detriment to our domestic science base (and indeed national economy) if the UK, which retains an opt-out to the Schengen Agreement, was in any way to re-enforce restrictions on international travel from within the EU.

4.10 Free movement also plays an important part in filling skills gaps, especially in STEM subject areas. The CBI states that 63% of their members report the ability to recruit and transfer staff from across the EU as a beneficial factor for their business. In their survey only 1% of members said that the impact had been negative.[97]

4.11 Beyond business, 125,300 non-UK EU nationals came to study in UK universities in 2013/14[104], generating £2.27 billion for the UK economy.[105] Upon graduation many of

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103 British Society for Immunology (2015). Response to CaSE survey on Immigration and its impact on UK science and engineering.

104 Higher Education Statistics Agency (2015). Students in Higher Education 2013/14.

105 Universities UK (2015). Speech given by Dame Julia Goodfellow at Universities for Europe launch.

these students continue on to postgraduate degrees and will subsequently choose to stay and work here either in academia or industry.

4.12 Importantly, collaboration in the EU also includes the operation and management of shared infrastructure and facilities. The UK often takes a leading role in these initiatives, such as with the European Bioinformatics Institute (EBI) and ELIXIR, both located at the Wellcome Genome Campus in Hinxton, Cambridge. EBI and ELIXIR conduct internationally significant research that is the result of close collaboration across associated sites in EU member states.

4.13 EBI in particular is at the heart of modern medicine and hosts the databases and analytical tools which have proved fundamental in the development of new medical therapies. Both receive funding from a variety of sources, including from outside Europe, and many of our members use their tools. They are each examples of initiatives where the UK benefits disproportionately compared to the resources we invest.

Regulation

5.1 EU frameworks and directives have a considerable influence over much of the science that is carried out in the UK. For example, legislation governing the use of animals in scientific research has been transposed to give effect to the EU Directive on the Protection of Animals Used for Scientific Purposes.

5.2 Working under common regulatory frameworks ensures that member states are working an agreed standard in relation to legality, quality, transparency, and ethics. This helps to reduce bureaucracy and streamline protocols. For example, the EU Directive on Clinical Trials seeks to simplify the process through which Member States regulate clinical trials to ensure the highest standards of patient safety are upheld. Through this mechanism information is recorded on an EU-wide portal that allows for a database on the results of all clinical trials conducted in Europe.

5.3 Pharmaceutical manufacturers can also seek to gain market authorisation for new drugs and treatments under a centralised procedure through the European Medicines Agency (EMA). The EMA coordinates expertise from across the European Economic Area (EEA) and allows the regulatory authorities from individual Member States to share data on the reporting of side effects and compliance with various legal requirements. Different authorisation routes also exist, including through single EU Member States, from which a streamlined application for European-wide authorisation can be made. This is only possible because the regulatory system for medicines is harmonised across the EU and despite their being different authorisation routes (either through the centralised process via the EMA or through individual Member States) each works to a common set of rules.

5.4 Another example would be the work of the European Patent Office, which provides a single patent grant procedure for innovations across Europe. The organisation also works closely with international bodies through, such as the United States Patent and Trademark Office, through bilateral and multilateral partnerships that seek to develop a global patent system that is more efficient in driving strong knowledge-based economies

for EU member states. It is unclear how disruption of our membership with the EU would hamper the ability of UK scientists to apply for national and international patents across EU member states and beyond.

Scientific Advice

6.1 Scientific advice on public policy decisions in the UK is chiefly communicated through the Government Chief Science Advisor, a position that is complemented by Chief Scientific Advisers in central Government Departments. These roles exist to ensure decision making on public policy is informed by scientific evidence. It is believed that the UK is in the minority of EU member states in having this mechanism which promotes evidence based policy making.

6.2 The post of European Chief Scientific Adviser was abolished under President Juncker and will be replaced by a new Scientific Advice Mechanism. This system is yet to be put fully in place and we await to see how this system works in practice before commenting on its success.

20 November 2015

Tessa Burrington – Written evidence (EUM0018)

I have sent the same comment today to Scientists for EU with regard to Regulation No. 11: www.parliament.uk/documents/lords-committees/science-technology/EUmembership/eu-membership-call-for-evidence.pdf

I am a concerned International Public Citizen.

Precautionary Principle and GM

1. I responded to the "GM foods and application of the precautionary principle in Europe" Inquiry. I thought the basis of the Inquiry and conclusions were on shaky ground. I do not think there is the holistic scientific and ethical understanding (including the geopolitics) by the London Government and establishment academics to reform EU safety regulations in the public interest both in the UK and beyond.

2. There are numerous reasons for this, some of which are explained in Steven Druker's book "ALTERED GENES, TWISTED TRUTH: How the Venture to Genetically Engineer Our Food Has Subverted Science, Corrupted Government, and Systematically Deceived the Public".

3. There is an argument that the EFSA regulations are already inadequate. I can send more details if requested by Scientists for EU and the House of Lords Science and Technology Committee.

4. There was a recent conference in Paris to discuss global regulation and substantial equivalence (about a week ago). I can send more details if required.

5. I believe the doctrine of substantial equivalence is flawed.

6. I would say this lack of holistic understanding by some establishment academics also extends to other emerging technologies.

7. In 2014, Testbiotech published this www.testbiotech.org/en/node/1089. I share their concerns and similar concerns such as those voiced by organisations like the Transnational Institute, Institute for Agriculture and Trade Policy and War on Want. I hope the issues will improve in the future.

Thank you for the opportunity to comment. I also responded to the Science Budget Inquiry.

19 November 2015

Campaign for Science and Engineering (CaSE) – Written evidence (EUM0047)

Summary of key points
CaSE does not have a policy position on whether the UK should stay in or leave the EU but recognises it is an important issue that has significant impact on science and engineering in the UK. It does however intend to inform the public debate with evidence and insight gained from analysis of available data and interactions with the science and engineering community.

EU funding of UK research

- The UK receives substantial funding for research from the EU: €8.8bn between 2007 and 2013. The UK is a net contributer to the EU overall, but it is a net reciever of EU funding for research.
- EU funding complements national research funding, providing access to specialist skills and equipment and supporting new collaborations. This increases research quality, reach, and impact.

The role of EU membership in research collaboration

- Collaboration is essential to effective and high-impact research. The UK collaborated with at least 120 different countries through Framework Programme 7 projects.
- When asked in a survey conducted by CaSE and the Engineering Professors' Council (EPC), 93% of respondents said EU membership is of benefit to UK research, and 83% said that EU funding is of increasing importance to UK research. Although the vast majority of researchers were positive about the EU, some highlighted bureaucracy as a problem.

Effects of free movement of people in the EU

- The free movement of people between EU member states aids the quality of UK science by reducing barriers to the recruitment and travel of skilled scientists and assisting collaboration. This international connectivity can increase the productivity and impact of research, and fills skills shortages in the UK.
- However, if the Government were willing, these benefits could be realised through an effective immigration policy if the UK were outside the EU.

Impacts of EU regulation on UK research

- UK VAT rules are subject to EU legislation. As a result, the British Government is limited in its ability to create a tax policy scheme that better supports research collaboration than the current one.

Introduction
The Campaign for Science and Engineering (CaSE) is the leading independent advocate for science and engineering in the UK. CaSE works to raise the political profile of science and engineering, and ensure that the UK has world-leading research and education, skilled scientists and engineers, and successful innovative businesses. CaSE is funded by around 800 individual members and over 100 organisations including businesses, universities, learned

and professional organisations, and research charities. Collectively our members employ 350,000 people in the UK, and our industry and charity members invest around £19.3bn a year in R&D globally[106].

CaSE is neutral with regard to the upcoming EU referendum but we wish to inform the debate. We therefore welcome the opportunity to provide evidence to this inquiry. CaSE's Chair, Professor Graeme Reid, is advising the House of Lords Science and Technology Committee on this inquiry. He has therefore not had any part in the production of this submission.

CaSE is currently undertaking two research projects which are relevant to this inquiry. Our response incorporates the relevant points from these, and from other on-going work. The first project is considering how immigration affects UK science and engineering, the results of which will be published in early 2016. The second is a joint project with the Engineering Professors' Council (EPC) on the role of EU membership in UK science and engineering. An interim version of this report will also be submitted as evidence to the inquiry jointly by CaSE and the EPC. As part of this project, CaSE and the EPC completed a survey asking researchers for their views on the impacts of EU membership to which over 400 individuals from academia and industry contributed.

Funding

Investment in UK science and engineering creates a virtuous cycle, leveraging investment from industry[107], raising productivity[108], and creating more high-value jobs[109]. This investment comes from a variety of UK, EU, and international sources, including that from governments and industry. These funding sources, having different priorities and requirements, can complement each other in parallel to fund UK research. Each source brings a range of benefits to individual researchers and to the UK research environment, such as novel collaborations and access to specialist skills and equipment. When asked in a survey conducted by CaSE and EPC, 93% of respondents said EU membership is of benefit to UK research, and 83% said that EU funding is of increasing importance to UK research.

Between 2007 and 2013, the UK received €48bn[110] from the EU, of this €8.8bn[111] was for research, development, and innovation. Over the same period, the UK contribution to the EU was €78bn[8], of which €5.4bn[112] was specified as the indicative contribution to the EU's R&D budget. This means that the UK is a net contributer to the EU overall, but it is a net reciever of EU funding for research. €6.9bn of this research funding was through the Framework Programme 7 (FP7)[113], and €1.9bn through European Structural and Investment

[106] Calculated using data from the latest year available from CaSE members. This is likely to be an under-estimate as data was not available for all members.
[107] Leveraging public funding of science and research, Research councils UK, 2013
[108] The economic significance of the UK Science base, BIS, Innovation Report, Haskel, Hughes and Bascavusoglu-Moreau, 2014
[109] The current and future UK science workforce, The Science Council, 2011
[110] EU expenditure and revenue 2007-2013, European Commission
[111] Calculated from EU Cohesion Policy and FP7 funding
[112] Science, Engineering and Technology (SET) statistics, Office for National Statistics, 2013
[113] Seventh FP7 Monitoring Report, European Commission, 2013

Funds[114] (this includes the European Regional Development Fund and European Structural Funds).

Table 1. The EU contributions from and to the UK (2007-2013)

	UK received from EU (€bn)	**UK contributed to EU** (€bn)
Total funds	47.5	77.7
Research funds	8.8	5.4

The UK is particularly successful in obtaining EU funding, ranking 2nd in terms of number of participations and budget in FP7[5]. Many therefore say the UK does extremely well in attracting EU research funding. Certainly the UK does better than it should if you simply consider what its fair share would be based on the ratio of its GDP to the aggregate GDP of the EU[115] as a whole. However, the UK attracts less funding than that implied by measures of research excellence, such as Field Weighted Citation Impact.

EU funding in UK Higher Education Institutions (HEIs)

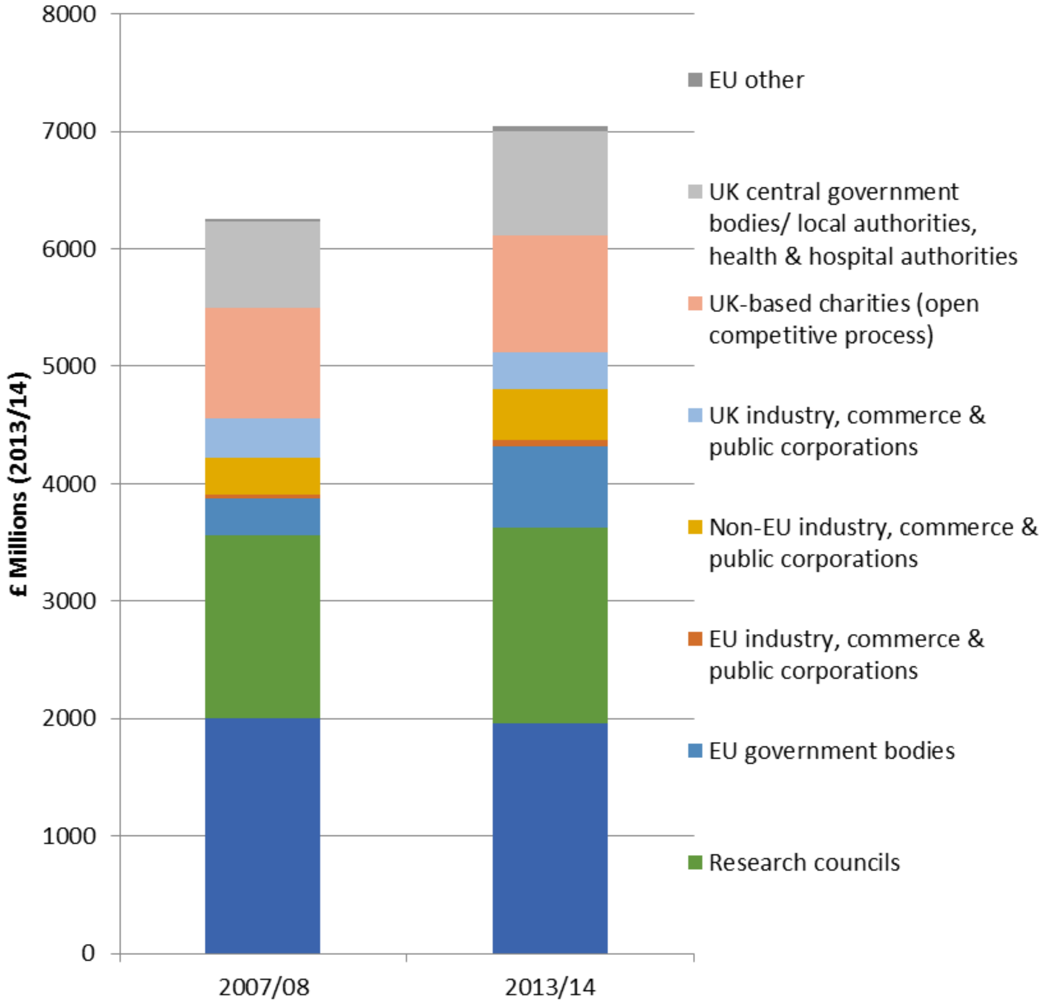
The university sector is a major asset to the UK, not least because it contributes at least £73bn annually to the UK economy[116]. UK HEIs conduct high quality research; with the Research Excellence Framework (REF) in 2014[117] reporting that 76% of all submissions were 'world-leading' or 'internationally excellent'.

Just over a quarter (26%) of UK expenditure on R&D is in the higher education sector, with business R&D making up the majority of the rest[118]. UK HEIs are particularly successful in winning EU funding, receiving 71% of the total FP7 funding awarded to the UK[119].

Overseas sources of funding for research in UK HEIs are significant, in particular those from the EU. In real terms, the funding from EU government sources more than doubled during the period 2007/08 to 2013/14 (Figure 1), while over the same time period UK Research Council funding increased by 7% and recurrent research funding (HEFCs) for research declined by 2.2%. EU government sources of funding are therefore increasingly important to UK research, making up 10% of income in HEIs.

[114] European Commission Cohesion Policy Data
[115] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development, HM Government, 2014
[116] Efficiency, effectiveness and value for money, Universities UK, 2015
[117] Research Excellence Framework, 2014
[118] UK GERD Statistics, Office for National Statistics, 2013
[119] Seventh FP7 Monitoring Report, European Commission, 2013

Figure 1: Funding for research in UK HEIs



Source: *Higher Education Statistics Agency*

Collaboration

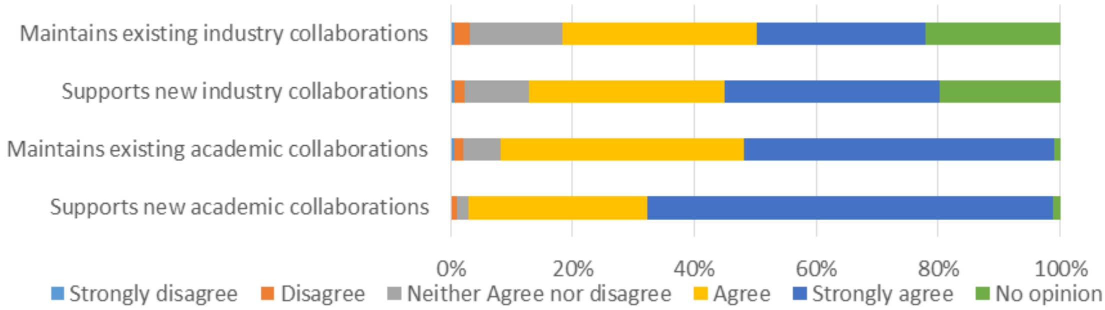
Collaboration is essential to research, it allows sharing of expertise and equipment, facilitates multi-disciplinary work, enables complex global challenges to be addressed, and increases the capability of researchers to commercialise innovations[120]. A remarkably high proportion of respondents (95%) agreed that EU funding supports and maintains academic collaborations (Figure 2). This is important for UK research performance as international collaboration and researcher mobility have been found to be correlated with high research quality[121,122].

Supporting universities in collaborating with industry and commercialising research is a focus of the current government[123] and two thirds of survey respondents (66%) said that EU

[120] The Dowling Review of Business-University Research Collaborations, 2015
[121] International Comparative Performance of the UK Research Base – 2013, Elsevier, 2013
[122] Characteristics of high-performing research units, A preliminary analysis, Manville, Hinrichs, Parks, Kamenetzky, Gunashekar, Wilkinson and Grant, Higher Education Funding Council for England (HEFCE), 2015
[123] Fixing the foundations: Creating a more prosperous nation, HM Treasury, 2015

membership supports new industry collaborations. The UK has been ranked among the top five countries in the world on university-industry collaboration in R&D for the past four years[124]; our survey suggests that EU funding plays a role in supporting this.

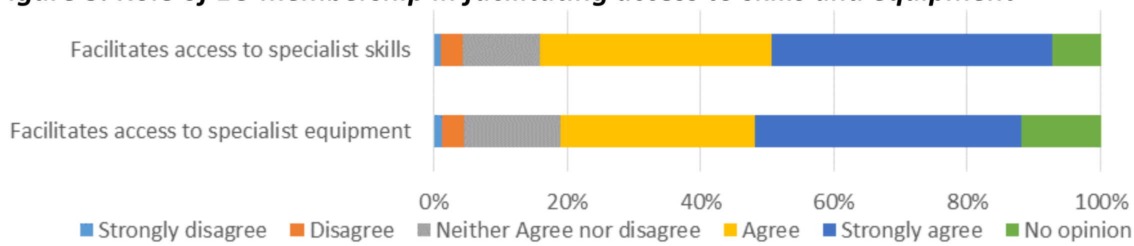
Figure 2. Role of EU membership in enabling collaboration with academia and industry



Source: Survey undertaken October, 2015 amongst CaSE and EPC members. 403 respondents from UK HEIs and industry

Respondents to our survey highlighted that the EU supports cross-border collaboration by enabling access to specialist equipment and large international research facilities, and by facilitating the exchange of skills and knowledge between researchers. Over three quarters (76%) of respondents to the survey agreed that EU membership facilitated access to specialist skills, and 68% said it facilitated access to specialist equipment (Figure 3).

Figure 3. Role of EU membership in facilitating access to skills and equipment



Source: Survey undertaken October, 2015 amongst CaSE and EPC members. 403 respondents from UK HEIs and industry

The strong agreement from survey respondents that the EU supports collaboration is matched by data showing that the UK collaborated with at least 120 different countries[125] through FP7 grants. The top collaborative links for the UK are with Germany, France, Italy, Spain and the Netherlands[126]. The number of collaborators in EU funded projects, from countries outside Europe and the Associated Countries, is growing. The USA, Russia, China, Brazil and India were the biggest participants of this type in FP7[127].

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[124] The Global Competitiveness Report, (2013-2014) World Economic Forum, 2013
[125] The impact of the EU RTD Framework Programme on the UK, Technopolis Group, Simmonds, Stroyan, Brown and Horvath, 2010
[126] Seventh FP7 Monitoring Report, European Commission, 2013
[127] Seventh FP7 Monitoring Report, European Commission, 2013

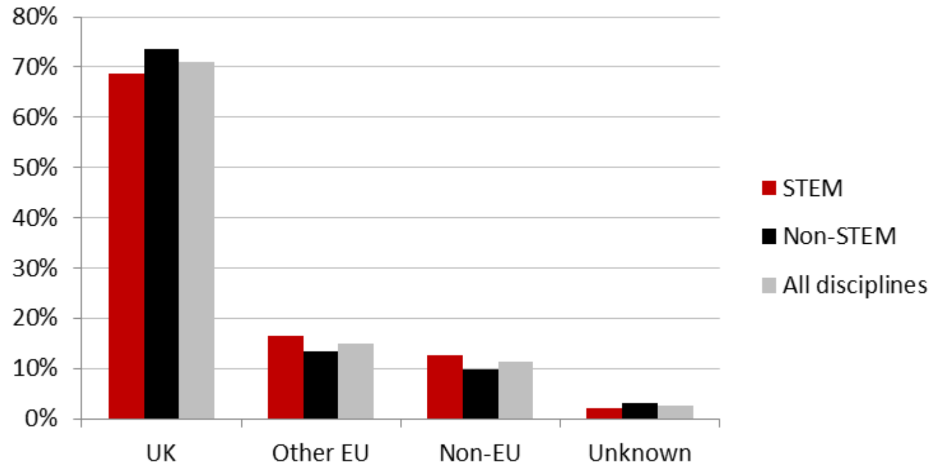
The EU funding system offers a framework in which collaborations can be supported. It provides a single system for funding applications to be made and a network through which to find and identify new partners. This can provide simplicity and efficiency above what is provided by national systems. This support remains valued despite criticisms being made by some researchers of the bureaucracy involved in the reporting requirements of EU grants.

Free movement of people

The ability of European researchers to move freely between Member States aids the quality of UK science by reducing barriers to recruitment and travel for skilled scientists. However, it should be noted that workers from non-EU countries in the European Economic Area (EEA) and Switzerland also enjoy this privilege.

Almost 30% of academic staff in UK universities are non-UK nationals[128]. In 2013/14, there were over 22,000 academic workers from outside of the EU (12% of the total) and over 29,000 from within the EU (16% of the total). The proportion of non-UK academics is slightly higher in the Science, Technology, Engineering, and Maths (STEM) disciplines, with 13% from outside the EU and 16% from within (Figure 4).

Figure 4: International make-up of academic staff in UK universities, 2013/14



Source: Engineering Professors' Council analysis of HESA data from the Higher Education Database for Institutions (HEIDI), September 2015

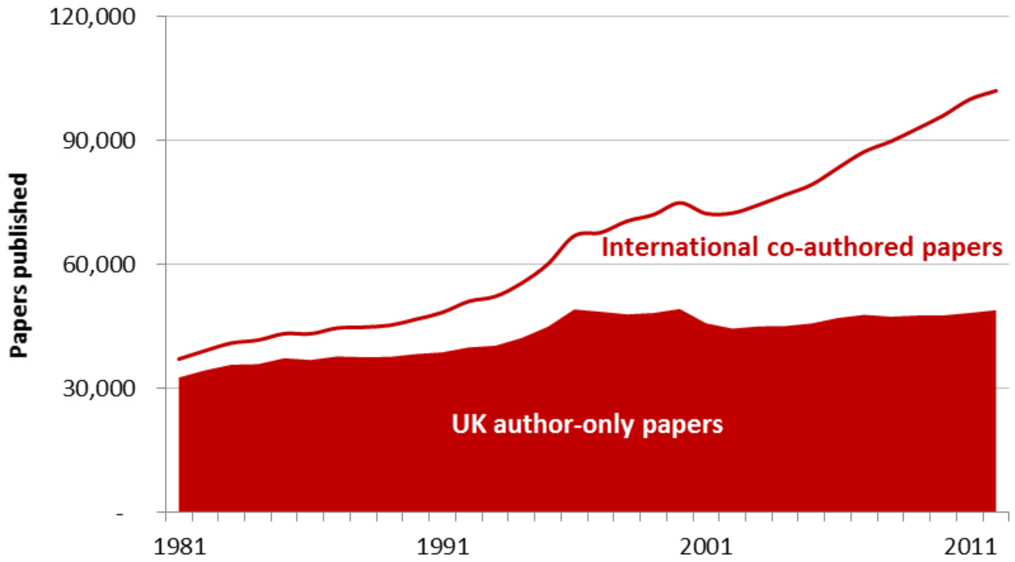
The UK has benefitted from the internationalisation of its research community, not only with researchers from EU Member States but those from all around the world. A recent study by King's College London found that high-performing institutions in the 2014 Research Excellence Framework had above-average proportions of staff with a non-UK nationality and more staff whose previous appointment was overseas[129]. International connectivity has also resulted in a rise in research output in the form of published papers over the past few decades. The UK's output has tripled since 1980 with the rise almost-wholly resulting from a

[128] Source: Engineering Professors' Council analysis of HESA data from the Higher Education Database for Institutions (HEIDI), September 2015

[129] Characteristics of high-performing research units, A preliminary analysis, Manville, Hinrichs, Parks, Kamenetzky, Gunashekar, Wilkinson and Grant, Higher Education Funding Council for England (HEFCE), 2015

rise in international co-authorship (Figure 5)[130]. Around half of UK publications are co-authored with international collaborators and such papers are on average more scientifically-significant, being associated with 61% greater citation impact when compared to papers published by authors all from one institution[131].

Figure 5: UK research output between 1981 and 2011



Source: Thomson Reuters Web of Science; Analysis: Jonathan Adams, Digital Science

Foreign researchers bring novel skills, ideas, and ways of thinking to the UK research environment; they open up new global markets and collaborations; and they fill skills shortages. Skills and expertise in science can often be extremely rare, even in the global labour market, meaning the UK must remain open and attractive to global scientific talent. Likewise, international free movement benefits British scientists and engineers, who can move overseas during their career to gain new skills. They can then bring these back to the UK as well as open up new markets and opportunities for collaboration.

All of the above benefits have been facilitated by the free movement of people in the EU. However, this is not to say that they could not have been enjoyed at all without the EU. Although recruitment and travel within the EU is easier, CaSE has not identified significant barriers preventing non-EU researchers coming to the UK. In the event of Britain leaving the EU, arrangements could be made to ensure scientists and engineers continue to have free-movement rights. Indeed, the UK's current Points Based System for non-EEA migrants contains concessions for PhD-level occupations, showing that the Government is willing to make concessions in immigration policy for the research community.

CaSE is not aware of any immigration policies imposed by the EU that directly inhibit UK collaborations with countries outside the EU.

[130] Collaborations: The fourth age of research, Adams, Nature 497, 557–560, 2013
[131] International Comparative Performance of the UK Research Base – 2013, Elsevier, 2013

Regulation- EU VAT rules and their impact on UK science and research
EU-directed regulation affects the UK research environment in diverse ways, across the breadth of scientific disciplines, from animal research to vacuum cleaner design. Sector-specific submissions to the Committee will address these areas. We therefore wish to highlight an impact of an area of EU regulation that has an over-arching effect on the UK research system.

UK VAT policy is subject to EU legislation. As a result, the British Government is limited in its ability to create a tax policy scheme that better supports university-business collaboration than the current one. This was recognised by the Dowling Review of university-business collaboration, which recommended that the problems with current VAT rules (see below) should be addressed "as a matter of urgency"[132].

EU VAT rules inhibit academia and industry working side-by-side
The construction of public and charity research institutes is subject to zero-rate VAT due to it being for a 'Relevant Charitable Purpose' (i.e. grant-funded non-business research activities).[133] This is on the condition that a minimum of 95% of the activities undertaken within the new building are for non-business research. This means that only 5% of activities within the building can be for commercial purposes, including research collaboration with industry[134]. Therefore institutions are severely restricted in the amount of business collaboration that can happen on their premises if they wish to benefit from VAT-exemption. This is a key obstacle to increasing the permeability between academia and business, which is a priority of the current Government[135].

Current VAT rules have some flexibility allowed by the EU, but it is not sufficient or without negative consequences. Institutions can designate areas of the building that will be used for commercial purposes. In doing so they elect to pay VAT on these parts but they must also pay VAT on communal areas such as corridors and shared services, which can be significant in some cases. This designation must then be monitored for 10 years, which is a very bureaucratic and costly process for university finance offices. Furthermore, the dynamic nature of higher education and scientific research makes such apportionment very difficult and in some cases risky, as universities may not know what the future demand for commercial activity may be. If, having built the building and not paid VAT, the institution decides to collaborate on site with commercial partners within the ten year period, it must pay back a proportion of the VAT saved. This creates a financial disincentive to collaboration during the first ten years of a building's life.

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[132] The Dowling Review of Business-University Research Collaborations, 2015
[133] VAT Notice 708: buildings and construction, HM Revenue and Customs, 2014
[134] If the 95% 'Relevant Charitable Purpose' proportion is not achieved and sustained for a 10-year period, the construction cost would become standard-rated (20%), and the full VAT cost on construction would become payable. Where qualifying non-business activities exceed the 5% threshold, it is still possible to obtain zero rating on those parts of the building which are used solely for qualifying non-business activities but the method of calculating this apportionment is somewhat cumbersome and where any space (eg corridors or other facilities) is used for both qualifying and non-qualifying activities then this must be treated as non-qualifying space so does not benefit from zero rating – and so the overall result can seem unfavourable.
[135] Fixing the foundations: Creating a more prosperous nation, HM Treasury, 2015

Alternatively, if the institution opts to pay VAT on the whole build, it must add VAT when invoicing the users of its services, including on rent, as it is considered a commercial enterprise. This does not negatively impact businesses, which can reclaim VAT from HMRC but raises costs by 20% for academic tenants, who do not have the ability to reclaim VAT from HMRC. Thus opting in to VAT on a research building raises the costs and adds a perverse disincentive for academic collaborators to work in the building alongside businesses.

EU VAT rules for shared services are not clear

Prior to August 2013, money for research, regardless of its original source, passed between universities to cover research was not subject to VAT (it was referred to as “exempt”). Following challenge by the European Commission, HMRC accepted that this contravened EU tax law and changed UK rules. Despite welcome efforts by HMRC to issue guidance and work with the research community to reduce the impact of the changes, additional confusion and bureaucracy has resulted.

With the supply of research services between universities (or other eligible bodies) now subject to VAT[136], there is a cost and bureaucracy disincentive for collaboration between academic institutions. HMRC estimates that the withdrawal of this exemption will lead to increased VAT on these supplies of £50m by 2017-2018 as more contracts become taxable rather than exempt. Much of this will be public money.

Research services affected by the policy could include, for example, collaborative research where one academic research group provides funds to another to conduct a particular experiment, or where a researcher uses a large piece of equipment at a different university and is required to pay for that use.

To further confound the problem introduced by the European Commission’s ruling, UK authorities have been unclear on how to interpret the EU law. Following consultation[137], HMRC conceded that despite the August 2013 change, ‘collaborative’ research should legitimately fall outside the scope of VAT if it is for the public good with no commercial gain (see Annex 1 for more detail). However, there is confusion within the research community and its finance departments over exactly what can be classed as collaborative research, especially when commercial partners are involved. This is exacerbated by the fact that even public and charitable funders can place terms on awards that would gain them some IP rights emanating from the research (which could count as a taxable business service).

‘Pre-competitive collaboration’ involving academia and industry is a growing practice that current tax definitions are not well drafted to accommodate for. One example of this is when a pharmaceutical company provides compounds that have not proven useful in in-house tests to academic researchers who wish to test them for other indications in a more curiosity-driven process. This could be considered VAT-exempt as there is a clear public-good and no money has changed hands. However, there would be an agreement that if a

[136] Dealing with HMRC – policy paper, Revenue and Customs Brief 21: withdrawal of the VAT exemption for supplies of research between eligible bodies, 2013

[137] Consultation outcome, Consultation on the withdrawal of the VAT exemption for research, HM Revenue and Customs, 2012

compound were to be found to be effective then the pharmaceutical company would have the right to develop the compound into a marketable medicine. At this point the earlier curiosity-driven research could be considered commercial and therefor VAT-liable. Paying tax retrospectively could be costly and hugely burdensome on the researchers and therefore may reduce the inclination of researchers to engage in pre-competitive research.

With the growth of innovation funding to businesses through government agencies like Innovate UK, companies are increasingly the majority beneficiary of public grant money with their academic partners receiving smaller proportions of the grant, often channelled through the company. Current HMRC guidance on how the EU law should be applied is not clear on how research at the academic-business interface should be classified. There is therefore confusion over whether transactions between the partners should be subject to VAT and academic finance offices are over-cautious as a result and can incur higher tax bills than necessary. This results in inefficient use of public funds and can discourage collaboration due to the difficulty of managing the financial relationships. This is very unwelcome at a time of constrained public finances when universities are trying to improve efficiency and open up new opportunities for co-funding with industry.

20 November 2015

Annex 1 – extract from HMRC briefing on research services

HMRC has produced a briefing[138] attempting to add clarity to what research falls outside the 'scope of VAT':

- research which is funded for the 'general public good' and there is no direct benefit for the funding body

- research which is funded for the general public good and is either not expected to generate any intellectual property (IP), or if it does then any reports or findings will be freely available to others

- where there is a 'collaborative' agreement between different research institutions where all parties to the grant are named on the application[139]

- where the funding flows through one named party - and they act purely as a conduit passing on the funds to others involved in the research project - the funding remains outside the scope of VAT

Where funding is provided to a named party for research that will either generate IP to be exploited by the funder and/or is not for the public good and they subsequently decide to sub-contract some of the research to an eligible body (for example a university), the initial

[138] Policy paper, Revenue and Customs Brief 10: withdrawal of the VAT exemption for supplies of research, HM Revenue and Customs, 2013

[139] However, the briefing also elsewhere says that institutions can be added retrospectively to an agreement on a case by case basis as assessed by HMRC.

funding to the named party (assuming an eligible body) will be taxable consideration for a supply.

Campaign for Science and Engineering (CaSE) and the Engineering Professors' Council (EPC) – Written evidence (EUM0048)

We welcome the opportunity to submit this interim report on the role of EU membership in UK science and engineering to this inquiry. This report is the output of a joint project between CaSE and the EPC. It is planned that the full report will be published during the week commencing 14th December on both the CaSE and EPC websites.

Neither organisation has a policy position on whether the UK should stay in or leave the EU but recognises it is an important issue that has significant impact on science and engineering in the UK. The report intends to inform the public debate on the relationship between EU membership and science and engineering, drawing on evidence and insight gained from analysis of available data and interactions with the science and engineering community.

The Campaign for Science and Engineering (CaSE) is the leading independent advocate for science and engineering in the UK. CaSE works to raise the political profile of science and engineering, and ensure that the UK has world-leading research and education, skilled scientists and engineers, and successful innovative businesses. CaSE is funded by around 800 individual members and over 100 organisations including businesses, universities, learned and professional organisations, and research charities. Collectively our members employ 350,000 people in the UK, and our industry and charity members invest around £19.3bn a year in research and development globally[140].

The Engineering Professors' Council (EPC) has as its mission the promotion of excellence in engineering higher education research and teaching in the UK. It has over 6,500 members in virtually all of the UK universities that offer engineering programmes and is led by an elected Committee of the membership's professors and senior leaders.

The role of EU membership in UK science and engineering research

First-class research is critical to innovation and industry in the UK, with a skilled workforce and a strong research base being considered vital for the UK's future prosperity. Investment in UK science and engineering creates a virtuous cycle, leveraging investment from industry[141], raising productivity[142], and creating more high-value jobs[143]. Science and engineering are also essential in producing more effective medicines, cleaner energy, generating new technologies, and tackling the major challenges facing our society now, and in generations to come.

The role of EU membership in UK science and engineering research is consequently not simply a question of importance to the UK science base, but to the UK public. As one piece in a wider puzzle, this report seeks to inform the current debate around the question of UK

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[140] Calculated using data from the latest year available from CaSE members. This is likely to be an under-estimate as figures were not available for all members.

[141] Leveraging public funding of science and research, Research councils UK, 2013

[142] The economic significance of the UK Science base, BIS, Innovation Report, Haskel, Hughes and Bascavusoglu-Moreau, 2014

[143] The current and future UK science workforce, The Science Council, 2011

membership of the EU, by examining the role of EU membership in UK science and engineering research.

In addition to investigating the scale and scope of EU research funding, we conducted a survey to capture the views and experiences of over 400 researchers. Their responses were overwhelmingly positive, with 93% agreeing that EU membership is a major benefit to UK science and engineering. The report also showcases exciting examples of engineering research that illustrate the role that the EU plays in UK research through providing funding, and facilitating international and industry collaboration.

It is clear that EU membership interacts with UK science and engineering in a number of ways that are beyond the scope of this report. For example, EU regulation and legislation are significant factors influencing the UK research environment and policy more generally. Therefore, these are an important part of the overall context when considering the role of EU membership in UK science and engineering research.

Summary

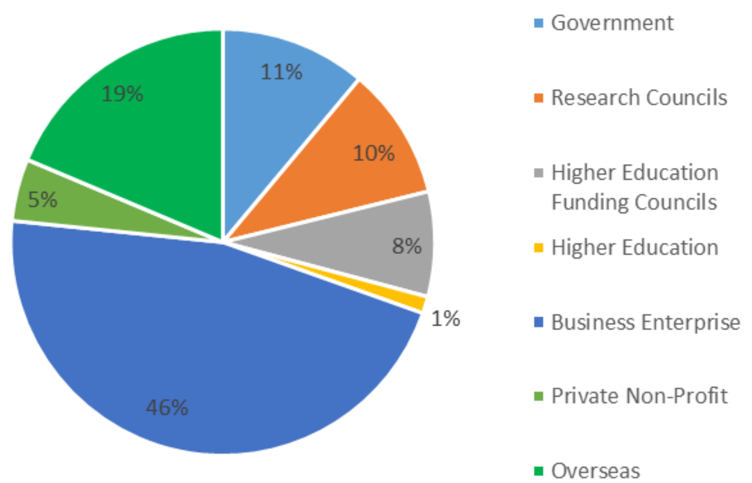
- The UK receives a significant amount of money (€8.8bn) from the EU for science and engineering research.
- Some regions of the UK are more dependent than others on EU funding in maintaining research capacity and infrastructure, and as a result could suffer disproportionate adverse impacts if this source was withdrawn.
- The ability to attract academic staff to the UK through free movement of labour is important, particularly in science and engineering.
- The role and benefits of EU membership to UK research is considered by researchers to be broader than just the funding for research that EU projects bring to the UK. The improvement in quality, reach and impact, facilitated by EU collaboration and coordination, helps to solve "Grand Challenge" problems in a way that would be much harder for any one country to achieve alone.

The UK produces world leading science and engineering research[144,145]

Despite the UK having a hugely productive research base the UK government is investing in science at a lower rate than the majority of the EU and OECD[146]. In 2013, the expenditure on research and development (R&D) performed in the UK (GERD) was £29bn[147] (Figure 1). The biggest contribution to this is through the business sector which accounted for almost half of the funding (£13bn, 46%). Funding from government, UK Research Councils and the UK Higher Education Funding Councils (HEFCs) totalled 29% (£8.4bn) and overseas sources, including EU funding, accounted for 19% (£5.4bn) of the total (See Box 1 for further information on funding for research in Higher Education Institutions (HEIs)).

[144] International Comparative Performance of the UK Research Base – 2013, Elsevier, 2013
[145] Engineering for a successful nation, Royal Academy of Engineering, March 2015
[146] Science and Engineering Investment Policy Briefing, CaSE, 2014
[147] UK GERD Statistics, Office for National Statistics, 2013

Figure 1. Funding sources for expenditure on research and development performed in the UK (GERD) in 2013 (totalling £29bn)



Source. Office for National Statistics, UK Gross Domestic Expenditure on Research and Development.

EU funding contributed €8.8bn to UK research, development and innovation between 2007 and 2013
Between 2007-2013, the UK received €48bn[148] from the EU, of this €8.8bn[149] was for research, development and innovation. Over the same period, the UK contribution to the EU was €78bn[8], of which €5.4bn[150] was specified as being for the EU's R&D budget. The UK is a net contributer to the EU overall, but it is a net reciever of EU funding for research. €6.9bn of this research funding was through Framework Programme Funding (FP7)[151], and €1.9bn through European Structural and Investment Funds[152] (this includes the European Regional Development Fund and European Structural Funds; see Box 2 for further details on EU funding for research).

Many therefore say the UK does extremely well in attracting EU research funding. Certainly, the UK does better than it should considering what its fair share would be based on the ratio of its GDP to the aggregate GDP of the EU[153] as a whole. However, the UK still attracts less funding than that implied by measures of research excellence, such as Field Weighted Citation Impact.

Higher Education Institutions (HEIs) are a focal point for excellent research in the UK
The university sector is a major asset to the UK, not least because it contributes over £73bn annually to the UK economy[154]. UK HEIs conduct high quality research; with the Research

[148] EU expenditure and revenue 2007-2013, European Commission
[149] Calculated from EU Cohesion Policy and FP7 funding
[150] Science, Engineering and Technology (SET) statistics, Office for National Statistics, 2013
[151] Seventh FP7 Monitoring Report, European Commission, 2013
[152] European Commission Cohesion Policy Data
[153] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development, HM Government, 2014
[154] Efficiency, effectiveness and value for money, Universities UK, 2015

Excellence Framework (REF) in 2014[155] reporting that 76% of all submissions were 'world-leading' or 'internationally excellent'.

Just over a quarter (26%[156]) of UK expenditure on R&D is in the higher education sector, with business R&D making up the majority of the rest. In 2013/14 the total spend on research across all subjects in UK HEIs was £7bn. This included £5.1bn from research grants and contracts from UK, EU and international sources, and £1.9bn contributed through the HEFCs[157].

EU funding is of increasing importance to UK research

Overseas sources of funding for research in UK HEIs are significant, in particular those from the EU. In real terms, the funding from EU government sources more than doubled between 2007/08 and 2013/14 (Figure 2), while over the same time period UK Research Council funding increased by 7%, and recurrent research funding (allocated through the HEFCs) declined by 2.2%. EU government sources of funding are therefore increasingly important to UK research, making up 10% of income in HEIs in 2013/14. Specifically, disciplines within science and engineering together attract over half (53%) of all research grants and contracts income from EU sources (Figure 3).

Figure 2. The proportion of research grants and contracts income to UK HEIs from different sources

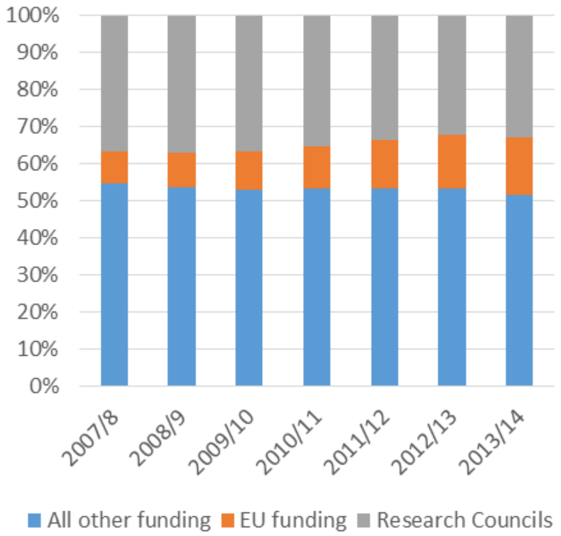
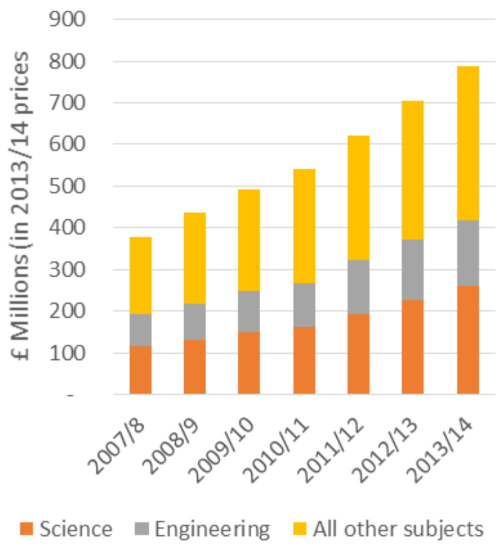


Figure 3. The research grants and contracts income to UK HEIs from EU sources for different disciplines



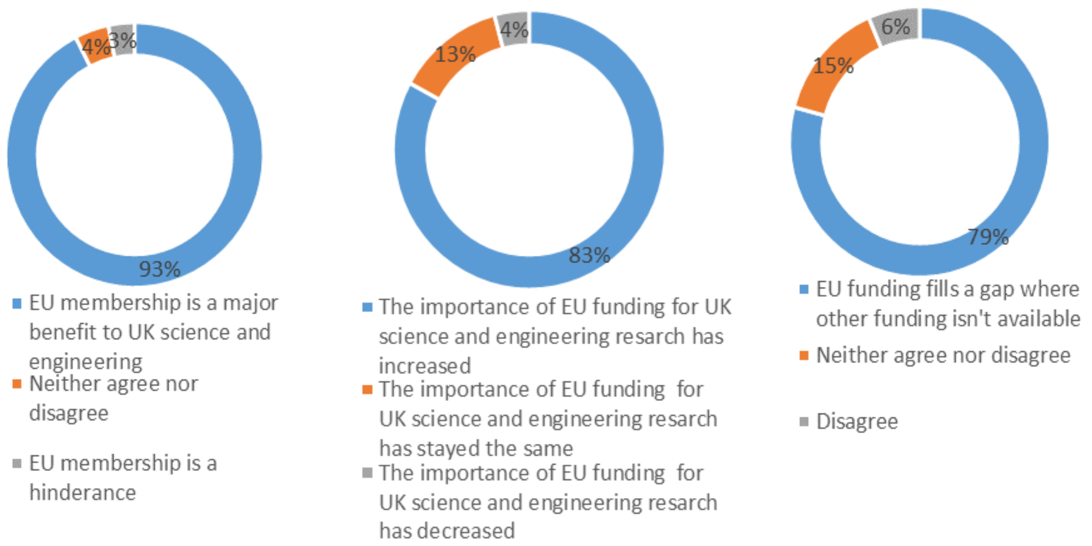
Source: Higher Education Statistics Agency. The funding for research from Research Grants and Contracts and HEFCs is included in this. EU sources include that from government, industry and charity.

The figures indicating the importance of EU funding for UK research are borne out by the views of the research community (Figure 4). In our survey of UK researchers, EU funding was

155 Research Excellence Framework, 2014
156 UK GERD Statistics, Office for National Statistics, 2013
157 Higher Education Funding Council for England, Higher Education Funding Council for Wales, Scottish Funding Council, Department for Employment and Learning (Northern Ireland)

identified as being of increasing importance to UK science and engineering research. EU membership was considered to benefit the UK research environment and to fill a gap where funding for research may not otherwise be available.

Figure 4. Researchers views of on the benefit and importance of EU membership and funding



Source: Survey undertaken October, 2015 amongst CaSE and EPC members. 403 respondents from UK HEIs and industry.

Box 1. UK funding of research in Higher Education Institutions

UK government funding for science and engineering research in HEIs is largely administered through a dual funding system:

- The resource and capital budget for research which is largely allocated through the seven UK Department for Business, Innovation and Skills (BIS) administered research councils through research grants.
- The Higher Education Funding Councils for England, Scotland and Wales, and the Department for Employment and Learning (Northern Ireland) allocate 'recurrent funding' for teaching and research to HEIs. The main research funding method allocates 'mainstream quality-related research' (QR) funding based on research quality, and taking into account the volume and relative cost of research in different subject areas. QR funding provides the flexibility and financial stability needed for making a long-term commitment to curiosity-driven research, and emerging research areas informed by institutional priorities.
- Research grants and contracts (including EU funding) and the Higher Education Funding Councils make up 36% of total funding to HEIs[2].
- UK HEIs are particularly successful in winning EU funding receiving 71% of the UK's total FP7 funding[3].

[1] In England quality related research will be delivered through a different funding body, as yet unknown
[2] HESA
[3] Seventh FP7 Monitoring Report, 2013

Box 2. EU funding of research in Higher Education Institutions

The UK receives R & D investment from the EU through various routes, including:

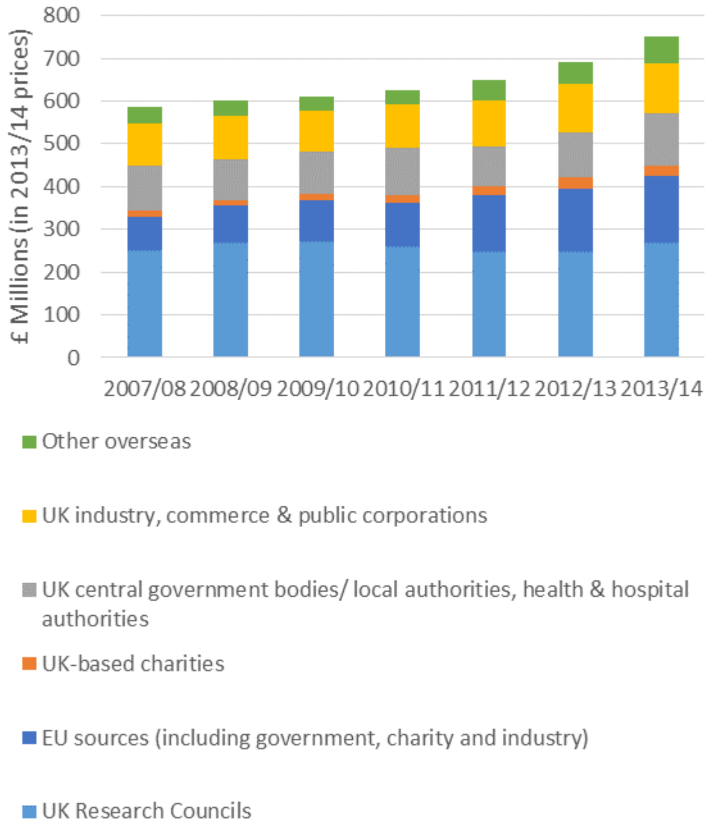
- Framework Programmes: the current programme is Horizon 2020. The previous programme which ran from 2007-2013 was the 7th Framework Programme for Research and Technological Development (FP7). This includes European Research Council (ERC) grants as part of the FP7 Capacity Programme, which allocates grants for individual researchers on a competitive basis through a peer review process which focuses on excellence. Also included in this are Marie Skłodowska-Curie Actions which support research training and career development, focusing on innovation skills. These include grants for all stages of a researcher's career, from PhD candidates, to highly experienced researchers, and encourage transnational, intersectoral and interdisciplinary mobility.
- European Structural and Investment Funds: five funds, of these the most relevant to the UK research environment are the European Regional Development Fund (ERDF), and the European Social Fund (ESF). These funds address regional development and economic change and aim to enhance competitiveness and territorial co-operation throughout the EU; this includes providing substantial support for research and innovation. The level of funding and the types of projects that are funded differ from one region to another.
- Sectoral research and innovation programmes: programmes focusing on space and nuclear energy and coal and steel production.

A look at EU funding in different disciplines

Changes to UK and EU investment are not uniform across disciplines. Variations in UK and EU research priorities over time, as well as shifting areas of UK research strength, are contributing factors to this. In the following section, we look more specifically at disciplines which fall within science and engineering.

Funding for engineering research in UK HEIs

Figure 5. Source of research grants and contracts funding for engineering in HEIs



Source: Higher Education Statistics Agency, HEFC funding is not included in this analysis

Engineering received 15% of all research grants and contracts[158] to UK HEIs, but 20% of the funding from EU sources, in 2013/14. The income to HEIs through research grants and contracts for engineering research (Figure 5) increased by 22% between 2007/08 and 2013/14. Nearly half (48%) of the increase in income for engineering research can be attributed to EU sources (Figure 7), the great majority of this being from EU government bodies (43%). In real terms the amount of EU government funding for engineering in HEIs has doubled over this time, reaching £139m, and now represents 19% of total engineering research grant and contract funding. On the other hand, UK Research Council funding represents a declining proportion of the total funding for engineering research in the UK.

Engineering also receives a relatively large proportion of its income from UK industry (16%), when compared across all subjects the proportion of income from UK industry is only around a third of this (6%). EU industry funding represents 1.5% of the total funding in 2013/14 and only 1.1% across all subjects, indicating the importance of industry collaboration and links to engineering research.

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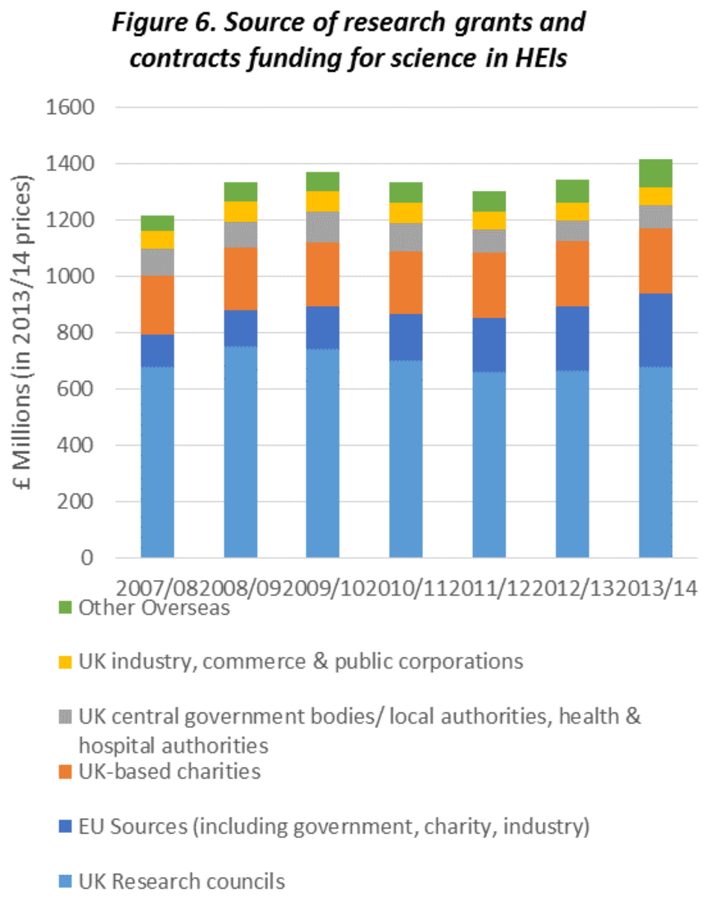
[158] HESA data on Research Grants and Contracts to UK HEIs, this does not therefore include funding through the Higher Education Funding Councils, or that allocated to research institutions.

Funding for science research in UK HEIs



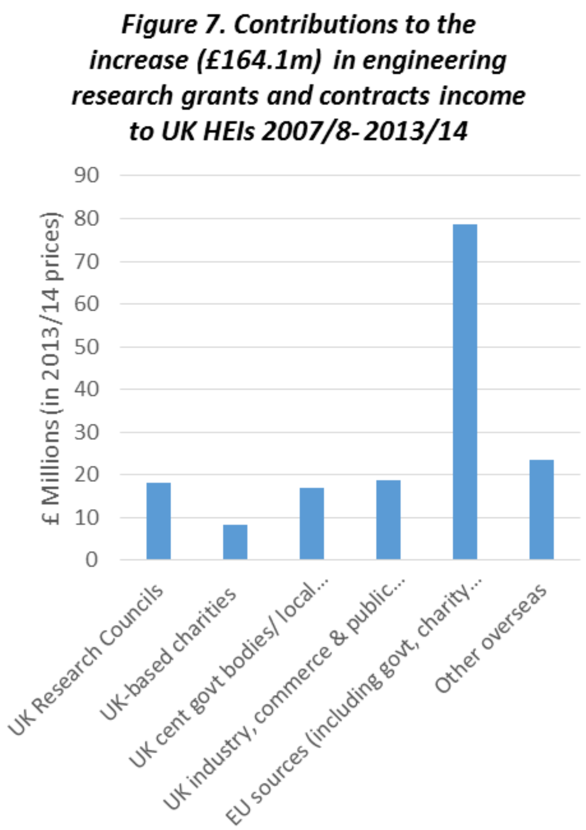
Source: Higher Education Statistics Agency, HEFC funding is not included in this analysis

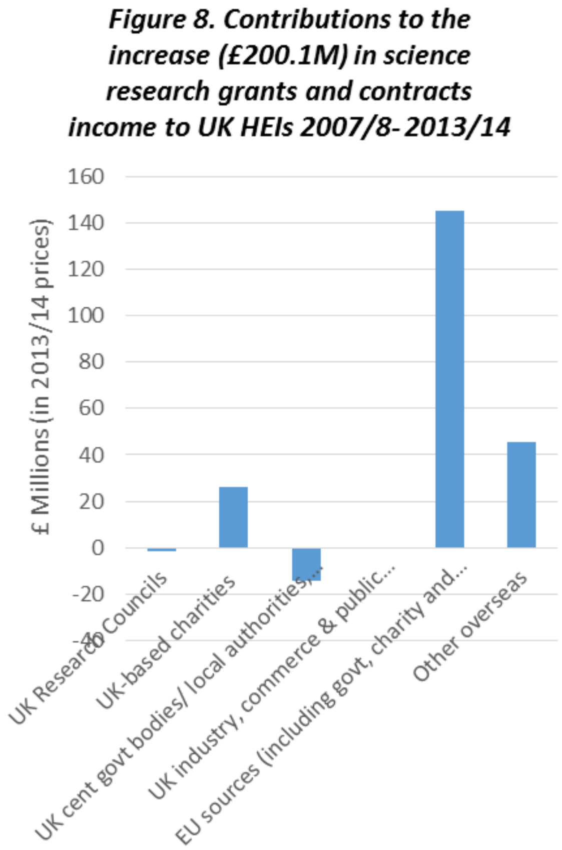
The total spend on science[159] research in HEIs in 2013/14 from all research grants and contracts (Figure 6) was £141m (46% of this was in the Biosciences). Therefore, just under a third (28%) of the total amount spent on research grants and contracts in HEIs was spent on science. The total spend on science research in the UK has overall increased between 2007/08 and 2013/14, although the increase has not been steady over this period.

The UK Research Councils alone in 2013/14 contributed nearly half (48%) of the funding to science, this has decreased from 56% in 2007/08. In real terms the contribution of UK research councils to science research funding has decreased by £2m between 2007/08 and 2013/14 (Figure 8). The amount of funding from UK central government bodies has also decreased in this period by £14m. EU government bodies in 2013/14 contributed 17% of the total research grants and contracts income for science in HEIs, this has increased from 8% in 2007/2008. Nearly three quarters (73%) of the increase in funding between 2007/08 and 2013/14 can be attributed to EU sources.

Our analysis shows that in a period of static or reducing funding from other sources in the UK, EU investment has become an increasingly important source of income.

[159] HESA data, Science includes, Bioscience, Chemistry, Physics, Earth, Marine and Environmental and Mathematics,





Source: Higher Education Statistics Agency

EU funding in HEIs has an impact on a national, but also a regional level
Research capacity and funding for research in HEIs varies across the UK (Figure 9). At the total level, funding for research in HEIs is concentrated in London (£1850m) and Yorkshire and the Humber (£812m). When the concentration of the various component sources of the funding are examined the dependencies in each region can be seen to differ. The region receiving the most UK Research Council and HEFCs recurrent research funding is London (£900m), followed by the West Midlands (£411m), Wales (£381m) and Yorkshire and the Humber (£371m). For EU funding the pattern is similar; with London receiving (£176m), followed by Yorkshire and the Humber (£80m) and Wales (£79m).

However, when looking at the relative importance of each source of funding to a region, the picture looks quite different. The regions with greatest dependence on UK Research Council and HEFCs recurrent research funding are the East Midlands (65%) and the West Midlands (59%), the South West (59%) and Scotland (58%). Those with the greatest dependence on EU Government funding are the South West (12%) and North West (11%), Scotland (11%) and Wales (10%).

There are also variations in regional reliance on EU funding by discipline, highlighting the complexity of the relationship between regions and research investment. For instance, for engineering research the region with the greatest dependency on EU government funding is Wales (27%), followed by the North East (19%). When industry investment is considered, the East (2.3%) and the North West (2.4%), receive a greater proportion of their funding from EU

industry when compared with other UK regions. The East also receives a high proportion of funding from UK industry (17%).

Evidence shows that public investment in R&D 'crowds in' private investment[160] and this seems to be underlined by this regional analysis of EU funding; regions that receive a greater proportion of funding from the EU government also attract a greater proportion of EU industry investment. However, there are exceptions, with Wales receiving a large proportion of its funding for engineering from EU government bodies but a relatively small proportion from EU industry. This is likely to be due to the focus and priorities of the various sources of EU funding available, impacting on the way money is allocated to UK regions. All regions of the UK have received funding from the EU, with some EU funding being geared to support capacity building. As a consequence, Cornwall, parts of Wales, and the Scottish Highlands in particular have previously received significant funding as 'Less Developed Regions'[161].

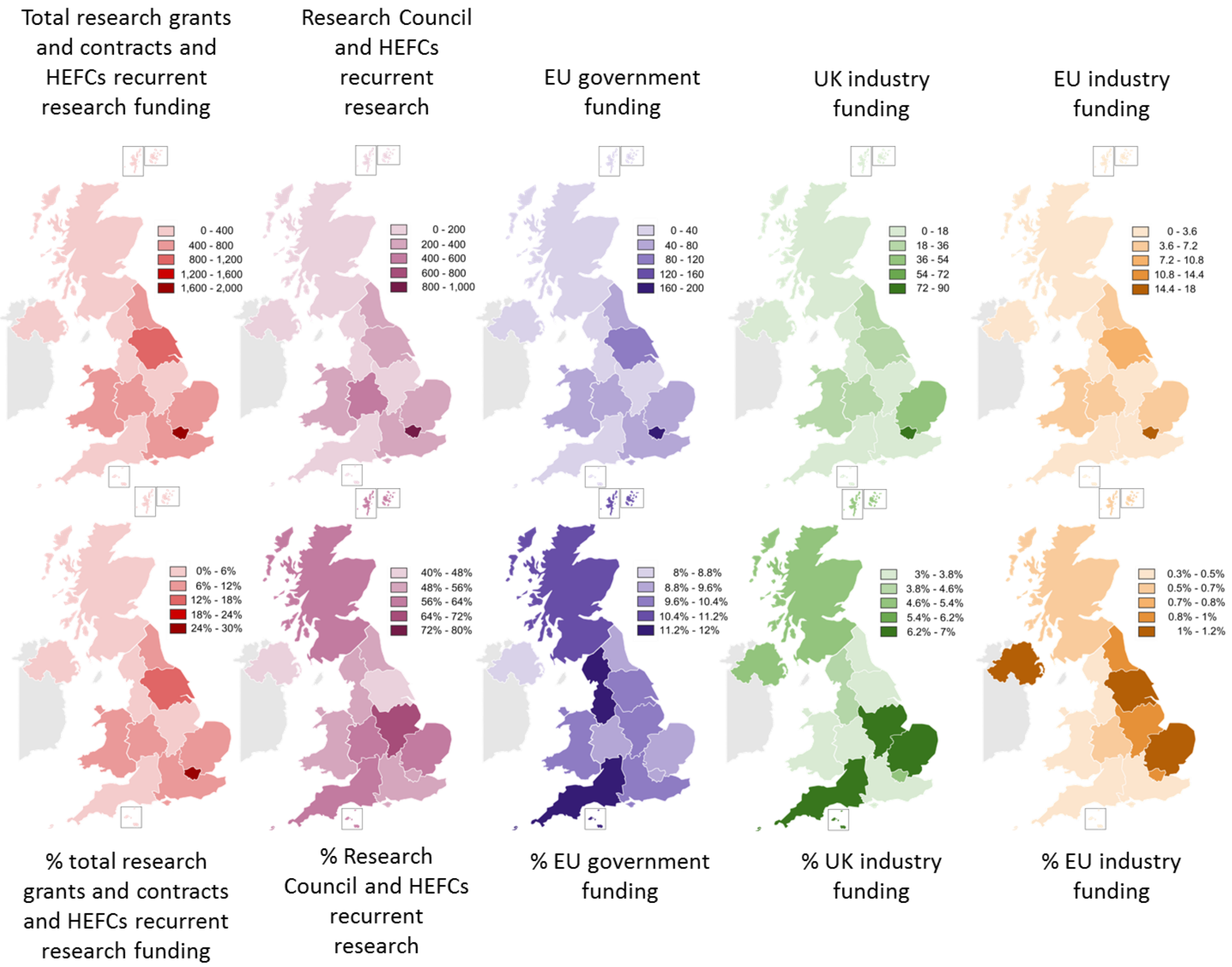
When considering regional differences, the different characteristics of the regions must be considered, for example, the density and size of the population, the scale of the research base and the concentration of industry. For example, Wales and London have, per person, the same level of EU government investment for engineering, despite the disparity in the headline figures.

Any changes or restrictions to UK access to EU funding would therefore disproportionately affect certain UK regions, with consequential impacts on the industries and businesses based there.

R&D performed by businesses in the UK (including EU investment) is a large proportion of the total R&D investment in the UK. This expenditure has a slightly different regional profile[162] to that of HEIs, due to the distribution of industries across the UK. The South East, East and North West have the highest industry R &D investment, delivered through business.

[160] The Economic Significance of the UK Science Base, Haskel, Hughes and Bascavusoglu-Moreau, 2014
[161] Current categories for UK region eligibility for ERDF and ESF EU Structural Funds, 2014-2020
[162] Research and Development funding for science and technology in the UK, National Audit Office, 2013

Figure 9. Regional allcoations of funding for research (across all subjects) in HEIs in 2013/14. The amount (£ Millions; top row) and the relative amount (%; bottom row) each funding source represents of the total funding for the region is indicated.

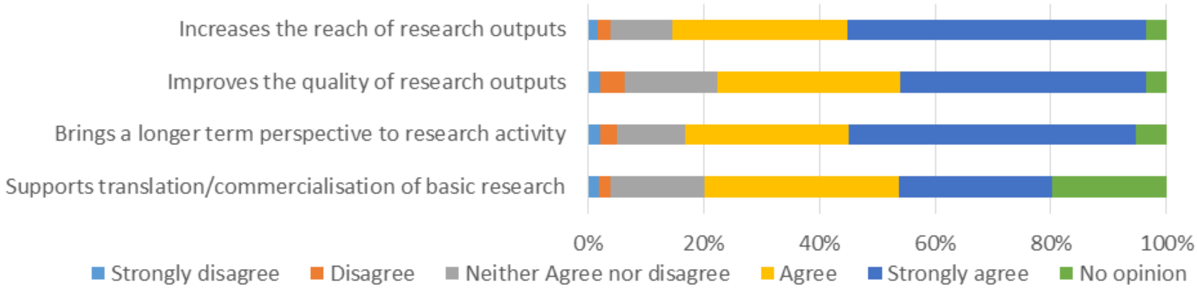


Source: Higher Education Statistics Agency (HESA) data on research grants and contracts received by UK HEIs and QR funding from Higher Education Funding Councils.

EU funding influences the impact, reach and quality of UK science and engineering research

In our survey, 93% of respondents agreed that EU membership is beneficial to UK science and engineering research. However, the importance of EU research programmes goes far beyond the funding. Researchers strongly agreed that the reach of research outputs is increased through EU membership (Figure 10) -an interesting perspective in a UK funding and policy context that has an increasing focus on effectiveness and impact. Critically, our survey respondents considered that the EU brings a longer term perspective to research, allowing major projects addressing complex questions to be supported, and providing a strong platform to enable strategic and mutually beneficial relationships with industry and charity partners to develop.

Figure 10. Benefits EU membership brings to UK research

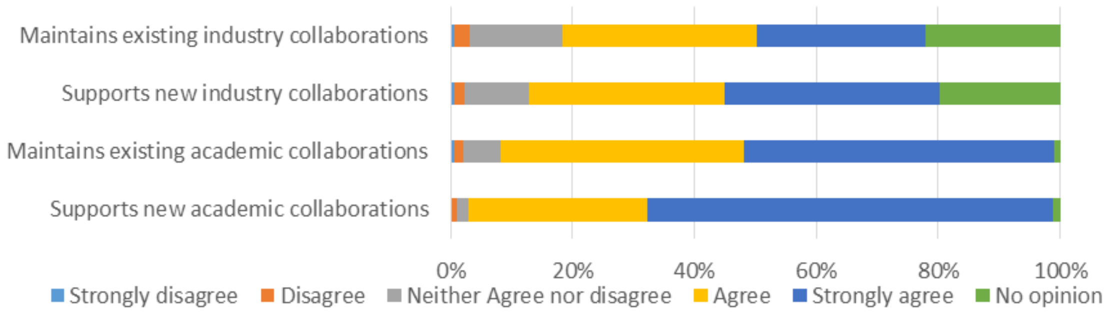


Source: Survey undertaken October, 2015 amongst CaSE and EPC members. 403 respondents from UK HEIs and industry

EU membership supports and maintains collaboration
Collaboration is essential to research, it allows sharing of expertise and equipment, facilitates cross-disciplinary work, enables complex global challenges to be addressed and increases the capability of researchers to commercialise innovations[163]. A remarkably high proportion of respondents (95%) agreed that EU funding supports and maintains academic collaborations (Figure 11). This is important for UK research performance as international collaboration and researcher mobility have been found to be correlated with high research quality[164,165]. Around half of UK publications are co-authored with international collaborators, and such papers are on average more scientifically-significant, receiving a greater number of citations by other authors[166].

Supporting universities in collaborating with industry and commercialising research is a focus of the current government[167], and two thirds of survey respondents (66%) said that EU membership supports new industry collaborations. The UK has been ranked among the top five countries in the world on university/industry collaboration in R&D for the past four years[168] and our survey suggests that EU funding plays a role in supporting this.

Figure 11. Role of EU membership in enabling collaboration with academia and industry



Source: Survey undertaken October, 2015 amongst CaSE and EPC members. 403 respondents from UK HEIs and industry

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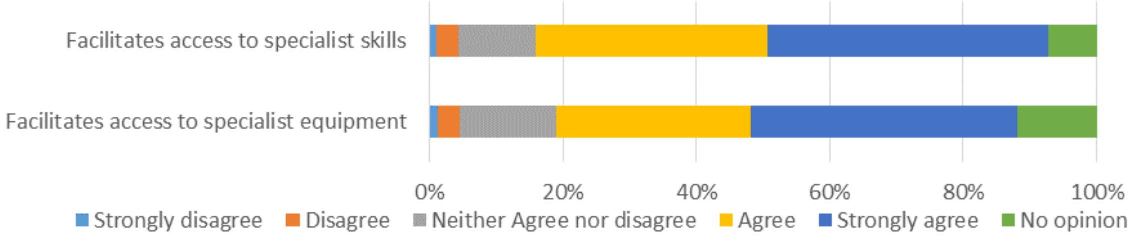
[163] The Dowling Review of Business-University Research Collaborations, 2015
[164] International Comparative Performance of the UK Research Base – 2013, Elsevier, 2013
[165] Characteristics of high-performing research units, A preliminary analysis, Manville, Hinrichs, Parks, Kamenetzky, Gunashekar, Wilkinson and Grant, Higher Education Funding Council for England (HEFCE), 2015
[166] Tracking UK and International Researchers by an Analysis of Publication Data, Gurney and Adams, 2005
[167] Fixing the foundations: Creating a more prosperous nation, HM Treasury, 2015
[168] The Global Competitiveness Report, (2013-2014) World Economic Forum, 2013

Respondents to our survey highlighted that the EU supports cross-border collaboration by enabling access to specialist equipment and large international research facilities, and by facilitating the exchange of skills and knowledge between researchers. Over three quarters (76%) of respondents to the survey agreed that EU membership facilitated access to specialist skills, and 68% said it facilitated access to specialist equipment (Figure 12).

Figure 12. Role of EU membership in facilitating access to skills and equipment



Source: Survey undertaken October, 2015 amongst CaSE and EPC members. 403 respondents from UK HEIs and industry

The strong agreement from survey respondents that the EU supports collaboration is matched by data showing that the UK collaborated with 120 different countries[169] through FP7 grants. The top collaborative links for the UK were with Germany, France, Italy, Spain and the Netherlands. The number of collaborators in EU funded projects, from countries outside Europe and the Associated Countries, is growing. The USA, Russia, China, Brazil and India were the biggest participants of this type in FP7[170].

The EU funding system offers a framework in which collaborations can be supported. It provides a single system for funding applications to be made and a network through which to find and identify new partners. This can provide simplicity and efficiency above what is provided by national systems. This support remains valued despite criticisms being made by some researchers of the bureaucracy involved in the reporting requirements of EU grants.

As a member of the EU, the UK, as well as receiving funding for research, is able to influence the policy and decision making around EU research funding systems, including the priorities and thematic areas for research funding. There are some countries that have specific agreements in place, for example Norway, which is an Associated Country in Horizon 2020,[171,172] that enable them to also have a voice in agenda or strategy setting. However, for the majority of non-member countries this is not the case.

EU membership enables researcher mobility

The ability of the UK to attract the best researchers in a field is critical to the maintenance of a solid UK research base. Specific EU projects encourage the international mobility of researchers and the UK is successful in obtaining these. For example, 3,454 British researchers were funded through Marie Curie Actions (see Box 2) between 2007- 2014,

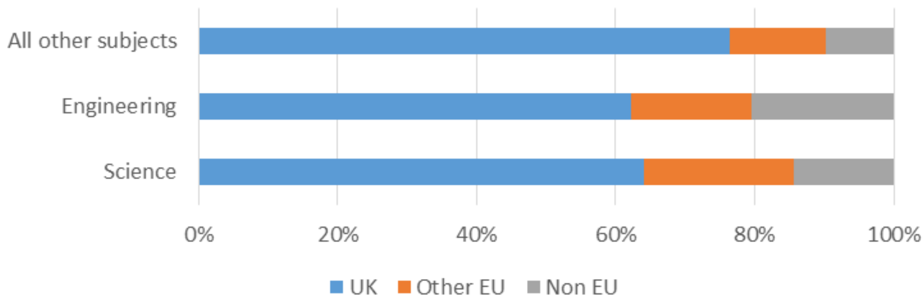
[169] The impact of the EU RTD Framework Programme on the UK, Technopolis Group, Simmonds, Stroyan, Brown and Horvath, 2010
[170] Seventh FP7 Monitoring Report, European Commission, 2013
[171] Norway's affiliation with European Research Programmes, Technopolis Group, 2012
[172] Associated Countries, European Commission, 2015

through which transnational, intersectoral and interdisciplinary mobility is encouraged. These can often be important building blocks in researchers' career development and facilitate the sharing of knowledge across international and sectoral boundaries.

Research is an international endeavour and academics from across the world undertake research in UK universities. In science and engineering disciplines, the academic researcher population is even more international than in other subjects (Figure 13). Engineering has a greater proportion of non-EU academics (20% compared with 9% across other subjects) and science has a greater proportion of non-UK EU staff (21% compared with 13% across other subjects).

The number of non-UK EU nationals and international academic staff at UK HEIs has increased by 13% between 2007/08 and 2013/14. Over this time the number of non-UK EU nationals has doubled but the number of UK nationality staff has only increased by 3%.

Figure 13. Proportion of academic staff by nationality by discipline in 2013/14



Source: Higher Education Statistics Agency

EU funding supports academics in UK HEIs
A significant number of academic jobs in the UK depend in part on EU funding. In 2013/14 across all subjects over 5,000 Full Time Equivalent (FTE) academics relied on EU grants for part of their basic salary. 8.5% of academic staff on fixed term contracts were funded by EU government bodies, and 2.1% by other EU sources (including EU industry). A great proportion of academics with permanent contracts receive their entire basic salary from the university (85%). In comparison, a smaller proportion of those on fixed term contracts are funded by the university (44%).

The proportion of academic staff funded through EU sources also differs depending on the discipline. For example, in engineering, EU funding appears to be particularly important as 18% of FTE engineering academic staff on fixed term contracts were funded by EU government sources and 4% by other EU sources. When permanent contracts are considered, the same is true, with 4% of engineering FTE academic staff being funded through EU government sources compared to only 1.2% across all subjects.

The numbers tell their own story but to illustrate the role EU funded projects play in the UK research environment a number of case studies from across the engineering disciplines were collected. These range from projects tackling pollution with digital fish, to detecting landmines and improving border security. These examples are a small sample

demonstrating the range of benefits EU funding and collaboration can bring to the UK research environment, and the UK more broadly.

Improving the safety of helicopters
HeliSafe TA, 2003- 2007, €4.8M , 12 partners from 7 countries
Key benefits project provided- **Access to specialist facilities and skills, Direct transfer of knowledge to industry**

EU funded research has improved the simulation of helicopter crashes, to enable safety improvements to be made to helicopters to save the lives of those inside. In this research, computer simulations developed at the **University of Coventry** informed helicopter crash tests which were performed in Italy at the Italian Aerospace Research Centre (CIRA). Crash tests are very expensive and the project allowed the researchers to complete these due to its scale, and by using the expertise of all the partners.

As a result of the project, the industry partners, including the engineering company TASS, have been able to adopt more efficient and economically beneficial practices, and offer improved products for crash simulation to the automotive and aerospace sectors. For Autoflug GmbH, a German company coordinating the project, the computer simulation is now used to support and enhance new product design.

Detecting landmines and remotely exploring other planets
SWIPE, 2013- 2015, €2m, 5 partners from 5 countries
D-BOX, 2013- 2016, €9.9m, 21 partners from 11 countries
Key benefits projects provided- **Enabling expertise to be applied to different disciplines through industry partners, Ensuring continued collaboration with partners, Funding research in a field for which UK funding is limited**

The **University of Leicester** have been involved in several EU funded projects which have allowed their research in how to process data from multiple sensors to be used in different applications. This has been made possible through association with different industrial partners. 'SWIPE' investigated how to remotely collect information from other planets by dropping small wireless sensor nodes from a satellite onto the surface of the planet. 'D-BOX' then applied the University of Leicester's expertise to automatically detect landmines in minefields and mine-suspected zones, safeguarding those helping to remove landmines as well as protecting local populations.

Throughout these projects there have been strong industry links for the university, particularly with Airbus Defence and Space, who coordinated 'D-BOX' and were a partner in 'SWIPE', this has allowed the University to successfully apply for other funding in conjunction with Airbus Defence and Space, including from the European Space Agency. The EU funded projects have also enabled masters and PhD students to get involved in applied research. The UK funding streams have not tended to focus on space as a research area and so this gap in funding has been filled in part by the EU funding systems.

Improving border security through facial recognition
3D FACE -2006-2009, €11m, 15 partners from 7 countries

PIDaaS- 2014-2016, 9 partners from 6 countries
Key benefits projects provided- **Continued collaboration of UK researchers with EU partners, Addressing cross-border questions, Providing a network for researchers**

The Intelligent Interactions group at the **University of Kent**, whose research includes addressing issues around security and biometrics, has a long standing history of involvement in both EU and UK funded projects. Both funding sources have been interdependent, and critical, to their on-going research and have allowed collaborations to develop with researchers from other institutions over time. The University of Kent was a partner in the 'BioSecure' FP6 Network of Excellence which lasted from 2004- 2007 and included 30 core partners across the EU. 'BioSecure' addressed a range of scientific and technical challenges around biometric technologies, as well as international standardisation and regulatory questions.

The University of Kent and other partners of BioSecure have continued to collaborate through EU funded projects to address cross-border issues including '3DFACE' on face recognition technology in self-service border controls, and 'PIDaaS', which aims to create a secure authentication system for mobile devices through digital fingerprint scanning, and voice and face recognition. As well as providing a joined up route to funding collaborative projects in biometrics, the links between researchers through EU funding routes have provided a useful network for early career researchers and have enhanced technology transfer to industry.

Utilising different funding sources to maximise impact in Photonics research
Aston Institute of Photonics Technologies, Aston University
Key benefits projects provided- **Enhancing industry links and technology transfer, Increasing collaboration**

The **Aston Institute for Photonic Technologies** pursues cutting edge technology relating to high-capacity optical communication systems, lasers and fibre-based optical devices for various sensing applications. Their work spans basic science and engineering through to the creation of prototype devices and system demonstrators. AIPT cultivates an environment where academics and engineers work side-by-side on the most challenging, high-impact research, solving industrial problems and developing new technologies.

Over the last 5 years AIPT was successful in winning research and industrial grants of more than £18.4m, with around half coming from the European grants.

Where EU funding is concerned, the more fundamental work at the Institute tends to be supported by the European Research Council. For example, an ERC Advanced Investigator Grant supported research into ultra-long fibre lasers and led to development of fundamentally new concepts for telecommunications and laser applications. EU funding is also regularly used to exploit a particular line of research by enabling collaboration with appropriate industrial partners (i.e. The Integrated Project, 'DISCUS', which is working with fibre optic and wireless communication technologies to design the internet networks of the future).

Over £500,000 ERDF funding has enabled the institute to promote the use of photonic technologies to over 100 SMEs in Birmingham and the West Midlands, by offering free consultancy and business support. This has helped to raise awareness in these local businesses of how photonics can fundamentally change their existing technologies and has helped these businesses to grow.

The Institute has seen great benefit from participation in over 20 Marie Skłodowska-Curie Actions, and other European exchange schemes. These schemes have enabled the brightest young researchers from around the world to work at AIPT, bringing with them new knowledge and skills, enhancing AIPT activities in fields of high industrial relevance, and establishing new international research and industrial collaborations.

We asked researchers to let us know their views on the role that EU membership plays in science and engineering research in the UK

"Whilst international collaboration is perfectly possible with any country, the existence of the established political mechanisms across the EU massively improves the chances of strong multilateral co-operation."

"Today's research is of a scale that cannot be undertaken by a small team, and EU research funding allows larger consortia, bringing together relevant Industry and Academic partners to provide the deep skill as well as breadth required."

"It allows us to participate as a key member in the multi-national teams that are necessary to tackle current challenges in science and engineering, challenges that no nation could attempt working in isolation."

"Enables the UK to benefit from the large range of expertise and equipment available across the EU"

"Countries are picking winners and choosing areas of national importance. Where there are needs outside of these areas there is the need to fund those needs. Since we do not cover everything in the UK we need experts elsewhere. The EU can fund this."

"EU membership strongly supports academic mobility and helps the UK to recruit the best talent internationally and allows early career researchers from the UK to gain experience working with leading experts outside the UK."

"EU membership provides incentives to collaborate within the EU. International collaboration is extremely productive."

"Whilst the UK punches above its weight with respect to science and engineering research it still needs to be part of the formal combined EU science and engineering community in order to ensure global competitiveness."

"Without the investment from the EU into fundamental research many world class research projects could not have gone forward."

"The EU encourages openness and sharing of information."

"We all have the same technical challenges - we don't need to all solve them individually."

"It facilitates big consortia that allow UK researchers to translate the relevance of their work beyond the immediate region and into a more globally relevant context."

"The administration of EU projects is honest but also pragmatic, permitting you to work in a way to get the best results, but also ensuring a high standard of ethics and audit."

"The free movement of workers makes it very easy for scientists to take jobs around the EU area with minimal administrative hassles, allowing them to build international careers very easily."

"Scientific research is a global endeavour, and it thrives if the top people can collaborate and share their facilities and resources freely without being constrained by national boundaries."

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Centre for Ecology & Hydrology – Written evidence (EUM0053)

The Centre for Ecology & Hydrology (CEH) is a world-class research organisation focussing on land and freshwater ecosystems and their interaction with the atmosphere. We are a NERC Research Centre and integral to the delivery of the NERC Strategy, The Business of the Environment, with over 425 researchers and students based at sites in England, Scotland and Wales.

CEH integrates UK-wide observation systems and curiosity driven research, from the smallest scale of genetic diversity to large-scale, whole Earth systems. We work across disciplines and facilitate academic, public, private and voluntary sector partnerships.

CEH's extensive, long-term monitoring, analysis and modelling deliver UK and global environmental data, providing early warnings of change and management solutions for our land and freshwaters. These range from evaluating the causes of change in biodiversity stock and function, forecasting floods, identifying and addressing the impacts of pollution and climate change, to safeguarding UK soils and carbon stocks. Our work also includes developing decision support tools for the sustainable intensification of agriculture and the management of ecosystem services and water resources.

This written response focuses on Collaboration and Scientific Advice.

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

CEH secured on average £2.2m pa between 2012/13 to 2014/15 (an average of 18% of total external, non-NERC research funding), through Horizon2020 and predecessor Framework Programmes and through other Directorates, including Directorate-General for the Environment. These are vital funding streams for enabling delivery of our research and Mission, enabling us to maintain critical mass in science areas, and providing access to expertise and data at wider spatial scales.

Many of today's societal challenges can only be tackled at a continental scale, if not a global scale, hence the need to mobilise a critical mass of research capacity accessing a wider, multidisciplinary knowledge pool, facilitating the testing of different national approaches to establish optimal responses and the need to physically work across large geographic scales and diverse habitats. Moreover, we consider that competing with the best across Europe within this funding landscape, in part, drives the world-class science in our organisation.

Whilst CEH has participated in many EU Programmes, it has also coordinated a series of large-scale, high impact Programmes. These have generated significant outputs relevant to the UK's policy-makers, environmental practitioners and the private sector, as well as building sustainable scientific expertise within the UK. The UK's strengths in specific disciplines are further reflected by leadership of consecutive Programmes, for example CEH-

led EU Projects, NanoFate, nanoparticle fate assessment and toxicity in the environment, and NanoFuse, delivering an integrated Exposure Assessment Framework for regulatory registrations.

The platform provided by EU Programme coordination supports the recognition as a leading actor in European and global research. Indeed, coordination of NitroEurope, examining the effect of reactive nitrogen supply on net greenhouse gas budgets, and subsequent coordination of ECLAIR, Effects of Climate Change on Air Pollution and Response Strategies, supported the development of the European Nitrogen Assessment, and provided opportunity for CEH's international engagement beyond Europe, and in part, resulted in the leadership of the development of an International Nitrogen Management System through the UN Environment Programme.

EU Programmes, exemplified by the CEH-led WATCH, projecting future, global water cycles and related water resources, also depended upon multidisciplinary work, supported by the scope and scale of expertise across Europe, bringing together the hydrological, water resources and climate communities. Importantly, such collaboration stimulates common methodologies generating interoperable data and common data sharing standards.

EU membership and common funding streams, have driven the formation of organisational or discipline focussed partnerships, in many cases with limited dedicated EU funding. For example, CEH is a founding member of the Partnership for European Environmental Research (PEER) (www.peer.eu). PEER is a partnership of eight of the largest European environmental centres, founded in 2001, with the aim of combining forces to follow a joint strategy in environmental sciences and to enhance research on ecological sustainability. CEH is similarly involved in EurAqua (http://www.euraqua.org/), a network of freshwater organisations, and ALTER-Net (http://www.alter-net.info/), a biodiversity oriented network of institutions across 18 countries. Irrespective of the driver of formation of these networks, they facilitate joint institutional programming, staff interchange, integrated policy briefings and education.

CEH recognises the benefits of collaboration across Europe, but also the benefits accruing from the recruitment of European researchers within our research programmes, attracting high performing scientists, addressing specific skills shortages and creating a productive diversity with our workforce. Currently CEH employs 24 of 383, non-UK European researchers, i.e. 6% of the current researchers, albeit this information provided by staff is optional and therefore likely to be an underestimate. Use of Marie-Curie Fellowships has facilitated the movement of pre and postdoctoral researchers into and out of CEH.

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership?

CEH has been funded and participated in the development and delivery of EU experimental and observational infrastructures with research institutions and universities Europe-wide. These infrastructures have primarily focused on monitoring the environment, e.g. ACTRIS, integrating European ground-based stations equipped with advanced atmospheric probing instrumentation for aerosols, clouds, and short-lived gas-phase species, or providing large-

scale experimental platforms, e.g. ExpeER, which included creating future environmental conditions, with a focus on warming and CO_2 enrichment.

Whilst these EU research infrastructures are not on the scale of singular, large-scale research installations, they are nevertheless vital. They are focussed on global societal challenges, in this case environmental change, which can only be addressed through large-scale monitoring and experiment on diverse habitats across Europe. Aligned technologies and methodologies across the infrastructures produce interoperable data, essential for informed response to grand societal challenges. Furthermore, these infrastructures facilitate transnational access and thereby movement of researchers within Europe.

EU investment in platforms managed by CEH is often aligned with UK funding, establishing sustainable, longer-term support for platforms that are required for extended periods to understand natural and anthropogenic changes to our national and international environment. Hence, there is a dependency on a series, of sometimes independent funding awards, for sustainability and research impact. It is also noteworthy that the PEER members have sought to identify their unique research facilities (http://www.peer.eu/facilities/), e.g. organic and inorganic matter spreading platform at Irstea, primarily to increase the collaboration and competitive advantage of PEER researchers.

CEH is also a lead partner in eLTER (an Integrated European Long-term Ecosystem and Socio-ecological Research Infrastructure), which is funded by the EC (under H2020) to build a distributed network of ecosystem research platforms. This in turn is aligned with ILTER (International Long Term Ecological Research) previously chaired by CEH, a network of networks, forming a global network of research sites to help to understand and manage environmental change on a global scale. In this manner EU funding of research infrastructures facilitates collaboration and data sharing beyond Europe. A recent example of this is CEH's lead on an EC funded international co-operation project (ROBIN) in Latin America. This involved six European and six Latin American partners working on options for preventing tropical forest degradation, in work of broad relevance to policies on global climate change mitigation, averting global biodiversity loss and the UN sustainable development goals.

Scientific advice

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels?

Environmental policy in the UK is in part, driven by European regulations, and hence it is critical that UK researchers proactively engage. Indeed the science-policy interface and dialogue has been an important driver for European environmental research itself. CEH researchers are involved at all stages of the policy lifecycle: development, implementation and review, at a national and European-scale.

CEH's engagement in EU policy development is exemplified by research associated with invasive non-native species, which threaten native biodiversity and ecosystem services, including negative human health and economic impacts. Under EU funding awarded in 2003,

CEH led the development of DAISIE (Delivering Alien Invasive Species Inventory for Europe), subsequently led EC Commissioned Research to develop risk assessments and a list of invasive alien species of EU concern (http://ec.europa.eu/environment/nature/invasivealien/index_en.htm) and Chairs a COST action, ALIEN Challenge, involving 31 countries. The Regulation 1143/2014 on invasive alien species came into force in January 2015, which focuses on the risk assessments delivered by the CEH consortia. This series of EC awards, thus provide an example of the sustained funding and research community engagement required to support informed policy development, and the dependency on multiple funding streams to facilitate that engagement.

An example of policy implementation relates to the Water Framework Directive (WFD). Through the REBECCA & WISER projects, CEH developed site-specific lake standards that were adopted by the UK, underpinning an EU decision to allow flexible chlorophyll standards according to lake characteristics. As well as ecological status, CEH defined phosphorus targets in the context of public health risk for recreational activities, supported by a classification scheme for algal blooms. These targets have been adopted by the UK and other EU Member States, in the absence of which, these countries could not fully implement the WFD and would potentially be liable to fines.

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Centre for the Advancement of Sustainable Medical Innovation (CASMI), Oxford-UCL – Written evidence (EUM0008)

CASMI conducts research and policy development on issues related to the medical innovation process, specifically on new models of development and regulation that could bring innovative technologies to patients more rapidly and affordably.

This submission deals only with life and medical sciences. The backdrop in this sector is that most innovative medical technologies are developed for global markets and many are regulated at a European level. The UK market for pharmaceuticals, for example, is only 2.5% of the global market. The UK is therefore not a viable standalone source for funding, development or commercialization of most large-scale life science developments. EU membership is a substantial positive on all four dimensions of your enquiry, although of course some mechanisms could be optimized further.

We now comment on each of these four areas of interest to the Committee:

1. Funding

EU funding, via the Horizon 2020 programme and the EU-based Innovative Medicine Initiative (IMI) is a major (multi-billion) source that benefits UK universities substantially. IMI, for example, is the world's largest public-private partnership in life sciences, with a total funding envelope of more than 3 billion euros over the two phases of its programme.

The total income for UK universities (across all sectors) from European funding in 2014 was approximately 1 billion euros (in line with Germany's, once the the award to the Max Planck Society from Euratom is excluded). One of CASMI's host universities, UCL, received 73.2m euros for 55 separate projects in 2014 (again across all sectors). See references below.

EU funding also typically attracts overheads, enabling UK government funding to focus to a great extent on new infrastructure, versus the maintenance of current operations.

2. Collaboration

The mechanisms of H2020 and IMI secure two key dimensions of collaboration: international collaboration between universities across Europe (all successful bids have this characteristic) and engagement with industry (the programme involves major international companies that otherwise might not focus on academic partnership in Europe (versus the US and China, for example).

EU programmes frequently encourage the involvement of SMEs, favouring academic-industry partnerships and spin-outs.

The Erasmus programme provides funding for staff exchanges, offering opportunities for the development of new collaborations and knowledge-sharing. Most UK life sciences laboratories benefit from the presence of many talented EU nationals.

3. Research

Some of the most important research objectives now derive from "precision medicine": defining diseases by their exact molecular mechanisms. This theme is one of the most important in the H2020 programme, with clear potential for UK activities, including those being led by the Precision Medicine Catapult.

Precision medicine has the effect of sub-dividing conventionally defined diseases into those with small populations. This is most evident in inherited disorders and in rare forms of cancer. The numbers of patients in any one Member State may not be sufficient for conventional trials or observational studies and so cross-country research is becoming an increasingly important feature of medical innovation. The EU is a natural vehicle for such work.

The UK, through its 100,000 Genomes project, is well positioned to exert international leadership in the emergence of "genomic medicine", an important element of the precision medicine landscape in the coming years. However, that vision is likely to be pursued via a network of centres that should involve other EU partners.

4. Scientific advice and product regulation

The principal source of scientific advice of relevance in this sector is the European Medicines Agency (EMA). The EMA is based in Canary Wharf, but presumably would need to leave London were Britain's membership of the EU be terminated. The UK equivalent agency, the MHRA, is the leading European "rapporteur" body that both provides advice and examines regulatory submissions for the rest of the EU: it handles approximately 40% of this load. This too would be at risk.

This is not to say that the current regulatory situation is ideal. The EMA typically approves new products approximately 6 months after the FDA: one factor in this is the need for 28 Member States to reach agreement at the EMA and then the subsequent EMA recommendation to be accepted by the Commission. In advanced therapies (cell and gene therapy, for example) there are multiple UK and EMA committees and innovation is probably being impeded by this multiplicity of sources of advice and regulation. However, the best avenue for UK influence on the necessary process of global convergence is almost certainly as a leading EU member.

An increasingly important feature of "regulation" in life sciences is Health Technology Assessment (via bodies such as NICE). To date, most HTA has been conducted on a singlke Member State basis (where pricing powers reside). The result is a level of fragmentation that makes the European market less attractive to international companies. There are important moves underway to address this fragmentation, moves that might proceed without UK involvement in a 'Brexit' scenario.

For medical devices, both advice and regulation occurs via "notified bodies" that issue CE marks on behalf of Europe. The potential impact on such a system is less clear: some form of mutual recognition could perhaps continue.

5. Conclusion

Membership of the EU has a strong net positive contribution to the vitality of British life and medical sciences. There are opportunities to further streamline some of the mechanisms mentioned in this paper, but a standalone UK would be significantly less attractive as a venue for researchers and industry collaborators in an increasingly global endeavour.

15 November 2015

References:

Source: European Commission, taken from UCL News: http://www.ucl.ac.uk/news/news-articles/0715/09072015-ucl-horizon-2020

[2] ResearchResearch accessed 29/09/2015 http://www.researchresearch.com/index.php? option=com_news&template=rr_2col&view=article&articleId=1353226

Chartered Institute of Ecology and Environmental Management (CIEEM) – Written evidence (EUM0032)

Introduction to CIEEM

The Chartered Institute of Ecology and Environmental Management (CIEEM), as the leading membership organisation supporting professional ecologists and environmental managers in the United Kingdom and Ireland, welcomes the opportunity to comment on this consultation.

CIEEM was established in 1991 and has over 5,000 members drawn from local authorities, government agencies, industry, environmental consultancy, teaching/research, and voluntary environmental organisations. The Chartered Institute has led the way in defining and raising the standards of ecological and environmental management practice with regard to biodiversity protection and enhancement. It promotes knowledge sharing through events and publications, skills development through its comprehensive training and development programme and best practice through the dissemination of technical guidance for the profession and related disciplines.

CIEEM is a member of:

- All Party Parliamentary Group on Biodiversity
- Environmental Policy Forum
- Europarc Federation
- European Network of Environmental Professionals
- IUCN – The World Conservation Union
- Professional Associations Research Network
- Society for the Environment
- United Nations Decade on Biodiversity 2011-2020 Network

Comments from CIEEM

What is the scale of the financial contribution from the EU to UK science and research, and vice versa?

Anecdotal evidence would suggest that UK universities, being some of the best research institutions in the world, benefit enormously from EU funding. This funding would be unlikely to be provided from HM Treasury if the UK were to leave the EU.

How effectively are funds managed in the EU, compared to the management of science funding in the UK?

No comment.

What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

The EU COSME programme is also useful for our members. For example, The Environment Bank has recently received a development grant to expand its innovative land banking operations.

Although not strictly part of the EU research budget, the EU Business and Biodiversity Platform[173] in which some of our members and several UK companies participate, is definitely an innovative project led by DG Environment. It helps business improve their performance in terms of maintaining or improving biodiversity (natural capital) throughout their operations and supply chains.

Also see later remarks on free movement and policy effectiveness.

How is private investment in UK science and research influenced by EU membership?

CIEEM has both directly and indirectly benefited from private investment as a result of the UK being a member of the EU. Through our membership of the European Network of Environmental Professionals and its ability to address common issues (such as implementation of Directives) we have benefited from funding for internships and other activities.

EU institutions foster investment. For example, the European Institute of Innovation and Technology (EIT), and its main mechanism “Knowledge and Innovation Communities” (KICs), which are private-sector led but have government and research participants. The first set of KICs cover climate change, energy and ICT, and the second set will cover healthy lives, raw materials, added value manufacturing, urban mobility and sustainable food systems.

What contribution does EU membership make to the quality of UK science and research through the free movement of people?

With some of the best research institutions and some of the largest ecological and environmental consultancies the UK benefits from being able to attract, without unnecessary restriction, some of the best and brightest from across Europe.

The converse is also true, in that the UK can export people and services to other parts of Europe where those people and skills are needed, and where British researchers can gain direct experience of the state of art across Europe. For example, members are involved a whole range of environment-related FP7 and H2020 funded projects with large European consortia, covering the establishment of networks of Marine Protected Areas[174] and operationalising ecosystem services[175].

Does EU membership inhibit collaborations with countries outside the EU?

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[173] http://ec.europa.eu/environment/biodiversity/business/index_en.htm
[174] www.coconet-fp7.eu
[175] www.openness-project.eu *and* www.operas-project.eu

No. At a European level we collaborate with a Swiss organisation, the Association of Swiss Environmental Professionals (ASEP), through our membership of ENEP. At an international level we have worked with the Southern African Institute of Ecological and Environmental Scientists, the Institute of Environmental Professionals - Sri Lanka, and we have worked with the Environment Institute of Australia and New Zealand (EIANZ) on repurposing our Ecological Impact Assessment Guidance for the antipodes. Furthermore, many EU research programmes are globally oriented and not restricted to EU member states and their citizens alone.

Which EU regulatory mechanisms greatly affect the science and research community in the UK?

From an ecological and environmental management perspective, working to the same directives means that UK professionals can use their skills and experience in other EU member states. This has been particularly true in recent accession countries in relation to their obligations under the Habitats and Wild Birds Directives.

How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK?

From our perspective, the main advantage of UK involvement in the EU is the influence on European and thus global environmental research and innovation policies, which also then helps to align UK policies with global norms to which the UK has agreed. For example, a recently released report from DG Research and Innovation, *The Role of Science, Technology and Innovation Policies to Foster the Implementation of the Sustainable Development Goals*[176]*,* lays out a European policy in which the UK can effectively participate, and also benefit from.

In addition, the EU has agreed that, by 2020, 3% of Member States' GDP should be invested in research, development and innovation. According to BIS, the UK science spend for 2015/16 will be £5.8bn[177], which represents about 0.3% of forecast GDP for 2016. The EU policy should therefore drive up UK commitment to science, research and innovation.

Moreover, it is expected that at least 60% of the overall Horizon 2020 budget will be related to sustainable development, and at least 35% to climate-related expenditure, both of which are priority areas for the UK in terms of overseas aid and climate legislation.

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[176] http://bookshop.europa.eu/en/the-role-of-science-technology-and-innovation-policies-to-foster-the-implementation-of-the-sustainable-development-goals-sdgs--pbKI0415809/?CatalogCategoryID=Gj0KABst5F4AAAEjsZAY4e5L

[177] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/278326/bis-14-p200-science-and-research-budget-allocations-for-2015-to-2016.pdf

Culham Centre for Fusion Energy (CCFE), League of European Research Universities (LERU) and European Bioinformatics Institute (EMBL-EBI) – Oral evidence (QQ 1-8)

Evidence Session No. 1 *Heard in Public* *Questions 1 - 8*

TUESDAY 15 DECEMBER 2015

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Kakkar
Baroness Manningham-Buller
Lord Maxton
Baroness Morgan of Huyton
Baroness Neville-Jones
Lord Peston
Viscount Ridley
Lord Vallance of Tummel

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Examination of Witnesses

Professor Steve Cowley, Chief Executive Officer, UK Atomic Energy Authority and Head of the EURATOM/Culham Centre for Fusion Energy (CCCFE) Fusion Association, **Professor Kurt Deketelaere**, Secretary-General, League of European Research Universities (LERU), and **Professor Dame Janet Thornton**, Director Emeritus of EMBL-EBI and Senior Scientist, European Bioinformatics Institute (EMBL-EBI)

Q1 The Chairman: Could I welcome the three experts who have come to help us with our deliberations today? This is the first of what will be several oral evidence sessions. We are most grateful to you for helping us. Would you like to introduce yourselves for the record? We are being broadcast. If you would like to make any opening statement, please feel free to do so. Can we start with Professor Cowley?

Professor Steve Cowley: I am Professor Steven Cowley. I am the chief executive of the United Kingdom Atomic Energy Authority and I run Culham laboratory, which houses JET, the largest EU-funded facility on British soil.

The Chairman: We are very glad to see you again. I remember you gave evidence to us in July. Dame Janet?

Professor Dame Janet Thornton: I am Janet Thornton. I have worked in UK academia for 30 years, and then I moved to become director of the European Bioinformatics Institute, which is part of the European Molecular Biology Laboratory or EMBL. I will explain why I think it is relevant that I am here. It is a European organisation funded by 21 member states. It was not established and is not governed by the EU. In fact, although we receive about 25% of our funding through competitive grants, our core funding comes from our 21 member states 5 also receive a lot of funding—about €6 million in the UK this year—from the EU. In addition, over the last seven years I have co-ordinated the establishment of ELIXIR, which is the biodata infrastructure for Europe. That now involves 15 countries and is concerned with sharing biodata and bioinformatics tools across Europe. It is one of the infrastructures of the European Strategy Forum on Research Infrastructures (ESFRI).

The Chairman: You explained that you are a European rather than a European Union organisation.

Professor Dame Janet Thornton: That is right.

The Chairman: And you have associate members as well as the 21 full members.

Professor Dame Janet Thornton: We have two associate members, Australia and Argentina. This is rather a new venture for EMBL. Of course, science is global, as you will be well aware, and certain countries like to associate with EMBL because of its infrastructure, the way it operates and performs world-class science, and because the countries like to learn how to operate an international infrastructure.

The Chairman: We will come back to that perhaps in the questioning. I can see already that Lord Ridley is keen to ask about that. We will move on with the introductions. Professor Deketelaere?

Professor Kurt Deketelaere: My name is Kurt Deketelaere. I am a professor of European energy and environmental law at the University of Leuven in Belgium, but I am here today primarily in my other capacity as secretary-general of the League of European Research Universities, LERU. I will say a few words on LERU because I do not think you are all familiar with it. We are a group of 21 research-intensive universities spread over Europe. We are active in nine EU member states and Switzerland. We absolutely do not have the ambition to have members in every country of the EU, because, obviously, that would be a problem for the level of excellence that we demand of the membership, so, as a consequence of that, we are only active in nine member states and Switzerland. We are not funded by anybody else other than our own members. We refuse to receive any kind of funding whatsoever from the EU or the member states, because of course we want to stay independent and neutral.

Our main goal is to promote the interests of frontier research on a daily basis at the EU institutions, be it in Brussels, in Strasbourg, in Budapest or in other places where EU institutions are based. At the same time, we try to do the same thing at member-state level, because we see more and more that convincing national authorities, and in the first place Ministers of Finance, is an important element in the daily battle to defend frontier research. Next to that, LERU is also the main engine behind what is called the Global Council of Research-Intensive University Networks. That means that LERU has been teaming up with similar networks of universities worldwide, be it, for example, the Association of American Universities in the United States, the Group of Eight in Australia or the Russell Group here in the UK. It is clear, of course, that on an issue such as this, and on many other issues, we are

in close contact with the Russell Group in defending all kinds of positions where we clearly have similar interests. Obviously for an issue such as the one we have on the table today we also have close links with Universities UK and, if it comes down to figures, data and facts, it is clear that we would be happy to refer to the input into this inquiry by Universities UK, by the Russell Group and organisations such as the Royal Society.

Q2 The Chairman: As this is our first session, before I ask the first question I must declare my interests as a fellow of the Royal Society, a fellow of the Royal Society of Biology, and chairman of the Foundation for Science and Technology. You will recognise that our inquiry is about the relationship between EU membership and the effectiveness of science research and innovation in the United Kingdom. The questions today will be very much about the impact on UK research and innovation. Could I therefore ask a rather general question? To what extent is EU funding important to the UK science base? Does it contribute to vitality and productivity? Is it something that we should value?

Professor Steve Cowley: My career started in the United States where I went to do a PhD in the early 1980s. The US was very much on top of big science at that time and had great facilities. The funding in the US for big science was the envy of the world. In the years since the early 1980s, Europe has become the world leader in big science. More and more science is progressing towards big science. For example, if you look at the average number of authors on a paper, it is increasing with time. It is increasing because science is often done in large groups, in large collaborations—that is the way you get effective science. It requires large instruments, instruments in the billion dollar class—sorry, I should use euros. What has happened since the 1980s is that the infrastructures and the organisation in Europe have exceeded those of the US, and many of the great scientific instruments of our time, of the 21st century, are now in Europe. I cannot say that happened because of a particular political infrastructure, but the fact is it happened, and the advantage we now have, with access to the world's greatest scientific instruments, translates necessarily in the long run into greater growth, more jobs and greater innovation.

The Chairman: Could I come back to Professor Cowley before I ask Dame Janet whether she would like to add to that? In the evidence that you gave us earlier you explained how the nuclear fusion programme, by its very nature, has to be collaborative. The scale of expenditure and the scale of the research make it quite inconceivable that individual countries should try to play a significant role, although I think China is trying to do that as a lone operator. There is, of course, a programme in the United States—the National Ignition Facility—which has a rather different basis, and presumably it might have been possible, at one stage in our history, for us to have collaborated with America rather than Europe, if we were going to collaborate. Presumably, having gone so far with JET, and now ITER, it would be quite impracticable to change horses if we decided that the United States' facility was the one that was going to be the winner.

Professor Steve Cowley: At this point, the world's record fusion performance is at JET, on British soil. We have the greatest fusion capability in the world. That capability is supported largely by European money. I cannot answer the "what if" question as in "what would have happened if we had done this in the past." All I can say is the empirical fact is that we are world leading.

The Chairman: What I am saying is that whoever is going to be the winner—and presumably there will be a winner one day, and we are world leaders, as you say—we are committed to

the European one, which you say was the right decision, but, equally, there could have been a decision historically to have collaborated with America, but we did not take it.

Professor Steve Cowley: At the moment, of course, we are having the Americans coming to collaborate with us. They are coming to JET because we have the best facility. That still gives us the prime place. On the "what if" question, if we had done something in the past, at the moment we would not be in the lead. That is all I can say.

The Chairman: Dame Janet, did you want to add anything?

Professor Dame Janet Thornton: Yes, very much so. My experiences are rather similar to Professor Cowley's. I have always worked in the UK, which is different, but certainly when I started all my collaborations were with the US, and that was where I looked to for inspiration from the leading science and to form interactions. My very strong belief is that that has changed because of EU funding. As you will know, the EU funding that we receive for science is a very small fraction of science funding in the UK, at only about 3%. However, the impact that it has, in my opinion, is way more than that money would suggest, for a variety of reasons. It enables and encourages us to collaborate within Europe. I think that is very important. We are part of Europe, it is close, and, for many people in the UK, it is easier to go to the continent than it is to go up to Scotland, so we are natural geographical collaborators. It allows us a much stronger voice as part of the EU in the funding that we get. The UK leads in certain areas, and genomics is one of them. I would endorse strongly the mixed funding economy. The position of the UK in genomics came mainly through Wellcome Trust funding. However, with collaborations across Europe, I think we can look towards implementing it in genomic medicine. We cannot do that on our own, because it needs data for millions of people from across the world. We have the strength in Europe and the population, obviously, although whether the data in the health services are well organised remains to be seen. There is no doubt that the leaders of this are in Europe, and the US is now copying us in what we are trying to do.

Another reason why the UK benefits from European funding is that we speak English and, because we are excellent at science, we recruit many, many brilliant scientists from Europe to come and work in the UK, who want to learn English and be fluent in it, and they come, usually with either Marie Curie or postdoctoral funding, at their most creative time. That input of talent from Europe—and of course the UK is the second most successful country in getting competitive funding from the EU for research—has meant that the UK has been extremely successful in raising those funds from the ERC. I sit on the ERC Scientific Council and it is very clear that the UK has been very successful in winning those funds. These are the brightest and the best of the young science minds in Europe, and there is no doubt in my mind that the UK benefits disproportionately from recruiting those brilliant people.

Professor Kurt Deketelaere: I would add a few elements to that. As Dame Janet has indicated, if you look at the facts and the figures, it is clear that the UK is absolutely at the top of funding from the framework programmes of the EU, both from the seventh framework programme, which has ended, and from the new framework programme, Horizon 2020, which is in its third year of development. It is clear that the UK is in the lead. If you look at the figures from the ERC, as Dame Janet just mentioned, it is clear that the UK is the most successful country in winning ERC grants, be it starting grants or advanced grants, and things such as that. We have come to a position where EU funding has become what I would call an irreplaceable and increasingly important source of funding for UK research and

innovation. Some authors describe the European funding as a kind of eighth research council next to the seven that you have in the UK.

I know that very often in the past the argument has been made that the red tape which EU funding involves is way too much, and people are not interested in applying for EU funding because of it. With all modesty, I would say that through the lobbying that the Russell Group, Universities UK, LERU and other organisations have been doing over the past few years, certainly as regards Horizon 2020, this is no longer an argument to not participate in the framework programme. The red tape has been cut down very significantly and it is an ongoing process. It is clear the EU has made enormous progress over there, primarily through the lobbying and influence of organisations such as the Russell Group, Universities UK, LERU, and so on. It is important to be around the table, to be able to say what the problems are and what the solutions should be. Simplification, excellence and investment in research and innovation are going to become much more difficult if you are no longer around the table and no longer have a voice. Obviously, money is an important element in this whole discussion, but I would say that even the intangible elements and the fact, as was already said, that you have access through the EU—which is acting as a kind of vehicle, as a platform, having access to the best people, be it researchers or students, and to the best research infrastructures—to this funding and to collaborative projects have been very beneficial for the UK and, obviously, the rest of the EU has also benefited from UK involvement. It is clear that it is working in two ways.

Lord Maxton: Very briefly to Professor Cowley, because he said that there has been this change from the United States to Europe: is this down to a decline in US funding and the whole big science thing, or is it down to the fact that Europe has become more important?

Professor Steve Cowley: I do not think it is due to a decline in US funding. You can see that the US has commented on this. I used to write reports for the National Academy of Sciences in the States, and in those reports one of the things we pointed out was that as the scientific instruments get larger, the system of funding in the States, where the states compete for it, becomes more and more difficult to handle. The US should have one particle physics lab, but in fact it has five. In Europe, we have made those decisions rather well. It is impressive the way we have come together and coalesced on a series of large instruments that are world-leading. I think that is rather impressive as a political process.

Viscount Ridley: I have a point of clarification. Dame Janet, you said that there were 21 full members, plus Argentina and Australia as associate members. Are all 21 members members of the European Union?

Professor Dame Janet Thornton: No. Let me give an example.

Viscount Ridley: Switzerland and Norway, for example?

Professor Dame Janet Thornton: Switzerland and Norway are members. EMBL is separate from the EU.

Viscount Ridley: I realise that.

Professor Dame Janet Thornton: We are not run by the EU and, if we came out of the EU, the UK would still be part of EMBL.

Viscount Ridley: So is it right that all three institutions that you three represent have full non-EU members?

Professor Dame Janet Thornton: Yes.

Viscount Ridley: Because you have Switzerland and you have America.

Professor Dame Janet Thornton: Yes, that is right.

Viscount Ridley: And others presumably.

Professor Steve Cowley: We do not have America as a member, but we have Switzerland.

Lord Hennessy of Nympsfield: Could I follow up the red-tape question? A great weight of the written evidence suggests that the British research councils are much more nimble even still, despite the changes you have been describing, than the European one, which is very encouraging. I was thinking the other day that it would be nice, if we stay in, to come up with something constructive in Europe instead of the usual drizzle of complaint, which has been the British stance in Europe. The shock value would be immense. Is this an area that we might develop so we can strike down the remaining chains that are holding back the European Research Council and all its associated bodies as a bit of a British initiative?

Professor Dame Janet Thornton: If I may comment, I think that the setting up of the European Research Council, which funds individuals to do excellent research, was driven in part by the UK as well as a few other nations, and that has been a tremendous success. However one of the reasons for the complexity of EU funding is that it supports collaborations between existing projects funded by the member states. EU funding is only 3% of the total research funding in the UK and most research in Europe is funded by the nation states. These EU grants serve to form the collaborative umbrella that joins together that nation state funding. When you are organising large projects, it is inevitably more complex than is the case for most of the UK grants that go through RCUK. I agree completely that RCUK is brilliant. Because of ELIXIR, I have visited many European countries. In comparison our research councils are excellent. The decision-making process in general is excellent, compared with many other countries, and we can really lead the way and bring Europe on. Many of the smaller countries are trying to learn and the UK can help in that. I think that we can have a positive effect. Certainly I would vote for smaller projects being funded by the EU that were more directed. I think that would have a big impact in Europe.

Lord Peston: I would like to ask a question of Professor Cowley, and I speak, as he is, as a Princeton alumnus. He was talking about big science. By implication, is there also a subject called small science?

Professor Steve Cowley: Yes.

Lord Peston: That does not require vast funding or anything like that, but it does still go on, does it not?

Professor Steve Cowley: Yes.

Lord Peston: So we must have a perspective here.

Professor Steve Cowley: Yes. I was trying to make the point that there is more and more big science. If you look at the average number of authors on a paper, it is an increasing function of time.

Lord Peston: The other day I saw a piece in some book saying that a recent paper had 1,000 authors. I found that amazing.

Professor Steve Cowley: I am sure they all did significant work.

Lord Peston: Maybe they simply put their names at the end, but that is by the way. What I am interested in is what the driver is here. Is it the equipment that is driving the whole system—namely, the funding is for the equipment, and, if you have the state-of-the-art equipment, then you attract the people—or is it the people who enable you to get the equipment? What is the causation?

Professor Steve Cowley: That is interesting. You say 1,000 people, but, in order to run that experiment all those 1,000 people have to do their jobs and their jobs are all high level. At CERN, the people who analyse the data, the people who run the detectors, et cetera, all appear on that paper because big science is not only about the money for the equipment; it is about the money for the set of skills necessary to take the data and process it to the point at which it is useful. You see this in biology, too. The groups become larger because you need people who analyse and who have a certain set of skills, and some computer scientists and some electrical engineers. At Culham, to run JET, we have 350 engineers. They do not all get their names on the paper, but without them it would not work.

Q3 Lord Hunt of Chesterton: I am in a minority among British scientists, but I was involved in EU projects, and the so-called bureaucracy meant that the way the EU ran the research was much more effective, in my area, in evaluating what was done in a project. That is very poorly done in the UK; if someone publishes a paper, off you go. The EU system is considerably more considered. Are you not throwing the baby out with the bath water if you start becoming as slick as the Brits?

Professor Kurt Deketelaere: That is a good point. I would say if you look at EU funding you really have to make a distinction between the ERC grants, for example, where the administrative burden is certainly not more than that which you experience here in the UK, and is perhaps even less, I would say. For the collaborative projects, to which Dame Janet has also already referred, perhaps the administrative burden can be a bit bigger, but certainly the outcomes and the added value of those big collaborative projects justify that. You have to be aware of the fact that the most important change in EU-funded research over the past five years is probably this enormous drive towards simplification. For groups such as mine and the Russell Group, simplification was the first demand when we negotiated Horizon 2020. Money was the second most important element. Simplification, and making sure that our people do not have to spend months and months before they can introduce an application for funding, has been very successful, and there is a clear commitment from the European Commission in the following years to simplify further the whole process. As you correctly say, the whole evaluation programme and evaluation of outputs of research done is really top of the agenda.

Lord Hunt of Chesterton: What you have done in the EU is to encourage networks such as your one, EMBL, and so on. In my own experience, that has not been very forthcoming from the UK, and we are now trying to catch up, it seems to me. The EU has been tremendous and the Americans are quite envious of that, from my experience.

Professor Dame Janet Thornton: The Americans are now copying us. We introduced ELIXIR and they have introduced a similar programme in the last two years to try to mimic this collaboration across Europe.

Professor Kurt Deketelaere: It is clear that EU funding has always been aimed at two essential elements of fantastic research, and those are international collaboration and

researcher mobility, combined with the overall element of excellence, of course. It is clear that if you lose that element of access to international collaboration and access to mobility of people, that would be a significant loss.

Q4 Baroness Manningham-Buller: I declare an interest as chair of the Wellcome Trust. Could I come back to the infrastructure point on which you have already said a certain amount? I am interested, as are others on the Committee, in the way we have run ahead of the Americans, which is partly due to pork-barrel politics and partly of course due to access to National Health Service data, which they do not have. Let us think across the range of EU infrastructure, whether it is CERN, whether it is EMA, whether it is Heidelberg or whatever; is access to that denied? I think the answer to that is no, but is access to any of those key parts of the infrastructure denied to people who are not members of the EU? Are there any parts of infrastructure which are EU-specific and, if you are not a member of the EU, are the barriers to getting access, say at CERN, harder than if you are? There are two points there: is there no access at all; and, if you are allowed access, are the barriers higher, or are those barriers overcome by a recognition of the need for the data and the science and the global nature of science?

Professor Steve Cowley: I can tell you about my facility. We are a £60-million-a-year facility. We are negotiating with international partners for them to put cash into the facility to have access. We do not give them access unless they put something into the facility. At the moment, we are talking with China about it bringing in some microwave equipment, and that will be a few tens of millions of investment, for which it will get some access to the next set of fusion power shots. I think that is common, but I do not think there is a principle here.

Professor Kurt Deketelaere: The crucial element in this whole discussion is the question of preferential access or non-preferential access. It is clear that if you are part of the EU game you are with those which have preferential access. If you are not, then, obviously, with all those infrastructures, you enter into a situation of negotiation, just as you negotiate international treaties in fact, and then you will have to see first of all, as is indicated, how much cash you need to put on the table and to what extent this can lead to preferential access or not. As a consequence of that, it is clear that if you are an EU member state, you certainly have an advantage compared to a non-EU member state.

Professor Steve Cowley: Can I come back on that? Where the science gets closer to market, then access becomes harder and harder for people outside the EU. One of the reasons for trying to encourage collaborations in the EU is to make sure those innovations that the science produces come home and they do not go elsewhere in the world. With particle physics and CERN, the innovations from that research are not immediately apparent, but they are apparent when you are talking about research that is closer to the market. We have seen, particularly on pieces of technology, for instance, that the EU has told us it does not want any foreigners to have access to particular parts of its technology.

Baroness Manningham-Buller: Do you think those broad principles apply to the other pieces of infrastructure?

Professor Dame Janet Thornton: We have to distinguish between two things here. In science, as you all know, knowledge is our goal, if you like. Knowledge is usually freely available to everybody in the life sciences area. Within EMBL, our two associate member states, essentially, pay a third of what they would pay if they were full members, and for that

they have access, which is equal access, but they are much further away, and so they do not actually use the facilities as much as the Europeans would.

As we all know, biomedical data are an evolving world. The story of the genome and genomic status is a fantastic one, in the sense of making it available for everyone. Health data are a different matter. It is not resolved yet how we are going to share all those data and whether we should share them only within Europe. What is clear to me is if we are trying as a country, the UK, to negotiate with Europe—and the Nordic countries and the Netherlands are very good in this area and their equivalent to NHS data are very well organised—we want to collaborate with them, because they have these data. Together we can increase the power of our own data. If we are going to try to collaborate with 21 European member states and negotiate how we do it with every one individually to share biomedical data, that is going to take a long, long time to achieve. The European Union provides us with an umbrella where those discussions can take place—hopefully transparently—so that we can begin to develop the data exchange infrastructure. The technical standards are easy by comparison; it is the legal exchange of data that is complicated. We have access to the XFEL data in Germany, for which we pay, and we can send our scientists there. Clearly, that is cutting-edge. It cost billions and we would not have done it in the UK, but, because we are part of Europe, we can have access to it.

Q5 Lord Cameron of Dillington: We heard last week, or maybe the week before, that it was felt that European funding has increased greatly the collaboration of UK science generally and not only within the EU. How do collaborations differ with a scientist from an EU member state and, say, a scientist from the USA, or maybe a scientist from the UK and a scientist from Switzerland, which is outside the EU as such? Is there any difference at all between the sorts of collaboration you see?

Professor Dame Janet Thornton: To me, as a scientist, there is no difference. Scientists are scientists and it does not matter where they come from; they collaborate. The only difference is access to joint funding. Funding mechanisms drive science. I have seen it so many times, in many examples. Within Europe, collaborations usually start off informally. You will speak to somebody and say, “Oh that would be good. We could do this together and perhaps we can join forces on this”. Then you have the ability to apply for EU funding—and this is rather a crude term—to grease the wheels of the collaboration. Most of that science will be funded by the member states, in the UK, or in Germany, if it is with Germany, but having that collaboration makes a huge difference. As we have seen in ELIXIR, where the UK leads on biological and molecular data, having access to European funding is a great driver in bringing countries together.

Lord Cameron of Dillington: Does that apply to industrial collaboration as well?

Professor Dame Janet Thornton: The Innovative Medicines Initiative has helped with that. There are some bureaucratic issues that are being resolved as we are going forward. Of course, all the big international pharma companies operate across the world. There are very few mechanisms whereby one can raise funds to interact with, say, an American group. There is the Human Frontier Science Program, but almost nothing else. In fact, my collaborations with the US have always been funded by the US. EBI receives a lot of money from the US. It is our second biggest funder after the EU. It pays because it wants the access to the infrastructure that we provide.

Professor Kurt Deketelaere: In my view, the main difference is that if you work with somebody from an EU member state, there is across the board, for all 28 member states, a clear framework—legally, financially and content-wise—to work with people. If you look at the ERC or Marie Curie or Horizon 2020, all those initiatives are organised in a way that is applicable for everybody across the board. If somebody comes to my institution with an ERC grant, then I know the conditions under which this person is going to work. It is the same for a Marie Curie fellow. If you look at Horizon 2020, there is on the table, from the side of the European Commission, a model grant agreement which has to be used by everybody who is getting Horizon 2020 funding. The rules of the game are very clear for everybody involved in it. Obviously, if you go and work with people from other countries, other non-EU member countries or other funding sources, then each time you will have to regulate those things bilaterally, and this is going to become very burdensome at a certain point in time.

This model grant agreement makes it possible for the European Commission and the member states to be sure that the basic rules of the game are the same for everybody. For example, in the case of research integrity we have seen many disputes in Europe, but recently, the European Commission, in consultation with the member states, and inspired by the UK concordat on research integrity, has stepped up the rules on research integrity for everybody EU-wide in the 28 member states merely by changing this model grant agreement. It makes the rules of the game very easy and very predictable.

Q6 Viscount Ridley: I should declare my interests as president of the International Centre for Life in Newcastle, fellow of the Academy of Medical Sciences and vice-president of the Conservatives for Britain, as well as being a farmer. I want to take up the point about opportunity costs, because it is clear that if you are in, say, Horizon 2020 you have to collaborate with an institution in another EU country. To some extent that must mean that Professor X, who is thinking, “Who should I collaborate with?” might say, “Oh, I want a Horizon 2020 grant so I will collaborate with somebody in the European Union rather than somebody outside the European Union”. He might do both, but, if he has a choice, he would end up doing that. Does that mean that it is possible that this is causing people to collaborate with lesser institutions rather than choosing the best in the world? Is that not leading to, say, Indian, Chinese or American collaborators being, to some extent, left out of collaborative research projects?

Professor Kurt Deketelaere: I would say it is just the opposite, in the sense that one of the key elements of Horizon 2020 is international collaboration and opening up to the world is one of the leitmotifs of the European Commission now in research and innovation policy. Of course, you need the necessary number of EU institutions in your proposal.

Viscount Ridley: But there is no need for ones outside the EU.

Professor Kurt Deketelaere: You will see your chances of success increase if you bring in other partners. Very often it is easy to do that if those other partners are not taking part of the financial budget, because they are funded by their own country, such as the United States, Australia or other countries worldwide. We see in those non-EU countries that there is a huge interest in participating in Horizon 2020, and we see all kinds of American, Australian and Chinese institutions coming to European institutions and saying, “Can we team up with you?” Very often in my group, for example, we have the luxury of picking the best non-EU institutions in a team for a proposal under Horizon 2020.

Viscount Ridley: How do you know that that opportunity would not be even stronger if it were not for the requirement to collaborate within the EU?

Professor Kurt Deketelaere: I can only say that if Horizon 2020 was not there, as the framework programme created by the EU and its 28 member states, then probably there would not be such a huge non-EU interest in this programme, which is of course the biggest worldwide-funded programme for research and innovation.

Lord Hennessy of Nympsfield: I should have declared my fellowship of the British Academy when I asked questions earlier. There are many ingredients that go into the capacity of our country, the UK, to think above its weight in the world. However, it seems very difficult, following up Viscount Ridley's point, to calibrate the EU element in thinking above our weight in the world. It is very hard at the best of times because a great, swirling mixture of things goes into successful outcomes. Could you put a weighting on it? How important is the EU collaboration element to our wider capacity in the world as a thinking power?

Professor Steve Cowley: What makes us able to collaborate with the greatest scientists from around the world is the quality of our research and our research infrastructures. We have US scientists battering down our doors, because they want to work on our machine because it goes to much more extreme conditions. We have American scientists wanting to work with people in our area because we have the best numerical algorithms for simulating the behaviour of very hot plasmas. That is why we get good scientists to work with us. There is no question but that the European infrastructures have made us better and, by making us better, they make us collaborate with more people in the world.

Lord Hennessy of Nympsfield: So it is a very powerful and big factor.

Professor Steve Cowley: Yes.

Lord Hennessy of Nympsfield: Despite being only the 3% that Dame Janet was talking about.

Professor Dame Janet Thornton: I think it is, because where the UK leads in certain areas, we speak, effectively, for Europe. As we all know, the world is changing and the UK's position in the world has changed a lot over the last 50 years. The emergence of China and India as scientific powers, China in particular, is also causing change. They regard Europe as a balance against the US. There is no doubt about that. If we speak for Europe, I think we are much stronger than if we are only speaking for the UK. That is not to denigrate the UK, because we lead, with Germany, in the science areas where we are very strong, but being able to speak for Europe makes a difference. In fact, we were discussing before we came in that if we left the EU we have no doubt that there will be retribution. The gossips ask, "Is the UK coming out of Europe?", and in these discussions it is clear that there is a lot of antagonism if that should happen.

Lord Hennessy of Nympsfield: Retribution is a strong word.

Professor Dame Janet Thornton: I know.

Viscount Ridley: I want to pick up on that. You say that you speak for Europe, but do you mean Europe or the European Union, because, as you said, all three of you have non-EU members in your institutions? The UK, similar to Switzerland and Norway, would still be a very powerful voice for Europe as a continent.

Professor Dame Janet Thornton: If we were not part of the EU, I do not think we would be allowed to speak for Europe in the same way as we do now. For example, we have led

ELIXIR. The UK Government have been strongly supportive of that. I do not think that would have happened if we were not part of the EU. We would not have the influence to decide and to drive the priorities in the fundamental challenges within Europe.

Lord Maxton: Why not, given that Professor Cowley said that we have our seat at this table because of the strength of our scientific institutions and scientific abilities?

Professor Dame Janet Thornton: That would be true if everybody was perfect, but, as we know, people are not perfect and will not always react in the way that we would like them to.

Lord Maxton: Would this last? If we withdrew from Europe, would it continue for more than a couple of years and then would the scientific strength of the UK come through?

Professor Dame Janet Thornton: I think personally it would be a lot more than a couple of years, and we would lose so much influence.

Professor Kurt Deketelaere: Depending on the scenario on the table, what is leaving? Would the UK be in the situation of an associate country? Would it be something similar to Norway? Would it be bilateral? The point is in each of those cases, unless you go for a complete decoupling of the UK from the EU or Europe, whether you are an associate or a European Economic Area bilateral, none the less, you will always be bound by all the rules of the game in science, innovation and technology that are applicable in the EU28, and even beyond the EU28, with associate countries and the EEA and things such as that.

As a country, you are now in this fantastic position where everybody is looking up to you as being the leader for science and technology in Europe and you are able to determine what is on the agenda. Very often you are able to determine the final policy and contribute to the political analysis of a number of issues. At a certain moment in time, you would decide you were going to throw everything away, and throwing everything away by choosing to be an associate member or to be part of the Economic European Area will not liberate you, will not free you from what the EU is now doing in science and technology. If you leave, perhaps it will become worse. A lot of countries have already learned, of course, what you have been learning with those other member states. You will lose any kind of influence on the whole policy and budget, and you will have to abide by the rules if you still want, in one or another way, to play in that game.

Professor Steve Cowley: There is a great deal of difference between things in the area of science, where it is very international and all knowledge is shared, et cetera, and when you move over towards that boundary that we have been trying to develop in the UK, with things such as Innovate UK, which is how to translate our scientific excellence into growth, jobs and innovation in small companies, et cetera. The EU is not going to allow the kind of research that is adjacent to those small companies to go outside the EU. You can see that very strongly in the programmes in Horizon 2020, where they are looking at innovation. The point of that research is to do the research in the EU and bring home the benefits to the EU as much as possible. I do not think it is likely it will share that with everybody.

Q7 Lord Peston: I have just about understood that big science means big bucks or, rather, to change the cliché, enormous euros, since we might as well have our own European cliché. I want to ask about the freedom of movement within the EU of students and early career researchers, one of whom may be the next Enrico Fermi or the next Max Planck, and so on. Can you relate that to what you do in this area? Is there a problem, which we have found in

another inquiry we did, with students coming here because it gets mixed up with the immigrant problem? The Government defines students as part of the immigrant numbers, even though the overwhelming majority of them have no intention of emigrating here; they only want to work here until it is time to go elsewhere. Can you clarify that for us?

Professor Steve Cowley: It is hugely important. It is similar to the Jesuits: if you get somebody to collaborate with you early in their career in science then you have them collaborating with you for the rest of their career—and not only collaborating but feeling very strongly that they want to enhance your scientific infrastructure. Having the best and the brightest from around Europe come to UK universities and study here makes an instant set of collaborations that will last for 50 or 60 years. You can see it. It is an empirical fact that this is a way in which we make some of our very best collaborations and attract some of the very best people, who actually stay here. Hermann Hauser studied physics at Cambridge.

Lord Peston: To go back to my earlier question, because I am not clear about it, are they coming here because they want to work with the best equipment or because they want to work with the best scientists, or is it both?

Professor Dame Janet Thornton: Absolutely both.

Professor Kurt Deketelaere: It is clear you attract a lot of good people—students and researchers—because you have fantastic institutions over here. The question is how many of those people you will lose if you lose this absolute EU benefit of free movement of people. If those students and researchers are subject to the same rules as non-EU students or researchers coming into the UK now, then of course it is very likely that you will lose a significant number of those people because of financial reasons, political reasons, all kinds of red-tape reasons, and people will look for other locations to work and to study. EU students would have to pay similar tuition fees to non-EU students, to mention one example. Of course, the EU offers you an absolute vehicle and tool for free movement of people for its citizens, students and researchers, but once that is no longer applicable, of course you will still get fantastic people; the whole question is whether you are going to lose a number of them, which seemingly were the right people to get.

Lord Peston: To go back to an earlier question, the Brexit question cannot be ignored here. If we were to actually leave the EU, then this freedom of movement would disappear and it would go like that: bang.

Professor Kurt Deketelaere: Look at what happened in Switzerland. It said the freedom of movement rule was not applicable there any more so it had to invent a Swiss ERC funded by itself, it had to invent a Swiss Erasmus+ scheme, funded by itself, and, after a very short period of experience, it is already clear that a lot of people in the country are not moving any more. People are distrusting the vehicles that have been set up by the Swiss Government. Other countries are looking at those vehicles with a certain reluctance. To what extent is a Swiss ERC similar to an EU ERC? To what extent can a university in the EU28 accept Swiss Erasmus+ students? At the end of the day, are they getting equal degrees and going to pay the same? It is issues such as those. This has been a major surprise for Switzerland as an outcome of its own referendum, that suddenly all those things are no longer possible. If you could see the enormous diplomatic efforts it made after the referendum to ensure it could play again in pillar 1 of Horizon 2020, because for it the ERC is absolutely crucial, that illustrates how problematic this is.

Q8 Lord Kakkar: I should declare my interests as a professor of surgery at University College London, chairman of UCL Partners, and UK Business Ambassador for Healthcare and Life Sciences. I would like to turn to the question of the balance of regulatory power between the EU and the UK. Do you think that the balance is correct in the area of biomedical research and scientific research more generally? Do you have examples where there are particular problems with regard to regulation at a European level impacting research activity in the United Kingdom, or indeed examples of where EU-directed regulation has worked particularly well for us? There are of course a number of examples: data protection regulation, regulation on the registration, evaluation and authorisation of chemicals, the deliberate release directive, importantly, the regulation on clinical trials, and the use of animals for scientific purposes, to mention some.

Professor Kurt Deketelaere: As a lawyer, I can perhaps comment on that because this is one of my pet topics. If you look at the treaty on the functioning of the European Union, it makes possible much more EU action in the field of research and innovation than the EU is taking. In a sense, the treaty is foreseeing a basis for the EU framework programme, for the European research area and for research infrastructures. On the basis of the treaty, the EU could do much more, for example, in proposing and adopting legislation in the field of science and technology, but it does not; it is very reluctant to do that because most of the member states are not demanding parties for that. Very often I see that my own rectors are not the demanding party for new EU rules in our field. It is clear that the UK—and many other member states—has been very successful in pushing back the EU and in using the legislative powers that it has in the field of science and technology. Obviously, you are right that there are a number of problematic EU initiatives for science and technology. To be clear, it is not only the UK which is opposing a number of those initiatives. All 28 member states are opposing a number of initiatives of the Commission, and very often initiatives which are made even worse afterwards by the intervention of the European Parliament. Using the example you gave on data protection, it was clear to us as universities that the proposal of the European Commission was still workable. It was only after it went through the European Parliament that it became completely unusable and has resulted in blocking medical, social science and humanities research. A final compromise will probably be made today on that regulation in Brussels. All of us, and not only the UK, have been pushing back on that. That is a very clear example.

If I take another example where there has been a positive influence, that of research infrastructure, about which we have been speaking, if you look at the ERIC regulation that the European Union has adopted, which makes it possible to negotiate to organise in a legal way consortia for the building up of research infrastructure, this has been a very beneficial initiative. If you look at the animal directive that was mentioned, it is clear that in this country the use of animals for scientific research has been a fantastically problematic issue. I am sure that the animal directive that the EU has adopted has helped to solve the situation in the UK. The EU says that animal research is still possible and necessary. We have the 3Rs approach, but medical research still needs animals to a certain extent. The fact that the EU did not give in to the European Citizens' Initiative calling for the abolition of this animal directive is a clear indication that the EU can be beneficial. We all hope that the upcoming copyright revision is also going to be very beneficial for all of us, creating a level playing field throughout the EU on text and data mining, on copyright and on open access.

A final example, which is also very beneficial for the UK and other member states, is the legislation on patenting, where we have now created an EU-wide system of patenting, unlike in the past where we had 28 different schemes. All in all, I must say the EU has been reluctant to use its legislative power in this field. In a number of cases where it has done so, it has been very beneficial to all of us. In a number of cases it has been problematic, and we must push back. It is clear that if you push back you can be successful. I would say the fact that there are a number of problematic ones is certainly not a reason to leave. It is merely a question of pushing back harder.

Lord Kakkar: Listening to your very full answer, it seems counterintuitive that 28 member states can be opposed to a particular form of regulation, as in this case regarding data protection and its impact on biomedical research for instance, and there is still the risk that this scientific view that the regulation is damaging to the ability to take forward research, and therefore it is in the interests of all European citizens, can be overruled by other European institutions.

Professor Kurt Deketelaere: The problem there is not an EU problem. The problem is the people that all of us send to the European Parliament. To be correct, it is those people who really made a mess of the data protection regulation in the European Parliament. As I said, the proposal made by the European Commission was still acceptable and workable for us as universities and research institutes. It went completely wrong when a number of people in the European Parliament—in a very maniacal way, I must say, because of this discussion with the United States on privacy—came up with all kinds of amendments changing the text and introducing all kinds of obstacles to research. Obviously, at the end of the day the lesson is that perhaps we have to elect better people to send to Brussels and to Strasbourg. In that case, the problem was not in the European Commission.

Lord Kakkar: Let me turn to one other regulation, which is the regulation relating to clinical trials. I repeat my particular interest as an active biomedical clinical researcher. It has been suggested that the clinical trials regulations have resulted in Europe generally becoming much less competitive in undertaking clinical research. That is a different example from the one of data protection. How can it be that those regulations, which I understand also have caused considerable anxiety among European clinical researchers, have had such a detrimental impact?

Professor Kurt Deketelaere: I would say it is the same problem there, and it concerns the European decision-making process. The European Commission comes up with a proposal. The Parliament has no right of initiative at EU level, so every proposal that comes up comes from the European Commission, which in the case of the clinical trials directive was also an acceptable one. This is then consulted on in the European Parliament with all the different committees that are able to have a say on that, and very often it goes wrong. To mention another example of copyright and text and data mining, to our surprise, the opposition there is not coming from people in the Commission; the opposition is coming, for example, from the European People's Party in the European Parliament saying, "Okay, universities cannot be exempt from copyright and text data-mining rules. They must buy additional licences". I am very surprised that the biggest party in the European Parliament is coming up with this kind of rule.

Of course, at the end of the day, the Parliament is able to take a specific position and a text can only be adopted at EU level if the Parliament agrees with the Council. However, the

Council is also an institution which is run by the member states. It is our own Ministers who are sitting in the Council rather than members of the European Commission. At the end of the day, the European Commission is not officially involved any more in any compromise that has to be made. Of course, behind the scenes it does its utmost to ensure that what comes out at the end of the day is acceptable. We have two problems. For us, as a lobby organisation, our daily business is making sure that the Members of the Parliament stay on the right track and making sure that our own Ministers who we send to Brussels stay in line with what is important for the European universities when they have to approve something.

Lord Kakkar: To summarise this, the threat from regulation, if it is right to describe it as a threat, is not so much overutilisation of regulation, or, indeed, the initial proposals for regulation, but the way that the European Parliament sometimes deals with it on a less than well-informed basis which might therefore stifle research opportunities in Europe.

Professor Kurt Deketelaere: That is absolutely clear and the cases you have mentioned are very nice illustrations of that.

The Chairman: I am sorry that we have run out of time on this session. I apologise particularly to Lord Hunt, who I know had a question in mind, but I hope he will have the opportunity to ask the same question in the next session. I must be fair to those who are waiting patiently for the next session. Thank you, Professor Steve Cowley, Professor Kurt Deketelaere and Professor Dame Janet Thornton, for a very informative session this morning.

C-Tech Innovation Ltd – Written evidence (EUM0005)

C-Tech Innovation is a privately owned SME, and is one of the UK's most successful independent research, technology and innovation organisations taking part in EU funded programmes. C-Tech Innovation has participated in many European collaborative projects over the years, as a partner involved in RTD projects, and also as the project leader/co-ordinator. Our involvement and experience in EU projects goes back throughout the preceding Framework Programmes (4, 5, 6 and 7) and now into Horizon2020. The company was the highest ranked UK SME participant in FP7.

As a participant in RTD programmes we actively seek EU funding programmes and have benefitted greatly from the funding instruments that have been available for EU wide R&D collaboration. We have worked with many partner companies and organisations in multiple sectors across Europe.

We consider the involvement of innovative UK companies in European wide research projects to be highly beneficial to the UK and would offer some comments based on our experience in response to the questions posed by the Select Committee.

Funding
We believe, R&D funding application processes to be notably more difficult and carry a higher administrative burden in the EU than the UK. However in general the funding mechanisms for EU projects have worked well in the past programmes but there have been significant changes since the initiation of Horizon2020 which have impacted the participation of industry and SME companies in programme. Certainly, the 25% overhead that is now offered is very low and will discourage greater SME participation, particularly for SME's with high overheads (which are required for laboratory or manufacturing facilities etc.). Although it is possible for companies to claim some of their overheads by justification within the proposal as a direct cost to the project, this runs against the intention of simplifying the administration as intended by the EU. For example, where a company may have included the use of equipment and laboratory space as an overhead in FP7 these costs now need to be included into their direct costs. This is adding a greater burden of administration to SME's who will now need to apportion and keep records for those costs to the project.

Collaboration
There are many benefits to the EU-wide collaboration of industry and RTO organisations. Certainly, collaboration provides: greater access to new areas of science and technology across Europe (knowledge, equipment etc.); opportunities to work with leading EU organisations; routes to market and future exploitation of new products through established EU project networks (ensuring new innovations are more market focused and fit for purpose); access to IP for development purposes; access to funding to reduce risks (for SME and industry); greater capability to bridge the gap between early stage research and industrial demonstrators leading to pilot scale plant.

Collaboration with member states and associated states also provides greater access to partner networks through their respective National Contact Points. The EU also provides a

framework to encourage collaboration with non-EU states and researchers throughout the world who can also participate in Horizon 2020 projects (although they may not always be eligible for H2020 funding, EC Funding is available for some 130 developing states throughout the world). Collaboration with some specific industrialized states outside the EU have access to reciprocal (state) funding mechanisms (such as Mexico, Russia, Brazil, China, Canada, USA, Japan, South Africa, South Korea, and India) allowing them to take part in EC collaborative R&D programmes using their own grant funding schemes.

C-Tech has taken part in projects with organisations from Africa, Canada, USA and Australia amongst others outside EU collaborations and in these cases, EU membership has not been an inhibiting factor.

The free movement of people has considerable benefits for SME, RTO and industry in the UK. Specifically, C-Tech has benefited by hosting Marie Curie fellows and also other researchers from around the EU in various trans-national schemes, which has allowed us to recruit the best quality staff from other EU member states to complement our UK staff. This free movement allows people, especially young researchers, to gain greater experience in specialized areas of research in leading centres and provides them with valuable experience in an industrial environment. In addition this free movement also enables and promotes future networking opportunities and sharing of best practice. For example the UK Catapult Centre model is based on best practice learned from the German Fraunhofer Centres.

Regulation
In general, C-Tech considers regulation will be dictated by broader global standards being established. In order to be competitive on a world basis, ultimately, (UK) companies/researchers will need to comply with regulatory frameworks on a world-wide basis and not be limited by local regulations. Because such standards need to agreed and adopted at the global level, we believe that EU membership will be more positive because of the greater influence of the EU. UK participation and contribution to EU standards will therefore have greater influence on global standards.

Scientific Advice
Our view and experience is that there is a much stronger influence from other member states by large industry and RTOs to the scientific policy of Europe. This status allows greater influence from non-UK science organisations on future policy direction, technology focus and funding routes.

Having a greater influence in EC policy is a considerable advantage to organisations promoting UK focussed science & technology. Thus EU membership allows the UK to lobby for its own interests in areas of science policy, which if adopted give the UK greater influence in world science policy, because of the world influence of the EU block.

Additional comments regarding our experience of funding mechanisms and the EU and changes from FP7 to Horizon2020

- To prepare a full stage proposal is considerable cost burden for coordinators to bear. It can easily cost €40-70K (or more) to prepare a full stage proposal depending upon the size and complexity and it is estimated €2.5 to 3 billion of costs are being

wasted every year. That is equivalent to almost 20% of the entire Horizon2020 budget. This is an enormous “hidden” cost base that the EU has created for SME’s, Industry and academia who want to participate in EU programmes.

- Many high quality proposals remain unfunded for the sake of a few fractions of a point which pushes them below the funding threshold because only a small number of proposals can be funded from the available budget (often 1 or 2 projects per call topic).
- In FP7 the 60% flat rate option was available and was a widely used by a lot of SME’s RTO and Universities. At some point, this must have been calculated and agreed by the EC as a reasonable compromise to simplify the financial reporting and give a realistic rate – why was this not carried over and adopted into H2020?
- 70% innovation funding is too low for SME participation – should be commensurate with RTO funding (100% in all calls).
- In FP7 the calls were split between RTD, DEMO, MGT and Other with 75, 50, 100 and 100% reimbursement respectively. Funding levels are now fixed at one level for the call (R&I or I) in H2020 but this is not consistently applied and is often in conflict with the expected TRL level e.g. some calls have a significant research element, but are deemed innovation actions which attracts the lower funding rate (see also comment below).
- The emphasis on industrial leadership in H2020 is probably too strongly weighted at the moment (industry generally will not (does not want to) lead collaborative projects). Management of consortia is a time consuming administrative action offering no obvious benefits for industrial partners in most cases. If EU wants industry to lead the projects there has to be some concession on this otherwise most projects will be led (often poorly) by academia /RTOs. This makes a significant difference in the operating culture of projects. SMEs also run particular technical and commercial risks in projects and are still faced with the “valley of death” for technology at project end and/or suffer large company domination issues.
- H2020 needs more flexibility and longer term thinking for involvement of industry across Europe. The emphasis on industry leadership makes consortia building extremely difficult compared with FP7 – it takes considerable time and effort to find industry partners willing to commit resources and their internal decision making process to join EU programmes is very slow which can create significant risk.
- The NCPs need to be more visible to INDUSTRY. Can they do more work to improve the interest of small and large industry partners in H2020? Is their role consistent across the member states, i.e. does one in Spain do the same as their counterpart in UK? Universities and RTOs already have budgets and research offices etc. and organisations like UKRO to help them with their participation in seeking EU funding. Helping to match up SME’s with proposals would help enormously – often SME’s miss good opportunities to join proposals because they don’t have the visibility to look for the right proposals.
- In H2020, the competition field is much wider than FP7 and the grouping of call budgets makes it significantly more difficult to secure funding. You could have an excellent proposal not funded because a proposal in another group addressing another call may have a higher ranking and be funded leaving no budget for that call.
- Topics are now more specific and there is less chance that a similar call may come up, so a “good idea” may never get another chance.

- No (or very little) opportunity for follow on funding.
- Wider consultation with industry and SME's for future topics is needed. Participation appears to be limited (to select groups) and the process for selecting topics is not transparent. This results in call topics that are highly specific with narrow technology focus and will favour certain beneficiaries. This needs to be improved in order to provide scope for wider field of topics and opportunities and encourage greater participation of industry.
- Early stage research calls (e.g. FET open) till have a serious disconnect from Industry, and in the past has benefited from 'repeat' funding. There has to be a serious look at whether these calls actually enable development of ideas to the next stage or just end up funding an academic "research project" or something which is 'more of the same'. There are means to get funding for true early stage, fundamental research through national and international research funding organisations. H2020 should be looking for those projects that have more chance of making it to more advanced levels and leveraging those efforts.
- More help on new manufacturing process development would be beneficial – getting real interaction between academics and industry to help reduce the risks in building first to market manufacture or demo plant with realistic budgets across Europe.
- Significant reduction, simplification of proposal preparation is needed to reduce the cost burden for coordinators and participants.
- Significant simplification of implementation is needed – the current annotated guide for H2020 is <u>648 pages</u> which indicates the considerable admin. burden that can be associated with setting up, submitting and implementing a H2020 project.

6 November 2015

Diamond Light Source, the Royal Society of Chemistry and Professor Paul Boyle, University of Leicester – Oral evidence (QQ 9-24)

Transcript to be found under Professor Paul Boyle, University of Leicester

EEF, The Manufacturers' Organisation – Written evidence (EUM0006)

1. EEF, the manufacturers' organisation, is the voice of manufacturing in the UK. We are responding to this inquiry because science and innovation are central to manufacturers' strategies to compete and grow their businesses.

2. More broadly, some of the biggest policy challenges facing the UK economy at the moment are low productivity and a struggling export performance. Science and innovation will play an important part addressing these challenges, as well as creating opportunities for future growth, and helping the UK to overcome some of major socio-economic challenges it faces. Manufacturing is a significant contributor here, accounting for 69% of business expenditure on R&D.

3. While the manufacturing sector is highly innovative, manufacturers' investments in innovation are not always successful. Innovation is a resource-intensive activity and a lack of resources limits the amount of innovation companies are able to do. Support available through the EU – particularly EU framework programmes –provides a valuable complement to support provided in the UK. Not only does it enable access to additional funds, but it also facilitates international collaborations that would not happen without the framework programmes.

4. Although the research base has tended to outperform industry in accessing framework programmes, early signs from the latest Horizon 2020 programme point to improving levels of success amongst UK industrial applicants, particularly SMEs.

5. As well as the framework programmes, the EU's free movement of people is an important component in enabling international collaborations, which are highly valuable for manufacturers of all sizes.

What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

What is the scale of the financial contribution from the EU to UK science and research, and vice versa?

Collaboration is increasingly important for successful innovation in manufacturing

6. Innovation is a challenging process and in order to innovate successfully manufacturers requires access to a wide range of resources, including facilities, expertise and finance. However, these resources are finite, and 39% of manufacturers say that when innovating there are resources they would like to use, but they were unable to do so.[178]

[178] EEF Innovation Monitor 2015/16

7. Insufficient access to resources makes a considerable difference to manufacturers' ability to innovate successfully. In almost all cases, manufacturers report lower success rates when there were resources that they were unable to use.[179]

8. One way of addressing the challenges associated with innovation is to collaborate with others, this can particularly help with accessing facilities and expertise. For the manufacturing sector, collaboration is increasingly important, with 61% agreeing with the statement that "working with others is now more important for successful innovation than it was in the past".[180]

Manufacturers of all sizes engage in international collaborations

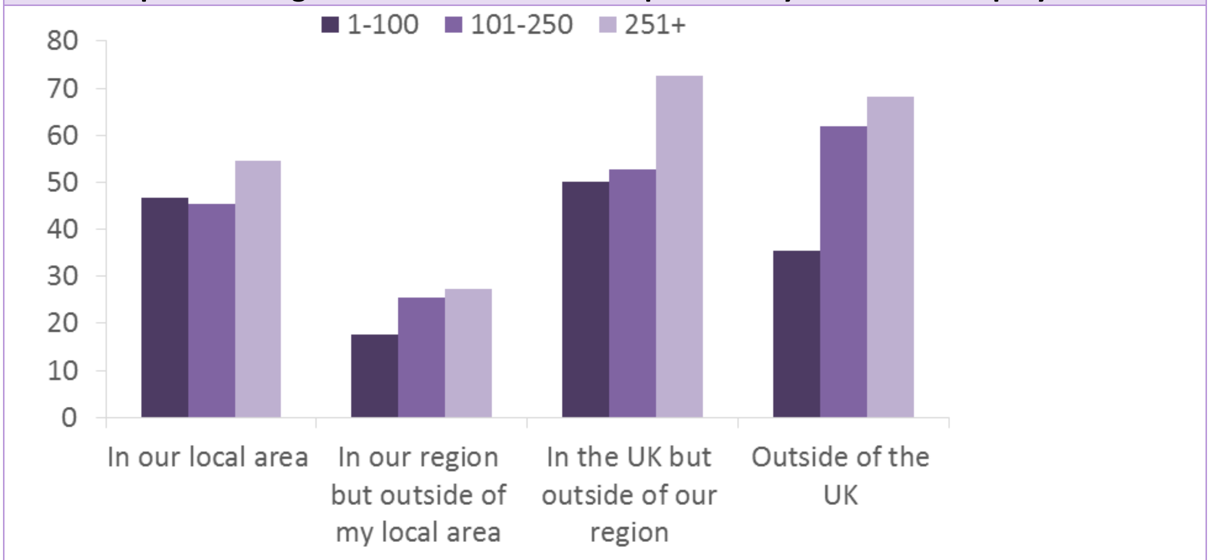
9. Manufacturers' collaborative relationships are not confined to national borders. Manufacturers most commonly collaborate with their customers, many of whom are located outside the UK.

10. One SME manufacturer told us that they have worked with partners outside the UK on a number of occasions. Their market is international so they felt it would not make sense to confine innovation to the UK alone. Both they and their partners have travelled to participate in the collaboration.

11. This SME is far from being an outlier. In our Innovation Monitor 2013 survey we found that half of manufacturers had collaborated with organisations outside of the UK. This was more common for medium and large companies, who were more likely to collaborate internationally than with companies in their local area. But even for companies with fewer than 100 employees, more than a third had engaged in overseas collaborations.

Chart: companies of all sizes engage in international collaborations.

% of companies citing location of collaborative partners by number of employees



Source: EEF Innovation Monitor 2013

[179] EEF Innovation Monitor 2015/16
[180] EEF Innovation Monitor 2013 and EEF Innovation Monitor 2014/15

Collaboration is challenging

12. Despite the prevalence and importance of collaborative relationships, manufacturers do raise concerns about their ability to partner effectively. The key problem cited by manufacturers is the ability to find the right organisation or individual to partner with.

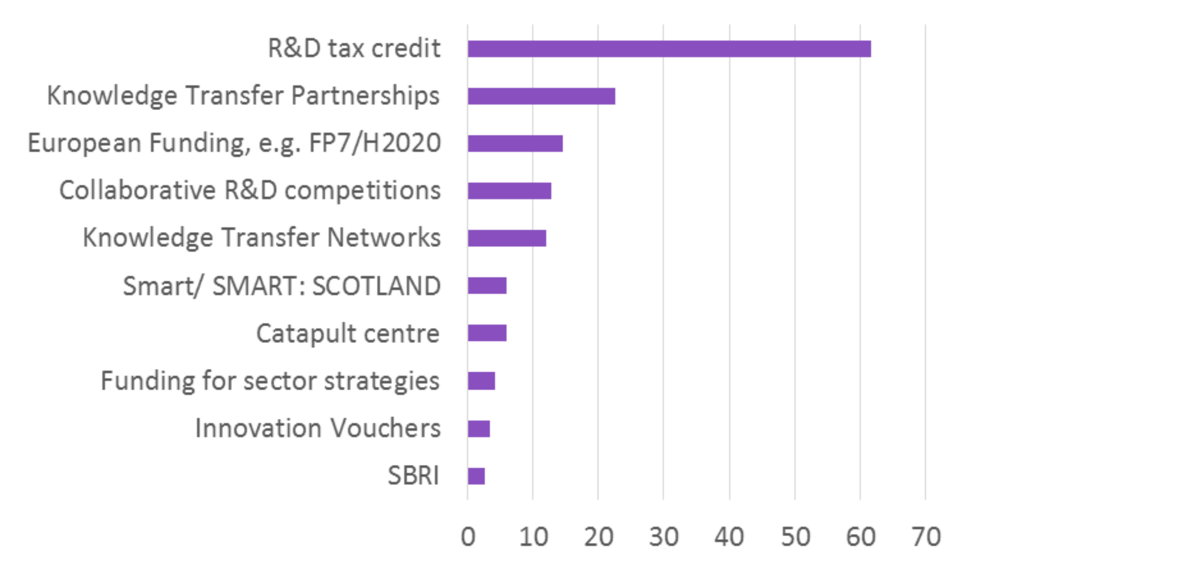
EU schemes play an important role facilitating international partnerships

13. For manufacturers, European support can play a key role in enabling and facilitating international partnerships. For example, anecdotal feedback from SME manufacturers raised the fact that a number of EU funding schemes required an SME partner and this had encouraged larger international partners to reach out to SMEs.

14. Manufacturers therefore see EU Framework Programmes are an important part of the innovation support mix. Our Innovation Monitor 2015/16 survey showed that 16% of manufacturers used EU support for innovation, making this the third most used support mechanism after the R&D tax credit and Knowledge Transfer Partnerships.[181] In particular EEF members value EU support because it aids overseas collaboration and can help companies to access new customers. It also presents an additional source of funds, on top of national support.

Chart: EU support is an important complement to UK schemes

% of companies saying they had used support schemes



Source: EEF Innovation Monitor 2015/16

Industry is receiving an increasing level of funds from European Framework Programmes

[181] EEF Innovation Monitor 2015/16

15. The UK has tended to do well out of European Framework Programmes. According to Technopolis the UK's share of FP funding has averaged 14.9%[182] making the UK the second-most successful country at receiving support. The latest Framework Programme, Horizon 2020 is worth €79bn meaning the UK stands to receive around €11bn from the scheme over its duration. Indeed, initial reports show the UK has so far received around 15% of total funds.[183]

16. In previous Framework Programmes, UK universities have tended to outperform industry in terms of participation in funding applications and receipt of funding. But the picture for UK business is not a negative one, for example, according to the commission, UK SMEs' applicant success rate in FP7 was higher than the EU 28 average (22% compared with 20%).[184]

17. Early signs from H2020 suggest that businesses are doing better as well. The programme is deliberately more geared towards industry, and this is paying off. The proportion of funding going to the private sector has increased from 24% to about 28%. A large share of this has gone to SMEs.[185] In particular, the new SME instrument is benefiting smaller UK companies. As of June 2015, UK companies were set to receive €18.6mn from the Horizon 2020 dedicated SME instrument. At 15% of the total funds, UK companies have been amongst the most successful participants.

What contribution does EU membership make to the quality of UK science and research through the free movement of people?

Skills shortages are an issue for manufacturers in a number of areas, including innovation

18. Our skills survey[186] revealed that for three-quarters of manufacturers, finding employees with the right skills was one of their key business concerns and almost half said it was their main concern. Such concerns will be exacerbated in the coming years, as manufacturers expect demand for skills to increase at a time when an ageing workforce will result in high numbers of engineers retiring. To compete in global markets, manufacturers must continuously focus on developing new products, services and processes.

19. When it comes to developing these innovations, access to skills is a particular issue. Our latest Innovation Monitor survey shows that the key resources manufacturers would like to use – but are unable to do so – are employees with specialist skills and external expertise.

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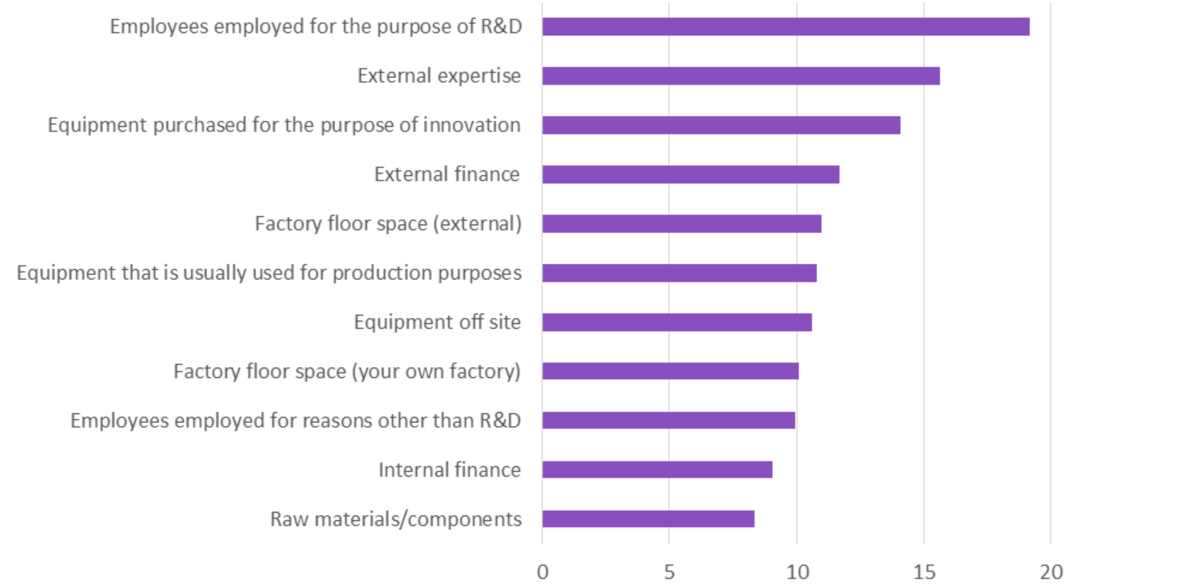
[182] https://ec.europa.eu/research/evaluations/pdf/archive/fp7-evidence-base/national_impact_studies/impact_of_the_eu_rtd_framework_programme_on_the_uk.pdf
[183] http://www.sciencebusiness.net/news/77103/Exclusive-Horizon-2020-success-rates-slide-towards-12-percent-
[184] https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf#view=fit&pagemode=none
[185] ibid
[186] EEF Skills Survey 2012

Chart: Access to external and specialist expertise key issues for innovation

% of manufacturers saying they would have liked to use resources for innovation but were not able to do so



Source: EEF Innovation Monitor 2015/16

Recruiting from the EU – whether directly or recruiting students – can help address skills shortages

20. Recruiting from overseas is one way that companies can overcome skills constraints. Our skills survey showed that almost a quarter of manufacturers recruit EU workers to bring in new skills into the workforce. The free movement of people will therefore play a key role in the future manufacturing.

21. The longer-term pipeline of skills also benefits from the free movement of people from the EU as 26% of EU migrants come to the UK to study. If there were restriction on EU students (ex UK), then this would reduce the number of engineering students to which manufacturers have easy access. Other subject degrees of concern would be Technologies Physical Sciences and Computer Sciences. Restrictions on students will undoubtedly impact on universities, in particular damaging the UK's reputation as a global leader in higher education.

22. Furthermore, if it becomes difficult for EU students to stay in the UK after completing their studies, this has potential implications beyond recruitment. For example, investors that might want to invest in the UK and then commercialise their research in the UK would be less likely to do so, and may take their innovative ideas elsewhere if they were not enable to recruit EU graduates, post-graduates and post-doctorates.

The UK's membership of the EU also supports international collaborations by enabling companies to post workers to member states

23. As well as benefiting from recruiting EU workers to their businesses, the free movement of persons also allows businesses to post workers to member states. This can have

benefits such as supporting knowledge transfer, collaborative partnerships and trade links. In addition, the free movement of persons allows for intra-company transfers within the EEA. This process would become far more complex, strict and time-consuming should the UK withdraw from the EU and employers would need to comply with the same conditions as when recruiting non-EEA workers, our concerns around which are discussed above.

24. UK businesses are able to support exports more effectively with UK workers based close to EU markets, or collaborate with partners in Europe to produce or promote new products. EEF members take for granted the ability to transfer employees with a company group, making the UK a more attractive venue for investment as a result, and any restriction upon this will damage the ability of UK-based manufacturers to compete equally with their European counterparts. Decisions which parent companies take upon where to invest, or which business units to restructure, will in part be based upon the ease with which workers can migrate. Even if the UK could secure a new settlement with the EU, this would be detrimental to UK businesses if the cost of compliance and administrative burdens were to increase.

Does EU membership inhibit collaborations with countries outside the EU?

25. We have had no feedback from members to suggest that EU membership inhibits other collaborations. Far from it, anecdotal evidence points to our members having a range of international collaborative relationships. For some a collaborative relationship in the EU can be even the launchpad for future collaborative relationships further afield.

About EEF

EEF, the manufacturers' organisation, is the representative voice of UK manufacturing, with offices in London, Brussels, every English region and Wales.

Collectively we represent 20,000 companies of all sizes, from start-ups to multinationals, across engineering, manufacturing, technology and the wider industrial sector. We directly represent over 5,000 businesses who are members of EEF. Everything we do – from providing essential business support and training to championing manufacturing industry in the UK and the EU – is designed to help British manufacturers compete, innovate and grow.

From HR and employment law, health and safety to environmental and productivity improvement, our advice, expertise and influence enables businesses to remain safe, compliant and future-focused. More information at www.eef.org.uk

12 November 2015

EEF–The Manufacturers' Organisation and Innovate UK – Oral evidence (QQ 77-89)

Transcript to be found under Innovate UK

Professor Tim Elliott, School of Earth Sciences University of Bristol – Written evidence (EUM0009)

I would like to contribute evidence, from my personal experience, as to the effectiveness and importance of ERC funding on fundamental UK science. Traditionally, many EU methods of funding have been fraught with rather complex applicaton and subsequent adminstration procedures. The more recent development of the ERC effectvely delivers significant amounts of money direct to researchers at critical times in their careers with relatively small adminstrative 'overhead'. I speak from my own experience in receiving an Advanced Grant which has allowed me to develop an entirely new analytical instrument (in a valuable collaboration with industry) and undertake adventurous, world-leading research. This would have been very difficult by other routes, UK research councils included. Within my Department (Earth Sciences, Univeristy of Bristol), I know of 5 others who have benefitted from ERC funding, which has had a dramatically positive effect on their research. In the current climate, winning an ERC award represents perhaps the most effective means to drive forward an ambitious research programme and is increasingly becoming a key underpining of cutting edge academic research.

16 November 2015

ELIXIR – Written evidence (EUM0036)

Statement

This submission represents the response of ELIXIR Europe, the pan-European research infrastructure for biological data. ELIXIR is the initiative to coordinate, sustain and integrate Europe's life science bioinformatics resources. Using a Hub and Nodes model, the central ELIXIR Hub supports the coordination of activities across partner organisations with services being run by ELIXIR Nodes throughout participating Member States. The following countries and EMBL are Members of ELIXIR: Belgium, Czech Republic, Denmark, Estonia, France, Finland, Israel, the Netherlands, Norway, Portugal, Switzerland, Sweden, Spain and the UK. An additional four countries are Observers: Italy, Ireland, Slovenia and Greece.

ELIXIR's legal basis is provided by the ELIXIR Consortium Agreement, which allows ELIXIR to use the legal personality of EMBL[187], an organisation backed by International Treaty. Two ELIXIR Nodes operate in the UK: EMBL-EBI[188] (as a European Node) and the ELIXIR UK Node[189]. The ELIXIR UK Node includes leading UK academic institutes and is currently supported through additional grants from BBSRC/MRC/NERC for bioinformatics infrastructure coordination and training. The UK, through the Large Facilities Capital Fund (LFCF), has also invested £75 million in EMBL-EBI as part of its contribution as host nation of ELIXIR. This has supported the off-site data storage requirements of EBI and the construction of the EBI South Building, which also houses the ELIXIR Hub secretariat.

ELIXIR's partners also access many major EC-funded research grants[190] including ELIXIR-EXCELERATE, BioMedBridges, CORBEL, EnvriPlus, AARC and EMBRIC. For the purposes of EU grant applications, the ELIXIR Hub and EMBL-EBI use the PIC Code of EMBL, which is classed as an 'International organisation' rather than a UK legal entity. The ELIXIR UK Node comprises UK legal entities and its partners are therefore classed as UK organisations within EU research programmes.

The submission has been developed in consultation with EMBL-EBI and the ELIXIR UK Node.

Funding

What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

The UK's strong academic base and openness to collaborate across Europe ensures that UK institutions receive a high return on participation in EU research and innovation programmes, perhaps more so than in any other policy area. The UK receives 13% of the

[187] www.embl.de
[188] www.ebi.ac.uk
[189] www.elixir-uk.org
[190] https://www.elixir-europe.org/about/eu-projects

total EU expenditure on R&D of €10.96bn. In 2013 it accounted for 23% of total funding received, well above the EU average of 8%. In absolute terms, the UK is second only to Germany in the cumulative volume of research grants received from the Framework Programmes[191]. Further, in proportion to its share of GDP and population, the UK is also second only to the Netherlands. In economic terms, the conclusion is clear: the UK is a major net beneficiary of EU research funding.

To ensure effective sustainability of bioinformatics resources, it is also important for bioinformatics resource operators to be able to access multiple funding streams, without over reliance on any one source. At a time of uncertainty over national science budgets and potential implications of the UK Spending Review, ensuring continued access to EU research funds should be of paramount importance.

What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

Official EUROSTAT data and reports on this subject suggest that in 2013, the UK contributed €14.51bn to the overall EU budget (inclusive of €3.8bn rebate), equating to 10.7% of the total EU expenditure of €134.6bn.[192] In the same year the UK received a total of €6.31bn (£5.36bn) in EU funding (4.7% of the total EU expenditure). Overall, the UK is a net contributor to the EU budget.

Of the total UK contribution to the EU in 2013, the actual contribution to the EU's R&D budget was €0.89bn. Yet of the total EU funding received by the UK in 2013, R&D funding accounted for €1.44bn (£1.22bn), showing that in R&D the UK is a major net beneficiary. It should be noted, however, the value to the UK of participation in EU research programmes goes far beyond return on investment in monetary terms. The additional benefits derived from close collaboration with partners are described further in the section Collaboration below.

What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

The process for applying to and managing EC research grants does differ from the rules and procedures that apply for other UK grant sources (such as Research Councils or charitable trusts). For bottom-up schemes and individual fellowships like the European Research Council and Marie Curie, the administrative burden is relatively light. However, for large trans-European and interdisciplinary proposals the processes are more complex. Whilst

[191] See FP7 Monitoring report, available at: https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf#view=fit&pagemode=none
[192] Source: EUROSTAT http://europa.eu/about-eu/basic-information/money/expenditure/index_en.htm

Horizon 2020 has seen the introduction of many improvements from previous programmes, continued simplification for applicants should always remain paramount.

Whilst all EC applications are peer reviewed, some differences remain between the EC and UK systems, particularly in terms of the time taken in reviewing the application, though this this has been reduced in Horizon 2020. Further strides could be taken to ensure that more feedback is provided to applicants following grant evaluation.

However, whilst improvements can and certainly should be made to the processes and rules of administering EU research grants, this does not detract from the clear message that continued UK engagement in EU research programmes is vital for the future competitiveness of the UK's science base and for the continued success of ELIXIR.

Collaboration

What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

In addition to the research funding brought into UK institutions (described in section 1 - funding), there are many real benefits that arise from European-wide collaboration which simply could not be replicated on the scale if the UK did not participate in EU research programmes.

Most big science projects now require trans-national collaboration. It is simply not possible for a single institution to have all of the necessary skills, expertise and facilities to carry out ground-breaking research alone in the life sciences. Major research projects and sequencing efforts are increasingly carried out by large consortia comprising teams across Europe and globally (ie Human Genome project, ENCODE, Pan-Cancer, stemBANCC, etc). This allows researchers to generate data from key populations, cohorts or geographic areas that they may otherwise not be able to access.

This helps the UK build links with academic and commercial partners from outside the UK, which is challenging to do on UK-funded grants. Much ground breaking research is now carried out at the interface of disciplines, where techniques from different fields are applied, or data from multiple sources are integrated and analysed. Again, this frequently requires trans-national collaboration with expertise from sites across Europe. The foundation of Europe's life science data infrastructure is based on open collaboration between partners and joint activities funded through multiple sources including EU grants. Withdrawal from the EU and its research programmes would seriously jeopardise the perceived openness of UK academia as a global partner on research projects.

Any attempt to negotiate entry and participation into research programmes upon leaving the UK would come with its own administrative burdens and likely require far more civil servants to negotiate entry into programmes or manage the additional grants. The example

of Switzerland[193] shows the potential impact of withdrawal from the EU that would be felt by the UK.

Table showing ERC grant awards by country [194]

	2011	2012	2013	2014
United Kingdom	122	141	65	68
Germany	63	78	43	69
France	57	83	30	48
Netherlands	49	46	29	39
Israel	23	26	33	28
Spain	27	25	12	22
Switzerland	23	37	22	2
Italy	27	28	8	16

The ERC is considered to be the gold standard European award for individual researchers in Europe. Switzerland has traditionally out performed in terms of country size. However, since the uncertainty over Swiss participation in Horizon 2020, its success for 2014 has fallen markedly.

In addition to a major drop in research funding awarded to Swiss academics, federal government agencies have had to create new programmes and administrative schemes[195] to compensate Swiss academics and the administrative cost in processing these is likely to be far higher than the overhead of participating in the EU research programmes where this is pooled between more countries.

What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

International countries (ie those outside the EU) often look to the European Commission as starting point for building collaboration with particular countries in Europe, and this has been proven to be helpful for ELIXIR directly. The G20 Group of Senior Officials (GSO) has produced a report highlighting ELIXIR as an example of a global research infrastructure[196]. The international effort around the GSO, and ELIXIR's role within it, has been supported enormously through close collaboration with the European Commission. In this forum, the European Commission acts as conduit between the G20 countries outside Europe and the

[193] Switzerland is currently only partially associated to the EU Framework Programmes and only until the end of 2016. This means that it can currently access some parts of Horizon 2020 as an associated country (for example ERC and MSCAs funding) but is considered a non-associated third country for other parts of the programme. This is due to recent restrictions Switzerland imposed on the free movement of people. Extension for the remainder of Horizon 2020 depends on Switzerland's ratification of the Protocol to the agreement on free movement concerning Croatia joining the EU.
[194] All data taken from: https://erc.europa.eu/projects-and-results/statistics
[195] http://www.sbfi.admin.ch/h2020/index.html?lang=en
[196] GSO report on Global Research Infrastructures: https://www.bmbf.de/files/G7_Broschuere_(3).pdf

European infrastructures, such as ELIXIR, with which the international countries would wish to join. This streamlines the process and makes managing international relations for ELIXIR far more manageable than it would otherwise be if the relations were only developed bilaterally.

The EU-funded ELIXIR-EXCELERATE grant will provide funding for ELIXIR to develop its International Strategy and to support the development of collaboration and dialogue with Ministries and scientific communities in key international countries. For an emerging infrastructure such as ELIXIR, building these collaborations without dedicated resource would be a challenge. Furthermore, the training and standards and interoperability activities developed within the project are also ensuring that ELIXIR's partners are recognized as setting the agenda globally.

How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

NA

How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

ELIXIR was recognized by the European Council and ESFRI as a priority Research Infrastructure for Europe[197], and has since been awarded a major Horizon 2020 grant in recognition of this. Being part of an international process that has been supported by the EC has ensured a level of visibility with EU member states and user communities that ELIXIR would not have otherwise been able to achieve.

What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

The UK's strong science base can be attributed to many factors, but people are critical. Having highly-skilled life scientists, computer scientists and developers in the UK is paramount to ensuring that the potential of open data on society and the economy can be realised. Of the UK's ten most recent Nobel laureates in the natural and social sciences, for example, five are foreign nationals working in the UK[198]. Indeed, foreign-born laureates in

[197] 'Conclusions on the implementation of the roadmap for the European Strategy Forum on Research Infrastructures' Competitiveness Council meeting Brussels, 26 May 2014: https://www.elixir-europe.org/system/files/142794.pdf
[198] Source: http://www.nobelprize.org/nobel_prizes/lists/all/

the UK, including Geim and Novoselov, have stated publicly the negative impact that restrictive immigration policies would have on UK scientific performance[199].

Within ELIXIR's EU grants, partners regularly recruit world-class talent from other EU countries to their organisations. Across the ELIXIR Hub, EMBL-EBI and the ELIXIR UK Node, a large proportion of staff, carrying out mission-critical work, are from EU Member States. ELIXIR Europe and the ELIXIR UK Node have a particular focus on training and any obstacles to the free movement of people would clearly be detrimental to the operations and success of ELIXIR.

The case of Switzerland again shows that an attempted renegotiation of the principles of free movement of people would severely restrict the UK's ability to attract, retain and fund the world-class scientists of other nationalities that currently make UK science base so strong.

Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

Scientific collaboration and immigration are separate issues, though they can be interlinked. Restricting the UK's ability to retain and attract top scientific talent from within and outside the EU would have disastrous long-term consequences for the UK science base. Restrictive immigration policies would therefore make collaboration through EU research projects more challenging, as the pool of talent available to carry out research would be diminished immensely; this would have dire long-term consequences for reasons described earlier.

However, collaboration between countries outside the EU can and is still undertaken at present. Indeed, participating in EU-wide collaborations with international countries can often be the most effective way of organising such efforts. On issues such as training, standards and interoperability, for example, global collaborations are frequently borne out of initial EU collaboration. ELIXIR does not consider that membership of EU has hindered in anyway the UK's ability to recruit leading talent from countries outside the EU. Rules around visas and quotas for nationals outside the EU are set by UK immigration policy, not the EU. Indeed, having to negotiate individual visa agreements with all EU countries in the event of a withdrawal from the EU would likely add additional cost to the UK government.

Regulation

What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

Science is one of the areas of EU legislation where competency sits with Member States[200]. This is the correct level of subsidiarity. Whilst there are some issues such as GMO and Data

[199] Nature Physics: http://www.nature.com/nphys/journal/v10/n12/full/nphys3195.html

[200] Chapter 2 of the Government Review of the balance of competences between the UK and EU – Research and Development.

Protection regulation where EU-level decisions can affect national policies, these instances are few and far between. The overriding principle is that each country sets its own research and science priorities, which are then fed in to develop a European approach. Member States are responsible for developing their own legislative bills relating to science and research. The recent changes to the 2008 Human Fertilisation and Embryology Act show that, even as an EU member, the UK retains the ability to create national bills and legislation that can stimulate scientific advancement in the UK.

In terms of EU science policy, the committees and groups that develop the annual and bi-annual Work Programmes for EU research programmes, the UK has a strong effective voice and is able to ensure that the focus and content of Calls for Proposals match the strengths and priorities of UK research. This is greatly beneficial to the UK research community and also ensures an increased research spend on the scientific areas that are important to the UK. On policy matters such as Open Access and Open Data policies, the UK can and does set the agenda in European-level policy discussions.

If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

In the area of Data Protection, the current European Parliament proposal to the EU Data Protection Regulation, would, if it came to pass, have negative consequences for ELIXIR and UK science in general[201]. However, at the time of writing, the European Commission and European Council's do not seem minded to accept this amendment during the ongoing trialogue discussions, so ELIXIR remains hopeful that this would not come to pass.

Furthermore, the biggest impact to ELIXIR of this proposed amendment would be to create confusion and fear amongst academics that they are no longer able to deposit their data in the major archives such as the European Genome phenome Archive (EGA). This would make administering the archive more complex and have the potential to reduce the rate at which future data was deposited with it. As a central archive for sensitive human data, researchers from all over Europe, not just in the UK, currently deposit data in the EGA. The negative implications of increased confusion about data deposition - should the proposed EP amendment come to pass - would therefore actually remain even if the UK withdrew from the EU.

On issues such as VAT on shared facilities, the legal model of ELIXIR (as an International Treaty) should ensure that if the UK withdrew from the EU it could still participate in ELIXIR and benefit from the VAT exemptions afforded to ELIXIR as an intergovernmental organisation. However, many other research infrastructures use the ERIC model as a legal entity, including most of ELIXIR's ESFRI collaborators. Possible UK withdrawal from the EU could make ERIC membership more complex for UK organisations involved in those, bringing

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https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/279331/bis_14_592_balance_of_competences_review_government_reponse_to_the_call_for_evidence.pdf

[201] See ELIXIR report on impact of proposed amendment on EU Data Protection Regulation: https://www.elixir-europe.org/system/files/elixirs_position_on_the_impact_of_the_eu_data_protection_regulations.pdf

an unnecessary level of uncertainly at best. This would not help UK's strategic engagement in ESFRI research infrastructures.

The greatest risk for the ELIXIR UK Node, as a UK-national legal entity, is that of being frozen out of EU research funding.

How is the innovation landscape affected by EU membership?

NA

Scientific advice

How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

The EU's mechanism for scientific advice has recently changed and the new system has recently been introduced[202]. This system is now based on a committee of experts, rather than one individual Chief Scientific Advisor, as was the case previously in the EU and as is the norm in the UK government departments and developed administrations.

To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

The results of EU research and innovation often do feed into public policy, though this happens more in certain scientific domains than others, and the success to which this happens can vary from project to project. Research fields such as public health, environment, energy, nano-safety and social sciences, for example, lend themselves to feeding into policy formation more than other research domains. The European Commission will also often fund specific projects where it is clearly stated that a desired impact of the project is to shape policy formation.

In the field of Open Science, big data, open access and data management, a lot of the activities carried out by ELIXIR partners on various EU grants is directly feeding into public policy discussions, which is then implemented at the national and EU levels.

More broadly, the European Research Area (ERA) is the policy objective to create "a unified research area open to the world based on the Internal Market, in which researchers, scientific knowledge and technology circulate freely and through which the Union and its Member States strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges."[203] Establishing the ERA requires

[202] European Scientific Advice Mechanism: https://ec.europa.eu/research/sam/index.cfm?pg=hlg
[203] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A Reinforced European Research Area Partnership for

coordination between individual EU Member States, the European Commission and the institutions, organisations and networks conducting the research, in order to maximise the return on research investment for both the EU and individual Member States. The 5 key priorities of the ERA are to deliver:

- More effective national research systems
- Optimal transnational co-operation and competition
- An open labour market for researchers
- Gender equality and gender mainstreaming in research
- Optimal circulation, access to and transfer of scientific knowledge including via digital ERA

As a research infrastructure, ELIXIR benefits directly from the policy discussions and commitments from Member States around establishing the ERA. It is highly unlikely that the UK would be able to participate as effectively in these discussions if it withdrew from the EU. This would have a knock-on effect on ELIXIR, as it would remove an effective channel and mechanism with which policy is currently shaped.

Many high-level European science policy bodies and committees are chaired by UK delegates: Dame Julia Slingo sits on the new Scientific Advise Mechanism; the European Strategy Forum for Research Infrastructures (ESFRI) is currently chaired by the Chief Executive of STFC[204]; and ERAC is chaired by John Wood. Non-EU members are unlikely to ever be able to shape policy discussions within these fora effectively. For example, non-EU countries can only sit as Observers on ERAC. Switzerland is excluded from participation in Programme Committees and setting the agenda for research priorities, yet still has to make a full financial contribution to take part.

The UK currently exerts a major influence in other forums and committees by virtue of positive agenda setting, its strong science base and its own responsiveness to new scientific priorities. In Advisory Groups and Programme Committees for Horizon 2020, the UK is seen as a member that positively shapes the influence of European programmes in a way complimentary to its own national research agenda.

Response submitted by Andrew Smith on behalf of ELIXIR Europe

20 November 2015

Excellence and Growth : http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012DC0392&from=EN

[204] ESFRI Membership: https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri-membership

European Bioinformatics Institute (EMBL-EBI) – Written evidence (EUM0038)

EMBL-EBI, situated on the Wellcome Genome Campus near Cambridge, is the UK site of the European Molecular Biology Laboratory (EMBL), an inter-governmental treaty organisation with 21 member states. EMBL is not an EU organisation; rather, it is funded by 21 member states and two associate member states. However, it benefits greatly from considerable coordination and funding from the European Commission. EMBL-EBI is Europe's hub for biomolecular data, and is an acknowledged world leader in the management and analysis of big data in biology.

Funding

> **Q9** What is the scale of the financial contribution from the EU to UK science and research, and vice versa? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

EU funding is extremely important for EMBL-EBI and our operations would be handicapped if such funding were not available. We are supported by EMBL core funding, competitive grants received from Research Councils UK (RCUK), the European Commission, the Wellcome Trust, industry partnerships and sources outside of Europe including the National Institutes of Health (NIH). In 2014 EMBL-EBI received **€5.7 million** in grant funding from the EU and €3.3 million from RCUK.

> **Q10** What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

Official EUROSTAT data and reports for 2013 (the latest available figures) show that while the UK is a net contributor to the EU budget, it is a net recipient of R&D funding: contributing €0.89bn to EU R&D funds but receiving €1.44bn in competitive awards. The benefit for UK science is clear. In addition to financial benefits the UK also benefits tremendously from freedom of movement and collaborations across the EU, as discussed in other sections below.

> **Q11** What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

The European Commission's approach to developing science programmes is based on extensive discussion and relies on consensus, which offers significant advantages. All parties, including EMBL, have an opportunity to make suggestions and comment on proposals. The UK Research Councils are more agile and operate more flexibly; successive governments have made funding policy decisions more rapidly than is possible within the EU institutions.

Operational aspects of EU funding, notably the bureaucratic management of funds, do not compare favourably to the UK. For example, EU rules require excessive attention to accounting processes for funds spent, which demands considerable staff time at EMBL-EBI. This has a negative impact on our research budget, as it requires researchers to spend valuable time managing funding-associated bureaucracy. However, on balance, the funding and associated opportunities for collaboration far outweigh these negatives. The UK research councils provide a reasonable model for balancing accounting processes and assessing research outcomes.

Collaboration

> **Q12** What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

EMBL-EBI has been extremely successful in attracting funds from the Framework Programmes and from Horizon 2020. Our research and services have benefitted tremendously from EU research programmes, which have often allowed us to fund projects that complement those funded by the UK. EU funds have contributed significantly to EMBL-EBI's growth into Europe's largest public provider of bioinformatics services.

EU funding for ELIXIR, Europe's pan-European infrastructure for biological information, allowed EMBL-EBI to manage the creation of the infrastructure and, with significant funding from the UK, to host its Hub on the Wellcome Genome Campus. As the ELIXIR host, EMBL-EBI has further strengthened its position as the focus of bioinformatics in Europe. Without the UK's EU membership, we would have lost this opportunity.

ELIXIR is providing a separate response to this inquiry that includes additional details of the value of European cooperation.

> **Q13** What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

EMBL-EBI's research and service activities are highly collaborative. Many of our services are jointly run with collaborators in Europe, North America, and Asia; and most of our grant-funded research and development activities are collaborations as well. In 2014 we had 112 active grants, of which at least 90 involved one European collaborator. Our collaborations, mostly multilateral rather than bilateral, are certainly not inhibited by EU mechanisms. The real enhancer of collaboration is personal contacts, and EU membership allows EMBL-EBI staff to develop and maintain personal networks throughout Europe that enhance collaboration. This occurs firstly in ease of travel throughout the EU: the ease, and low cost, of travelling in the EU allow our staff to maintain frequent in-person contact with collaborators. More significantly, the free movement of people (see question 7) means that many EMBL-EBI staff have worked in other EU countries, and many former EMBL-EBI staff have are now working in other EU countries. EMBL-EBI staff, both present and former,

maintain a rich network of contacts throughout Europe, and of course many of these contacts are also collaborators.

> **Q14** How is private investment in UK science and research influenced by EU membership?

EU projects often promote SME involvement directly, although this is frequently pro forma and does little to enhance synergy between projects and commercial drivers. The larger multinational industries do have pan-European funding vehicles, for example the Innovative Medicines Initiative (IMI). While this has been successful to an extent, it would be more so with less bureaucracy.

> **Q15** How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

EMBL-EBI is or has been a partner in a number of European research infrastructures, including ESFRI projects such as ELIXIR, EATRIS, Infrafrontier, and EMBRC; as well as other major infrastructures such as Géant. As a partner in these infrastructures EMBL-EBI has played a major role in shaping theses European-wide infrastructures, and has successfully led and hosted the management core for ELIXIR. Although EMBL is an “international organisation” and not a UK legal entity, EMBL-EBI would not have been able to participate so fully, or even at all, in these infrastructure projects were the UK not an EU member, and EMBL-EBI’s selection as the hub for ELIXIR would certainly have been in question were the UK not part of the EU.

We are unaware of any restrictions that EU membership has placed on the creation and operation of international facilities.

> **Q16** What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

We see the UK’s EU membership as a definite positive as it helps us hire the best talent and thus deliver reliable, high-quality research and services at a global level. The UK is a very attractive destination for European scientists, and easy movement between EU countries makes it possible for EMBL-EBI to recruit world-class staff. At the end of 2014, EMBL-EBI had 512 members of staff from 57 different nations. Of those, about 200 were British, about 200 were from other EU countries, and the rest came from other parts of the world. During the past decade over 900 skilled data scientists and bioinformaticians have moved on from EMBL-EBI employment, and of those over 400 have remained in the UK. Those scientists who remain in the UK move on to other, often more senior positions, and contribute significantly to domestic science and technology. Those who move to other countries inevitably maintain ties with EMBL-EBI and with collaborators throughout the UK, and

contribute to the creation of a pan-European community for bioinformatics that enhances science in the UK and throughout Europe.

Q17 Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

We believe that EU membership enhances our collaborations with countries all over the world. Our collaborators assume, correctly, that we have a good overview of the bioinformatics landscape in Europe and that we can, and will, involve collaborators from around Europe when appropriate.

Immigration policies are an entirely separate issue from scientific collaboration, but we have seen no evidence, nor ever even considered, that different immigration policies have any affect on our scientific collaborations. The UK's position as a world leader in science, its attractiveness as a place to live, and the openness of scientific institutions to researchers from all cultures are far more important than minor differences in immigration policy.

Q18 What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

Q19

In general EU member states set their own science policies and regulations: there are only a few EU-wide regulatory mechanisms. Of these, the one that most concerns EMBL-EBI is the set of current and future regulations is around data protection. Broadly, following the Scandinavian or British approach to data access would make regulation firm but not prohibitive for researchers, while following the German approach would make data access by researchers highly restrictive. The latter would seriously slow down scientific progress in the EU, which would have an impact on the UK. The UK is a leader in scientific research in Europe, and has a very strong and growing biotechnology industry. As a member of the EU the UK has a strong voice in steering EU rules and regulations. If the UK withdraws from the EU it will lose this voice and would thereafter have no influence on EU regulations while still, in effect, having to abide by them in order to do business and engage in collaboration in Europe.

Q20 If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

A slightly simplified regulatory environment would no doubt reduce administrative effort for UK research organisations, but this would be far outweighed by the disastrous reduction in scientific productivity—due to lost access to funding, reduced collaborations, and lack of skilled staff—that would result were the UK to withdraw from the EU.

Q21 How is the innovation landscape affected by EU membership?

A major bottleneck for SMEs and start-up firms is recruitment of talented individuals. EU membership allows talented people freedom of movement, and the UK innovation

ecosystem benefits from this freedom. The Cambridge area, in particular, is attractive for its large ecosystem of technology and biotechnology companies that are anchored by research and innovation generated by the University. As we noted in question 8 hundreds of our former staff have remained in the UK after leaving EMBL-EBI, and many of those are in the private sector. We do not have precise statistics but we know anecdotally that many have joined SMEs and startups due to better opportunities in the UK than in their home countries. A major factor in creating a successful innovation landscape is the attraction of talented staff, and EU membership greatly increases the available talent pool for the UK, which is a net importer of talented individuals.

> **Q22** How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

In our experience, the UK has better integration between science and policy than the EU. The EU lacks a clear, transparent, institutionalised interface and seems to fall back on less transparent, ad-hoc measures. While the EU might currently represent a generalised European position on evidence-based policy, it is missing many opportunities to inform decisions based on input from Europe's scientific thought leaders. The newly announced group of EU science advisors will, we hope, help change this situation.

The UK should be rightfully proud of its science-to-policy links and should lead, in alliance with other European countries with a similar scientific point of view, initiatives to help the EU achieve a similar level of quality and effectiveness of scientific advice on matters of public policy.

> **Q23** To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

The UK has a leading role in European science, and has significant direct influence in EU science policy, and funding decisions, through consultations, personal contacts, and membership in official EU bodies. EU input into international science policy discussions, such as for instance on climate change, is therefore influenced by UK scientists. This influence would be entirely lost were the UK to withdraw from the EU.

20 November 2015

European Bioinformatics Institute (EMBL-EBI), Culham Centre for Fusion Energy (CCFE) and League of European Research Universities (LERU) – Oral evidence (QQ 1-8)

Transcript to be found under Culham Centre for Fusion Energy (CCFE)

European Commission – Written evidence (EUM0081)

European Commission Response to the Questions addressed to Commissioner Moedas

Question 1. What is the extent of the UK's influence on decision-making and the development of EU strategies for science and research?

The UK fully enjoys all rights pertaining to EU decision-making associated with EU Member State status. It is represented in all formal bodies shaping and deciding EU research and innovation policies. This includes those at the political level, such as in the Council and the research working group, and in the European Parliament through its committees and the involvement of Members of the European Parliament (MEPs). UK nationals also participate in advisory structures helping to prepare Commission proposals and the Programme Committee that provides opinions on the implementing Decisions of Horizon 2020.

In this context, it should be noted that the UK made a number of comprehensive written policy contributions to the preparation of Horizon 2020. These included first a document published by the UK Department for Business Innovation and Skills (BIS) in advance of the Commission's Horizon 2020 proposal, with a submission on the Common Strategic Framework, and second via Research Councils UK (RCUK) - the strategic partnership of the UK's seven Research Councils - a submission on the Commission's Horizon 2020 proposal. The UK has also been fully involved in European Research Area activities for example in the implementation of the 'European Charter for Researchers' and the 'Code of Conduct for the Recruitment of Researchers'.

More generally, the UK has been amongst the leaders in terms of support to the key policy principles for Horizon 2020 including the defence of excellence as the principal criterion for the allocation of funding, the need for simplification and greater efficiencies with programme implementation including funding models, and the need to ensure open access to publications and data generated by EU funded projects. The UK has played a substantial part in Joint Technology Initiatives, Joint Programmes (under Treaty Article 185) and Joint Programming Initiatives with other countries. Also with regard to Horizon 2020 implementation and its work programme, the UK has been an active contributor through the Horizon 2020 Programme Committee in terms of proposed topics for funding, many of which have been taken up.

The UK has participated constructively in the debate and work to identify examples of regulatory barriers and gaps which hinder Research and Innovation (R&I) activities.

a. Is there any quantitative analysis in this area, for example the UK's percentage share of scientific expert Committee Chairs and positions? How does this compare to other Member States?

There is no quantitative analysis produced by the Commission on the UK's percentage share of committees and positions. When it comes to appointing experts the Commission fully

relies on Article 4(2) of the Rules for Participation and Dissemination in Horizon 2020[205] which states that:

> *'Independent experts shall be chosen on the basis of their skills, experience and knowledge appropriate to carry out the tasks assigned to them. ….*
> *When appointing independent experts, the Commission or the relevant funding body shall take appropriate measures to seek a balanced composition within the expert groups and evaluation panels in terms of various skills, experience, knowledge, geographical diversity and gender, and taking into account the situation in the field of the action. ….'*

This is the basis on which all expertise is chosen. Having said that, examples of UK nationals participating in key advisory bodies and expert groups, including those where the UK itself proposes the nominations, include the following:

- Prof. Dame Julia Slingo, Chief Scientist of the UK Met Office, is one of the seven member strong high level group for the Commission's new Scientific Advice Mechanism (SAM);
- Prof. Dame Athene Donald, Professor of Experimental Physics at the University of Cambridge, is one of the current 18 members of the Scientific Council of the European Research Council;
- Sir Leszek Borysiewicz, Vice-Chancellor of the University of Cambridge, is the Chair of the ERC Identification Committee for identifying potential new members of the ERC Scientific Council;
- Dr Claire Craig from the Royal Society is a member of the Governing Board of the Joint Research Centre;
- Of the 31 in total members of the high level expert group RISE for research, science and innovation, five are from the UK or currently working at UK institutions;
- 46 UK nationals are currently members of Advisory Groups (AGs) which provide input for the preparation of the Horizon 2020 work programme. This is out of a total of 446, or equal to just over 10 %. This is the highest number among Member States – Germany has 43. The AGs have recently been re-appointed and are just in the process of selecting their Chairs;
- Richard Fowler Pelly from the UK was one of the twelve member High Level Group of experts for the recent ex post evaluation of the Seventh Framework Programme;
- The UK has been a significant contributor to the work of the European Research Area and Innovation Committee (ERAC). The current co-Chair, David Wilson of the UK Department for Business Innovation and Skills (BIS) has been instrumental in preparing the ERA roadmap and the ERA governance document.

Question 2. How does the European Commission plan to pursue and capitalise on

[205] http://ec.europa.eu/research/participants/data/ref/h2020/legal_basis/rules_participation/h2020-rules-participation_en.pdf

synergies between Horizon 2020 funds and Structural funds awarded to Member States for research and innovation?

It is important to underline that Horizon 2020 funding is based entirely on the principle of excellence and there are no national quotas for funding. Synergies with Structural Funds are sought to ensure a higher impact of the funds. These can help build capacity of research and innovation players and pave the way for future proposals under Horizon 2020. Member States and regions, using Structural Funds, can support projects after Horizon 2020 funding has finished. This can also happen simultaneously, provided double funding is avoided. An initiative launched last year is the Seal of Excellence Pilot, which is a quality label designed to facilitate alternative funding support to Horizon 2020 SME Instrument projects that have been positively evaluated under Horizon 2020, but which could not be funded under that programme due to insufficient budget. If successful this scheme will be rolled out more widely.

a. We understand that ERDF funding for research and innovation is conditional upon the adoption of a smart specialisation strategy at national or regional level. How will smart specialisation develop?

Research and Innovation Strategies for Smart specialisation are the ex-ante conditionality for research and innovation investments under the European Regional Development Fund (ERDF) in the current programming period 2014-2020. Smart Specialisation can be defined as 'place-based approach to innovation, rooted on knowledge assets'. In other words it is 'a strategic approach to economic development through targeted support to research and innovation'. It gives priority to investments in research and innovation activities that play to the regions' (or country's) existing or potential strengths, and thus ensures a more effective use of public funds while stimulating private investment. It focuses on the real growth drivers of the country / region.

A smart specialisation strategy may take the form of (or be included in), a national or regional research and innovation policy framework depending on the choice made by each Member State during the Cohesion programming phase. The definition of a smart specialisation strategy is considered a bottom-up activity where all relevant actors have to actively participate (the entrepreneurial discovery process). The role of the authorities should hence be limited to providing information and facilitating the process, by bringing together the stakeholders - state/regional authorities, business community, universities and civil society - and providing technical assistance as well as other appropriate expertise. In a collaborative process involving all relevant actors, strategies should build on existing strengths and potential of a state/region, strengthen comparative advantage and connect with both local and external expertise. These strategies will be implemented through the relevant Operational Programmes where they are embedded.

b. What are the objectives? How will progress and impact be monitored?

Smart specialisation is not about achieving a simple and narrowly-focused specialisation process. The objective is more about smart diversification of priorities, enhancing connectivity across sectors, developing the appropriate skills at all levels and building on the

so-called 'related variety' of present sectors and specialisations. The degree of connectedness of the region and its exposure to the various interrelated sectors will define the scale and the choices that will have to happen in the context of the smart specialisation. The ultimate goal of smart specialisation is to achieve improved innovation ecosystems and a higher impact of the funds.

Each smart specialisation strategy must contain a monitoring mechanism. The Smart Specialisation Platform[206] of the Joint Research Centre's Institute for Prospective Technological Studies (IPTS) has identified a number of key issues for monitoring. Monitoring should focus on tracking the developments related to policy interventions within the specific priority areas identified in the strategy. The mechanism should be able to capture and follow the relevant expected changes that are foreseen in each priority by means of an appropriate choice of result indicators; it should also capture and follow the policy output that ought to make expected changes happen. The actual development of the Strategy will be monitored through the Operational Programmes where it is integrated.

Question 3. We welcome the development of the Science Advisory Mechanism (SAM) and have heard helpful evidence from Professor Dame Julia Slingo on the early stages of its work. Could you describe the future plans for the SAM group?

a. Will the SAM be empowered to identify areas that require advice or will it be confined to responding to questions posed by the Commission?

The Commission Decision of 16.10.2015 on the setting up of the High Level Group (HLG) of scientific advisors as part of the Commission’s scientific advice mechanism (SAM) states that the task of the HLG shall be to:

- provide the Commission with independent scientific advice on specific policy issues where such advice is critical to the development of EU policies or legislation and does not duplicate advice being provided by existing bodies and;
- support the Commission in identifying specific policy issues where independent scientific advice is needed.

The Decision also states that:

- The Commission may consult the group at any time on any policy field, defining the timespan in which advice is needed and;
- The chairperson of the group may advise the Commission to consult the group on a specific policy issue.

The SAM HLG may thus advise the Commission on the identification of specific policy issues requiring independent scientific advice.

[206] http://s3platform.jrc.ec.europa.eu/monitoring

The HLG held its first meeting[207] on 29 January 2016. As reflected in the minutes of that meeting[208], the discussions focused on future work including the first two issues to be considered by the HLG ('Cybersecurity' and 'Closing the gap between light duty vehicles' real world CO2 emissions and laboratory testing'). The HLG will hold its second meeting on 16 and 17 March 2016.

b. Do you think the SAM will be able to respond quickly enough to advise on a crisis where advice might be needed in hours or days?

The task of the HLG is to provide the Commission with independent scientific advice on specific policy issues where such advice is critical to the development of EU policies or legislation. This also includes, according to the Commission Decision, 'urgent advice', provided it does not duplicate advice being provided by existing bodies. A range of bodies exist that have crisis management explicitly included in their mandates. An example is the European Centre for Disease Prevention and Control (ECDC). In such circumstances, and in accordance with the task description of the HLG as defined in the relevant Commission Decision, the HLG will necessarily play a complementary role. In order to be able to play that role as well as possible, mechanisms have already been or are currently being established that should ensure that the HLG can act as quickly as possible. For instance, the Commission services are in regular contact with EU-ANSA, the EU Agencies Network for Scientific Advice. An informal network of Member State scientific advisors (or scientific advice structures) is also being established, which is due to meet in July 2016 at the Manchester ESOF conference and will be helpful to rapidly identify actions undertaken on the national levels. And finally, to ensure rapid access to expertise, provision has been made for an €6 million grant to European networks of Academies and learned societies to facilitate inter-academy co-operation and the flow of information and evidence between the academies and SAM HLG. The capacity for rapid responses will be required in the grant agreement. It is clear that it will take time for all of these different parts of the scientific advice mechanism to be fully operational, in particular in the case of urgent advice.

Also relevant in this context is the recent initiative of the Commission in establishing a Disaster Risk Management Knowledge Centre in a networked approach with the Member States, which provides an interface between science and policy in the whole disaster-risk-management (DRM) cycle. This Knowledge Centre will help in translating complex scientific data and analyses into usable and reliable information for science-based advice for DRM. It will also allow the SAM-HLG to perform scientific synthesis, assessments and analyses before and after major events, thus increasing preparedness and response levels of the Emergency Response Coordination Centre (ERCC), operating within the European Commission's Humanitarian Aid and Civil Protection department (ECHO). The Knowledge Centre is coordinated by the Joint Research Centre in cooperation with ECHO, DG Climate Action, DG Environment, DG Research and Innovation, and DG Migration and Home Affairs.

c. The remit of the SAM is to provide science advice to the European Commission. By what mechanisms do the European Parliament and the Council of the European Union receive

[207] http://ec.europa.eu/research/sam/pdf/meetings/hlg_sam_agenda_2016-01.pdf#view=fit&pagemode=none
[208] http://ec.europa.eu/research/sam/pdf/meetings/hlg_sam_012016_minutes.pdf#view=fit&pagemode=none

science advice?

Our understanding is that the European Parliament has a number of formal structures which enable Members, committees and other bodies to benefit from scientific advice. These include the Science and Technology Options Assessment Panel (STOA)[209]. Parliamentary committees may also obtain scientific evidence from the Policy Departments, within the Directorates-General of committee secretariats for Internal and External Policies, and individual MEPs may request briefings from the Members Research Service[210].

There is at present no formal structure which provides scientific advice to the Council of the European Union. However, in many Member States the Academies and Learned Societies play an important role in advising governments and the SAM will also engage these bodies. The Commission has also invited Member States to nominate scientific advisors (or structures) to facilitate interactions with Member State science advice.

4. How does the Joint Research Centre fit into the EU landscape for science, research and innovation? How does this Centre link with science advice and evidence-based policy making within the EU?

The Joint Research Centre (JRC) has a mission *"to support EU policies with independent evidence throughout the whole policy cycle".* It does this through a diversity of science and research-based activities to support and advise fellow policy departments in the Commission in areas like environment, energy, transport, finance, health, security, agriculture and food. The JRC also fulfils the Commission's research and training obligations in nuclear energy safety and security stemming from the Euratom Treaty. As a Directorate-General of the European Commission the JRC not only provides input to policy development but is also formally consulted on policy proposals before they are submitted to the College of European Commissioners. A Panel of independent experts under the Chairmanship of the former Chief Scientific Adviser to the Irish Government, Professor Patrick Cunningham, recently carried out an in-depth evaluation of the JRC activities over the past few years and its findings are available in the evaluation report of the JRC activities.[211]

Practical arrangements are being in put in place to ensure strong complementarities between the independent advice from the SAM and the in-house expertise of the Joint Research Centre. To support this aim, a number of staff have been seconded into the SAM Secretariat.

a. How were the locations of the seven JRC institutes chosen?

The establishments of the JRC are spread over five countries at six geographic locations: Brussels and Geel in Belgium; Ispra in Italy; Karlsruhe in Germany; Petten in the Netherlands; Seville in Spain. These sites were mainly decided following the signature of the Euratom Treaty in March 1957, when four of the founder Members of the European Community for

[209] http://www.europarl.europa.eu/stoa/cms/home
[210] http://www.europarl.europa.eu/atyourservice/en/20150201PVL00031/European-Parliamentary-Research-Service
[211] http://publications.jrc.ec.europa.eu/repository/bitstream/JRC96870/kjna27343enn.pdf

Atomic Energy (Euratom) (namely, Belgium, Germany, Italy, the Netherlands) offered sites for the location of the "Joint Nuclear Research Centre", established by the Euratom Treaty.

As a result, the Ispra site in Italy was inaugurated in 1959; the Geel site in Belgium was inaugurated in 1960; the Petten site in the Netherlands was established in 1962; and the Karlsruhe site in Germany was inaugurated in 1965. The Seville site in Spain was established in 1994 following a Research Council decision to reinforce cooperation in the research domain with the countries of the Mediterranean basin. Some of the JRC strategic and administrative units are located together with the majority of the other European Commission departments in Brussels.

Over time the organisation and scientific focus of the JRC Institutes have been adapted to the needs of its partners. The current organisation comprises seven Institutes with most of them located in more than one site: Institute for Reference Materials and Measurements (Geel, Belgium); Institute for Transuranium Elements (Karlsruhe and Ispra); Institute for Energy and Transport (Petten and Ispra); Institute for the Protection and Security of the Citizen (Ispra); Institute for Environment and Sustainability (Ispra); Institute for Health and Consumer Protection (Ispra); Institute for Prospective Technological Studies (Seville and Brussels).

b. Do these remain the optimum locations for the institutes?

The locations of the institutes are fixed in Site agreements concluded by the European Commission to fulfil its obligations under Article 8 of the Euratom Treaty "to establish a Joint Nuclear Research Centre" signed in 1958. The first Site agreement was signed with the Italian government in July 1959, which entered into force in 1960. Immediately after that, land and facilities long-lease agreements with the German nuclear research entity in Karlsruhe were concluded in 1960, followed by an agreement with the Land Baden-Württemberg and an exchange of letters with the German Federal Government in 1963. A land and facilities long-lease agreement was concluded with Belgian SCK-CEN in 1961 (not followed by an agreement with the Belgian Government) and a Site agreement with the Dutch Government in 1961 (followed by a long-lease agreement with a Dutch nuclear research organisation in Petten). As for the Seville Site, this involves only a Site agreement concluded in 1994 that places administrative building at the disposal of the JRC (no facilities, nuclear or conventional, are involved). The hosting founder Member States also established an educational infrastructure with European Schools at these sites.

Breaking up these host agreements, or moving large scale research laboratories, including nuclear facilities from one site to another, would have many negative side effects from political, technical, social and economic points of view. It should also be noted that for nuclear facilities phasing out would require decommissioning which is a long-term and costly process.

It should be also emphasised that the different geographical locations of the JRC are not an obstacle to the normal day-to-day functioning of the organisation, or to effective cooperation between colleagues, as the advanced information and communication platforms allow for this.

c. Is the network likely to be expanded or modified?

The Commission has no plans to expand the network. Nor does it intend to change the current geographical locations of the JRC as explained above due to existing long-term agreements with the hosting Member States as well as because of the large scale research infrastructures on most of the sites that are difficult to move or decommission. The Commission however has the right to change the organisational structure of the JRC if necessary for the organisation of the work in order to guarantee the best possible science-based evidence throughout the whole policy cycle.

In addition to the physical networks described above, the JRC has established large and very flexible virtual partnership networks with around 1000 partners across the EU and globally. This allows the JRC when needed to be able to mobilise competence and knowledge without expanding its own organisation.

Question 5. What percentage of EU investment in scientific research infrastructures goes to facilities based in the UK?

a. How does this compare with other Member States? [212]

In overall terms, taking infrastructure in the broadest sense to mean the research system as a whole, the UK has been one of the leading recipients of funding under both the Seventh Framework Programme (FP7) and Horizon 2020. For FP7 (2007-13), among the EU-28 Member States in all FP7 signed grant agreements, the UK ranks 2nd in terms of budget share, with a total EC contribution of just over € 7 billion. For Horizon 2020 (2014-20), current statistics show that the UK has received just over €1.4 billion, which also puts the UK in 2nd place in terms of budget share.

Under the narrower understanding of the term research infrastructures, Horizon 2020 does not invest in research facilities per se. The scope of the research infrastructures part of the programme is to facilitate the development of world-class research infrastructures in Europe, to integrate and open national research infrastructures, to foster the innovation potential of the infrastructures and their human resources, and to reinforce European policy and international cooperation through synergies by setting up partnerships between relevant policy makers, funding bodies or advisory groups. In the FP7 Research Infrastructures calls (the part of the programme set aside specifically to support research infrastructures), funded projects included 146 different UK participants, with 629 total participations, which represented around 11.9% of total participation. The related EU contribution, €272.7 million represented approximately 17.8% of the overall budget allocated to research infrastructures. Regarding Horizon 2020 calls for Research Infrastructures, the funded projects include, so far, a participation of 78 different legal entities from the UK, which constitutes 174 participations in total. In terms of budget, this amounts to €66.7 million, representing approximately 12.1% of the total budget allocated to these calls.

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[212] FP7 figures are accurate to 11-11-2015 and Horizon 2020 figures to 24-02-16

It should be noted that the data on Horizon 2020 does not include the GEANT specific agreements (SGA), in which DANTE (established in the UK) plays a major role. The data on UK participation in FP7 and Horizon 2020 do not include either the significant participation of EMBL-EBI (European Bioinformatics Institute, outstation of the European Molecular Biology Laboratory), which is located in the UK but whose headquarters are in Germany.

It should also be noted that the UK is coordinating the European Social Survey, one of the first European research infrastructure consortia (ERIC), which is a legal structure established by a decision of the European Commission to facilitate the joint establishment and operation of research infrastructures of pan-European interest.

b. Does that distribution of investment reflect the relative size and strength of science in Member States?

There is in general a good correlation between what the Member States invest in science at the national level and the funding received from the framework programme.

For the Seventh Framework Programme (FP7), UK grant holders received approximately 17.2% of the total EU contribution to grant holders (in the EU 28 Member States). This compares to a UK share of 12.4% of total R&D expenditure in the EU in 2013.

Question 6. We have repeatedly heard from the UK science community that EU level support for innovation is welcome and serves to complement that available in the UK. Could you describe future plans in this area, including the development of the European Innovation Council?

The first priority of the President Juncker Commission is boosting jobs, growth and investment. Research and innovation are also critical to other priorities, such as the Digital Single Market, Energy Union and Climate Action.

Commissioner Moedas has launched a debate about a possible European Innovation Council, including a public 'call for ideas' that will remain open until 29 April 2016[213]. The results of this debate will be taken into account in the interim evaluation of Horizon 2020 which will be completed before the end of 2017 and which may make recommendations for the remaining period of implementation of Horizon 2020.

Question 7. How does scientific evidence inform the development of EU regulatory frameworks?

a. At what stages and by what processes is scientific evidence and advice taken into account in the development of regulations?

Scientific evidence and advice are taken into account in the development of regulations at the impact assessment stage. The European Commission ex-ante Impact Assessment system is unique in the world. Before the Commission proposes a new initiative it assesses the potential economic, social and environmental consequences in an impact assessment.

[213] http://ec.europa.eu/research/eic/index.cfm

Impact assessments prepare evidence (including results from evaluations) for political decision-makers on the advantages and disadvantages of possible policy options by assessing their potential impacts and assess whether future legislative EU action is justified and how such action can best be designed to achieve desired policy objectives. The Commission's Joint Research Centre contributes strongly to the implementation of Better Regulation.

Aside from this, and at an earlier stage in the policy and legislative development processes, scientific advice provided by SAM may guide the early stages of these processes, but it is not a formal part of the Impact Assessment process.

b. Do you evaluate the effectiveness of scientific advice in the creation of regulatory frameworks?

Better regulation is about designing EU policies and laws so that they achieve their objectives in the most efficient and effective way. It ensures that policy is prepared, implemented and reviewed in an open, transparent manner, informed by the best available evidence and backed up by involving stakeholders. To ensure that EU action is effective, the Commission assesses the expected and actual impacts of policies, legislation and other important measures at every stage of the policy cycle – from planning to implementation, to review and subsequent revision. The Better Regulation package has established the 'evaluate first' principle, which means that before proposing new regulatory frameworks, the Commission first evaluates existing ones. Moreover any proposal for a new regulatory framework is accompanied by an ex-ante impact assessment which ensures evidence-based policy making, taking into account state of the art scientific evidence.

The Commission's Joint Research Centre performs an annual evaluation of the impact of its policy support work.[214] On the basis of a comprehensive set of criteria, it determines where its policy support became part or even the basis of European policy-making and implementation. In 2014, there were nearly 340 policy impacts across many policy areas.[215] This represents an increasing trend since 2010.

4 March 2016

[214] Productivity and Impact Evaluation (PRIME) exercise which is reported in the Joint Research Centre's Annual Activity Report, see http://ec.europa.eu/atwork/synthesis/aar/doc/jrc_aar_2014.pdf for latest version.

[215] See https://ec.europa.eu/jrc/sites/default/files/jrc-a-z-guide-2014_en.pdf for a more complete overview of the many policy areas to which the Commission's Joint Research Centre provides scientific support.

Europlanet Consortium – Written evidence (EUM0045)

Impact of European Union Funding on Planetary Science

Overview of European planetary science:

- Planetary science covers the study of our solar system and those around other stars. It is an interdisciplinary field of research that covers physics, chemistry, astronomy and geophysics, robotic and human exploration of other planets, as well as the search for extra-terrestrial life. Comparative planetology research, such as climate modelling, can help improve our understanding of the Earth, its history, evolution and risks that it faces from space, such as geomagnetic storms or asteroid impacts.
- The UK has had significant involvement in European Space Agency (ESA) planetary missions over the past decades and UK instruments have travelled to comets, moons and planets. The UK is playing a leading role in upcoming ESA flagship missions, including the ExoMars mission to Mars and JUICE mission to Jupiter and its icy moons[216].
- Europe has world leading facilities and the largest international community of planetary scientists, comprising over 800 tenured academics and around 4000 early career researchers spread in more than 200 research groups/institutions. The UK has more than 20 planetary science research groups and at least 10 companies and SMEs involved in planetary missions.
- Since 2005, the European Commission has supported the European planetary science community with over 40 million Euros funding, including 18 million Euros for the Europlanet project to integrate planetary science across the European Research Area, of which approximately 18% has gone to UK institutions and industry.

Background

1. In recent years, Europe's planetary space science programme has received wide-spread recognition for a string of successful missions. The dramatic landing of Rosetta's Philae probe on comet 67P/Churyumov-Gerasimenko in November 2014 demonstrates Europe's capability and innovation in planetary science and technology. Upcoming ESA planetary missions include ExoMars, a two-part mission consisting of the ExoMars Trace Gas Orbiter (TGO) and Schiaparelli, an entry, descent and landing demonstrator, which are due for launch in 2016, and the ExoMars rover, which is due for launch in 2018. The UK has involvement on the ExoMars rover vehicle, two scientific instruments, software and the design of the parachute sub-system[217]. ESA's Jupiter Icy Moons Explorer (JUICE), due for launch in 2022, will use a robotic orbiter to study three of Jupiter's icy moons: Europa, Callisto and Ganymede. The JUICE spacecraft will carry a magnetometer, led by Imperial College London, to study the magnetic environment around Jupiter. UK co-investigators will also contribute to the camera and the particle environment package.

Funding

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[216] UK Space Science Programme, UK Space Agency: https://www.gov.uk/government/collections/space-science-programme

[217] ExoMars Case Study, UK Space Agency: https://www.gov.uk/government/case-studies/exomars

2. ESA's annual budget for science and robotic exploration, which covers solar system science as well as astronomy and fundamental science, is over 650 million Euros[218] (around one fifth of the corresponding NASA budget[219]). The UK government contributes 155 million Euros for these programmes as part of its annual subscription to ESA and has invested an additional £214 million in ESA's ExoMars mission[220]. However, while NASA and other national space agencies have the responsibility both of developing missions and supporting the scientific communities involved, the remit of ESA is restricted to building and operating space missions[221]. Support for the underpinning scientific community is distributed among its national members and institutions, each with their own funding and support regimes. Europe's planetary science community is at least as large as its US counterpart[222], with more than 800 tenured academics and around 3000-4000 young researchers spread across over 20 countries and around 200 research institutions (more than 20 of which are in the UK). The European planetary science community is, therefore, much more fragmented, which can make it difficult for the community to carry out coordinated activities.

3. The Europlanet project was founded to support scientists and engineers working across Europe on planetary-related research and development, and to maximise the scientific return from investment in international planetary missions[223]. The European Commission has funded Europlanet through successive framework programmes, including 2 million Euros under Framework 6, 6 million Euros under Framework 7 and 9.97 million Euros under Horizon 2020[224]. In addition, a range projects focused on specific areas of planetary science (e.g. Near Earth Objects, Venus, Mars, astrobiology) have received total funding of more than 20 million Euros to date through targeted calls by DG Research and Innovation and DG Internal Market, Industry, Entrepreneurship and SMEs (formerly DG Enterprise) under FP6, FP7 and Horizon 2020 (Table 1). Funding from EU Framework programmes has allowed Europe's planetary science community to develop self-organized programmes, in order to complement and support the activities of ESA from the bottom up.

Table 1. Summary of EU funded planetary-related projects in Framework 6, Framework 7 and Horizon 2020.

[218] ESA Budget by domain 2015, European Space Agency: http://www.esa.int/spaceinimages/Images/2015/01/ESA_Budget_2015_by_domain
[219] The NASA's Planetary Science Division Funding and Number of Missions 2004 – 2020, The Planetary Society: http://www.planetary.org/multimedia/space-images/charts/historical-levels-of-planetary-exploration-funding-fy2003-fy2019.html
[220] UK Space Agency Annual Report and Accounts 2014/15: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/441292/Annual_report_final_web.pdf
[221] Convention for the Establishment of a European Space Agency: http://download.esa.int/docs/LEX-L/ESA-Convention/20101200-SP-1317-EN_Extract_ESA-Convention.pdf
[222] Anderson, G. Ivie, R. 2014, Demographics Survey of 2013 US AAS Members Summary Results, American Astronomical Society: https://aas.org/files/resources/aas_members_workforce_survey_final_jan2014v2.pdf
[223] Blanc, M. 2006, Europlanet: European Planetology Network, Organizations and Strategies in Astronomy Volume 7. http://link.springer.com/chapter/10.1007/978-1-4020-5301-6_8
[224] Europlanet project website: http://www.europlanet-2020-ri.eu/past-activities-successes-and-impact

Project Name	Framework	Funding (M€)	UK institutions/ industry involved
EuroPlaNet[225]	FP6	2.0	Imperial College, STFC Rutherford Appleton Laboratory, The Open University, University College London, University of Aberystwyth, University of Leicester, University of Liverpool, University of Oxford
Europlanet RI[226]	FP7	6.0	Armagh Observatory, The Open University University College London, University of Aberystwyth
NeoShield[227]	FP7	5.8	Astrium Ltd, Queen's University Belfast, The Open University, University of Surrey
ProVISg[228]	FP7	3.5	Airbus Defence and Space Ltd, Scisys Ltd University College London, University of Aberystwyth, University of Nottingham, University of Surrey
PRoVIScout[229]	FP7	1.9	Kings College London, University College London, Scisys Ltd, University of Aberystwyth, University of Leicester, University of Strathclyde
EuroVenus[230]	FP7	2.2	University of Oxford
AstRoMap[231]	FP7	0.5	
Europlanet 2020 RI	Horizon 2020	10.0	**The Open University (PI),** Natural History Museum, University College London, University of Aberystwyth
EuroCARES[232]	Horizon 2020	2.0	**Natural History Museum (PI),** Department of Health, The Open University Thales Alenia Space UK Ltd, University of Leicester
UPWARDS[233]	Horizon 2020	2.0	The Open University
NeoShield-2[234]	Horizon 2020	4.2	Airbus Defence and Space Ltd, Queen's University Belfast
Space Awareness	Horizon 2020	2.0	The Open University, UCL

225 EuroPlaNet Summary: ftp://ftp.cordis.europa.eu/pub/infrastructures/docs/001637.doc
226 Europlanet RI Report Summary: http://cordis.europa.eu/result/rcn/156533_en.html
227 NEOShield Summary: http://cordis.europa.eu/project/rcn/101239_en.html
228 PRoVisG project website: http://provisg.eu
229 PRoViScout project website: http://www.proviscout.eu
230 EuroVenus project website: http://www.eurovenus.eu
231 AstRoMap project website: http://www.astromap.eu
232 EURO-CARES project website: http://www.euro-cares.eu
233 UPWARDS project website: http://upwards-mars.eu/content/project
234 NeoShield-2 project website: http://www.neoshield.net

4. The UK's planetary science community has benefited significantly from EU funding for planetary missions. The Open University leads the Europlanet 2020 Research Infrastructure, to integrate and support the European planetary science community, and the Natural History Museum leads the EURO-CARES project for the curation of extraterrestrial material returned from space. More than 15 research institutes and companies in the UK have benefited from involvement in planetary-related projects funded through Framework 6, 7 and Horizon 2020 (see Table 1), receiving about 18% of the total funding overall.

Collaboration

5. Investment by the European Commission in the Europlanet project between 2005-2012 has enabled two significant and sustainable outcomes for the long term cohesion of the European planetary community: the formation of a community organisation, linked by a Memorandum of Understanding (MoU), and the establishment of an annual conference on planetary science of international stature.

6. The Europlanet Consortium was established in 2013 with the aim of creating a sustainable, active community for decades to come[235]. To date, more than 75 research institutions and signatories have agreed to cooperate on an informal and mutually beneficial basis through the terms of the MoU. The Consortium has been an active hub for discussing and forming consortia for Horizon 2020 proposals, many of which have had significant UK involvement.

7. The European Planetary Science Congress (EPSC)[236] was established in 2006 and has grown into a self-sustaining meeting. Over the past decade, more than 7000 researchers, industry representatives, amateur astronomers, educators and journalists have attended EPSC. Six countries have hosted the meeting and at least 53 countries have been represented by participants at EPSC, with significant delegations from the US, Japan and China as well as EU Member States. Thanks to the support of EU funding for students to attend the meeting, EPSC is frequently the first international meeting that young UK planetary scientists will attend. With more than 1000 participants (more than 300 of which came from the UK), the EPSC hosted by UCL in 2013 was the largest stand-alone meeting on planetary science held in Europe.

8. EU funding from Framework 6, 7 and Horizon 2020 has provided the planetary science community with a forum to meet, debate and define science goals and priorities for planetary science and future missions. Europlanet has organised more than 20 specialist working group meetings, attended by 400 of the world's leading planetary scientists[237].

9. EU funding has also supported Europlanet in maximising science return through the development of synergies between the different components of planetary science, namely: space exploration, ground-based observations, laboratory and field

[235] Europlanet: The Consortium: http://www.europlanet-2020-ri.eu/europlanet-2020-consortium
[236] European Planetary Science Congress: http://www.epsc2015.eu
[237] Europlanet RI FP7 Final report, Cordis: http://cordis.europa.eu/docs/results/228/228319/final1-publishable-final-report-europlanet-gan-228319.pdf

experiments, numerical modelling specialists, and technology. One successful product has been an interactive matrix, co-developed by UCL, to enable planetary scientists to link space mission requirements with ground-based facilities that can help them deliver their science goals. The matrix integrates more than 235 facilities[238].

10. Places on Earth that have the same geological, physical or extreme environments found on other planets, such as Mars or the icy moons of Jupiter and Saturn, are vital test-grounds in preparing for future missions and understanding where life might be found in the solar system[239]. With EC funding from FP7 and Horizon 2020, Europlanet has enabled scientists across the EU to access terrestrial analogues in order to test rovers and other instrumentation, or study life that has evolved under extreme conditions of temperature, salinity, acidity or aridity. For example, under Europlanet's FP7 Transnational Access programme, a team from the University of Leeds and University of Glasgow visited Ny-Ålesund on the island of Svalbard to investigate how the snow and ice there was first colonised by extremophiles – organisms that thrive in harsh conditions[240]. Through Horizon 2020 funding, Europlanet is preparing two further analogues for Mars and Europa (in Ethiopia and Spain respectively) in support of ESA's flagship ExoMars mission to the Red Planet and JUICE mission to Jupiter and its icy moons. Access to these unique sites will be offered to researchers for the first time[241].

11. Europlanet also provides access to laboratory facilities capable of simulating a wide range of environments encountered without natural analogues on Earth, such as the scorched, radiation-intense orbit of Mercury, dust storms on Mars or the frigid surface of comet Churyumov-Gerasimenko[242]. These facilities allow researchers to understand results coming from the ongoing Rosetta mission through laboratory experimentation, as well as the support upcoming BepiColombo mission to Mercury, and JUICE. The Open University's Mars Chamber, which is capable of recreating the atmosphere, temperatures, pressures and illumination of the Martian surface environment, and NanoSims and Stable Isotope Analytical Facilities are part of the suite of laboratories offered to European researchers. Upgrades to existing facilities through Joint Research Activities will offer new capabilities – currently unavailable anywhere in the world – for simulations relating to Venus, Mercury and asteroids. Through Europlanet's FP7 funding, over 400 researchers were given the opportunity to access state-of-the-art facilities across EU borders. In Horizon 2020, this provision should enable a further 1400 visits for researchers by 2019.

12. In addition, Horizon 2020 funding is assisting European scientists to prepare for future missions to collect samples from extraterrestrial bodies, such as Mars, comets, asteroids

[238] Europlanet NA1 Matrix for Ground-based Facilities and Space Missions: http://europlanet-na1.oeaw.ac.at/matrix/
[239] Mars in the Arctic, European Space Agency: http://www.esa.int/Our_Activities/Preparing_for_the_Future/Space_for_Earth/Arctic/Mars_in_the_Arctic/
[240] Benning, L. 2010, Europlanet TNA Report: http://www.isa.au.dk/networks/euroPlanet/reports/010-TNA1-Benning.pdf
[241] Europlanet 2020 RI Terrestrial Field Sites: http://www.europlanet-2020-ri.eu/europlanet-2020-ri/planetary-field-analogue-sites
[242] Distributed Planetary Simulation Facility: http://www.europlanet-2020-ri.eu/europlanet-2020-ri/distributed-planetary-simulation-facility-dpsf

or the Moon, and return them to Earth for analysis. This activity, led by the Natural History Museum in London and funded through the EURO-CARES and Europlanet projects, will define procedures for handling, studying and storing these rare samples, and will ensure Europe's – and the UK's – position as the world leader in curation of extraterrestrial material.

13. Planetary science missions, and their supporting observations and modelling efforts, generate vast quantities of raw data – data that are obtained at considerable expense and that require full exploitation so that Europe can capitalise on its investment. EU funding through Europlanet 2020 RI is supporting the construction of the first Virtual Observatory for solar system sciences, which will offer state-of-the-art access to the diverse datasets and visualisation and analysis tools needed for comparing and understanding planetary environments in the Solar System and beyond[243].

14. Venus is Earth's closest sibling, but our 'twin planet' has ended up with a radically different and hostile climate[244]. The emerging field of comparative planetology is helping us to understand how and why similar planets evolve in such different ways, and can assist in developing climate models for our own planet. The EuroVenus project, which includes involvement from the University of Oxford, is building on the legacy of ESA's Venus Express mission to strengthen Europe's position at the forefront of Venus research and comparative planetology[245].

15. In recent years, increasing attention has been given to hazardous solar activity that could inflict severe damage to our infrastructure. The European Union has funded over 40 million worth of space weather-related research to date[246, 247]. Horizon 2020 funding is allowing the planetary science community to extend space weather research to other planetary bodies, with the practical application of ensuring that missions throughout the Solar System are protected in the same way as Earth-orbiting and ground-based facilities. In an activity led by the University of Aberystwyth, space weather tools and models for Mars, Mercury, comets and the outer planets will be developed to support future missions such as ExoMars, Bepi-Colomobo and JUICE. However, these tools will also lead to more effective predictions and alert services for solar storms here on Earth, which will help prevent disruption to power and communication networks.

16. Near-Earth objects (NEOs) represent potentially catastrophic threats to our planet[248]. EU funding through FP7 and Horizon 2020 for the NEOShield and NEOShield-2 projects (for UK involvement, see Table 1) have provided access to technologies and characterisation for hazardous NEOs, preparing their for deflection and expanding our knowledge of the science behind them.

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[243] VESPA portal: http://voparis-europlanet.obspm.fr/EPN2020.html
[244] Venus Compared to Earth, European Space Agency: http://www.esa.int/Our_Activities/Space_Science/Venus_Express/Venus_compared_to_Earth
[245] Eurovenus – studying Earth's twin planet: http://eurovenus.eu/why/
[246] Chiarini, P. J. 2013, Space weather in the EU's FP7 Space Theme, Space Weather Space Climate. 3, EO1 http://www.swsc-journal.org/articles/swsc/pdf/2013/01/swsc130049.pdf
[247] Horizon 2020, European Space Weather Portal: http://www.spaceweather.eu/en/eu-h2020
[248] Near Earth Objects, United Nations Office for Outer Space Affairs: http://www.unoosa.org/oosa/en/ourwork/topics/neos/index.html

17. Europlanet has trained young scientists in communicating their research to a variety of audiences including the public, schools, the media and policy makers, through intensive workshops and short, practical seminars during meetings such as EPSC. EU funding has supported intensive 10-day summer schools for early stage researchers challenging them to develop concepts, e.g. for a mission to the outer planets, under the guidance of leading international researchers[249].

18. EU funding has also supported the training of amateur astronomers and the setting up networks of amateurs to provide observations in support of ongoing and upcoming space missions. UK professional and amateur astronomers were supported by Europlanet FP7 funding to initiate a programme of ground-based observations of comet 67P/Churyumov-Gerasimenko in support of the Rosetta mission.

19. Europlanet provides a platform for bringing industry and academia together. Under FP7, Europlanet RI organised seven technology foresight workshops for planetary scientists, instrument builders and commercial providers of space technology, in order to to create roadmaps for the development of the technology needed for future European planetary exploration. Two workshops were held at the University of Aberystwyth in Wales, on the topics of detectors and the design of instrumentation for high radiation planetary environments[23]. With Horizon 2020 funding, Europlanet will organise a further eight workshops and is working with a number of high-tech SME partners to develop new facilities for the planetary community. The project will also support industry-academia personnel exchanges to improve the scientific and innovation impact of the infrastructure.

20. ERC funding has enabled academic researchers and industrial partners in the UK, led by UCL and Surrey Satellite Technology Ltd, to investigate a new model for developing astronomy missions using off-the-shelf technology. The first mission under development is Twinkle, which will study atmospheres of planets orbiting distant stars.

21. Space is a recognised hook for encouraging students to choose careers in science, technology, engineering and mathematics[250]. EU funding is creating repositories of the best space-related teaching resources and activities, as reviewed by teachers, and ensuring that those resources are adapted and translated to make them available in classrooms across Europe. The Horizon 2020-funded Space Awareness project, in which the Open University and UCL are beneficiaries, works closely with ESA and collaborates with extensive European networks of schools and science museums to engage teachers, educators, students, and the general public across Europe with space and planetary exploration[251]. To understand more about what factors influence scientists and engineers in choosing a career in STEM, Europlanet and Space Awareness are currently

[249] Alpbach Summer School 2012: “New Space Missions to the Giants Planets and their systems“: http://europlanet-scinet.fi/index.php?id=94
[250] Europeans’ attitude to Space Activities Eurobarometer report, January 2014: http://ec.europa.eu/public_opinion/archives/ebs/ebs_403_en.pdf
[251] Space Awareness project page: http://www.space-awareness.org

conducting a survey to find out about backgrounds, education and career paths in the UK and European space communities.

Scientific Advice

22. Europlanet has also given a platform for the community to debate and decide on priorities at a European level (e.g. Europlanet statement: Europe should take leading role in curation and analysis of samples returned by missions[252]). The structure provided by Europlanet and EPSC has also been used for consultations of the UK and European planetary community on international strategy (e.g. on the US Planetary Science Decadal Survey)[253].

Summary

23. UK scientists and industry are an important and valued part of the European planetary science community. UK institutions have benefited from EU funding to support planetary science and exploration, and are taking a leading role in Horizon 2020 projects to develop capabilities and underpin the competitiveness of European planetary science in the future.

24. The Europlanet Consortium has identified the following five priorities for ensuring competitiveness of European planetary science over the coming decades, and it believes that they cannot be implemented without ongoing support for the community by the EU:
    i. Making European academia and industry the first choice for collaboration with emerging space powers, such as China, India and Brazil - all of which have ambitious plans for lunar missions.
    ii. Developing science and technology readiness for future planetary missions. Given the long timeframes and complexity of developing ambitious interplanetary missions, such as JUICE or BepiColombo, the planetary science community sees a clear need for research and development of data, instrumentation and tools at the conceptual stage (early Technology Readiness Levels).
    iii. Exploiting EU expertise in non-EU missions (eg New Horizons and JUNO). European science and technology has contributed to the success of these missions and it is vital to ensure that this knowledge is transferred and integrated back into the wider European community.
    iv. Developing inclusiveness capacity and community cohesion.
    v. Developing a trained workforce with the technical, academic and entrepreneurial skills needed for a next generation space industry that can compete globally.

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[252] Statement on Sample Return Curation: http://www.europlanet-eu.org/media-centre/32-epsc/epsc-2006/41-european-planetary-scientists-highlight-sample-return-as-key-priority
http://www.space-awareness.org

[253] Squyres, D. 2009, Planetary Science Decadal Survey 2009-2011: http://www.lpi.usra.edu/pss/july2009/presentations/11DecadalSurvey.pdf

European Society for Evolutionary Biology – Written evidence (EUM0011)

1. The European Society for Evolutionary Biology is an academic society representing evolutionary biologists with a world-wide membership in the region of 1500 scientists (www.eseb.org). Since there is no UK academic body specifically for this discipline, it is the primary professional affiliation of UK-based evolutionary biologists who are the largest national grouping amongst the membership.

2. Evolutionary biology is a core discipline in the biological sciences. Understanding of evolutionary processes underpins the interpretation of biological phenomena at all levels, from DNA to ecosystems. It is a highly active research field with fundamental significance as well as rapidly growing recognition of the importance of evolutionary understanding in applied areas such as medicine, agriculture, fisheries and biodiversity management.

3. The Society would like to express its view that European Union funding has played a critical role in the development of the field in recent years and, specifically, in fostering the integration of UK-based evolutionary biologists into the wider European scientific community. A survey completed by 172 of our members in October 2015 showed that 63% had received EU funding (78% considering UK-based members only). The most common funding type was through the Marie-Curie training scheme (either graduate training networks or individual fellowships; 59 members, 60% of funding). Although directed programmes rarely focus on basic sciences, 46 of the 172 evolutionary biologists had been funded via this route. 18 of the respondents had received the highly prestigious European Research Council grants. The majority of funded members were in the peak period of their research careers (aged 30-50 years). More than half (54%) of the 110 non-UK evolutionary biologists who responded and have received EU funding collaborated with UK-based scientists.

4. The Marie-Curie schemes are of particular significance. There are very few other opportunities for UK-based evolutionary biologists to attract and fund graduate students from the large pool of high-quality graduates produced in European Union countries other than the UK. The scheme also allows funding for exceptional students from outside Europe. Once their graduate studies have been completed, these talented young people often choose to continue to work in the UK. Marie-Curie schemes also provide postdoctoral fellowships for the most promising scientists at the next step in their careers. This is an exceptionally valuable scheme, both for attracting skills into the UK and for giving UK-trained graduate students an opportunity to widen their research perspectives in other countries (within Europe and beyond).

5. The European Research Council provides long-term funding for the most exceptional scientists at all independent career level. It has provided unparalleled research opportunities for some of the UK’s best evolutionary biologists as well as attracting exceptional individuals in our field into the UK.

6. The Society considers these two schemes, driven by the quality of science and the quality of scientific training, to be the best form of scientific investment. Directed programmes, subject to politically-motivated priorities, generally do not produce the same quality of science.

7. The Society considers the integration of the UK into the European scientific community to be essential for the future active development of evolutionary biology, both in the UK itself and in the rest of Europe. European Union funding has been, and continues to be, a critical catalyst for this integration. Mobility of established academics, also fostered by the UK's membership of the European Union, has also been a major stimulus to integration and has certainly promoted scientific quality and productivity throughout Europe.

18 November 2015

Genetic Alliance UK – Written evidence (EUM0039)

Introduction

1. Genetic Alliance UK is the national charity working to improve the lives of patients and families affected by all types of genetic conditions. We are an alliance of over 180 patient organisations. Our aim is to ensure that high quality services, information and support are provided to all who need them. We actively support research and innovation across the field of genetic medicine.

2. For patients affected by rare, genetic and undiagnosed conditions there are numerous advantages to the UK being closely aligned with other European Member States. We have structured our response to fit under the four themes of the call for evidence: funding, collaboration, regulation and scientific advice.

Funding

3. Though the majority of international research collaboration occurs outside the context of EU specific structures, it is important to recognise those EU initiatives that do facilitate cross border collaboration. One of these is research funding. A significant source of funds for health research in the rare disease field comes from European sources such as the Seventh Framework Programme 2007-2013 (FP7), the Innovative Medicines Initiative and Horizon 2020. These are not solely a source of funding, but also a significant driver in the formation of partnerships across the EU.

4. Genetic Alliance UK receives a significant portion of funding from European Union initiatives. In most cases, this is because the type of activity we are involved in can only happen at a continental level.

5. The European Patients' Academy for Therapeutic Innovation (EUPATI) is working to train a patient advocates across Europe (many of them based in the UK) to enable expert patient voice to be incorporated in decisions along the treatment development pathway. The Accelerated Access Review's interim report has recently identified greater patient voice along the innovation pathway as a key aim for the UK. EUPATI is funded by the Innovative Medicines Initiative (IMI) which was part of FP7 and will continue as part of the Horizon 2020 programme.

6. We are performing psycho-social research, gathering parents' perspectives, as part of a clinical trial gathering evidence for the repurposing of an off-patent medicine for congenital adrenal hyperplasia as part of the Treating Adrenal Insufficiency in Neonates (TAIN) project. TAIN is funded by the FP7 programme.

7. We are also partners in two other currently active projects, and have been part of four others in the past five years. These projects have contributed to 7.1% of our income over this time.

Collaboration

The importance of collaboration in the rare disease sector

8. Many rare diseases are severe and life-limiting. For individuals or families affected by most rare diseases, the day-to-day challenges of managing a severe condition are made worse by the absence of an effective treatment or cure. These patients look to research as the source of new therapies to address their unmet health need. In order for progress to be made, patients recognise that the rarity of their conditions means that research relies on the effective sharing and use of their medical data, nationally and internationally.

9. Unlike common conditions, patient populations of individual rare diseases are low, and sometimes very low. There may be too few patients with any particular rare disease in a single Member State to be able to advance treatment and research. National and international research collaborations are invaluable: by collating and analysing large amounts of patient data from across the world is it possible to make meaningful progress with understanding a condition or the effectiveness of a new treatment.

10. Regulations within the European Union provide a framework for this collaboration to take place. The Clinical Trial Regulation and the Data Protection Directive (soon to be updated by the incoming Data Protection Regulation) are major examples relevant to our community.

11. The Clinical Trial Regulation (which is still being implemented) represents a major improvement on the previous Clinical Trials Directive, improving harmonisation and reducing a great deal of regulatory burden restricting the scope to deliver low volume international multi-centre clinical trials. It would be disingenuous to argue that leaving the EU would rule the UK out of participation in clinical trials for rare diseases, but it would be another negative aspect that sponsors would have to consider in the planning of trials. The lack of up to date comparator treatment use in the NHS, and the decreasing possibility of reimbursement for the eventual product of innovation in the UK are already cited as factors counting against the UK as a clinical trial host.

12. Clinical trials are an important source of treatments for the UK’s rare disease patient population. There are numerous examples of patients that have accessed life-saving treatments through this route. These include the newest innovations in therapies for muscular dystrophy and metabolic disease.

13. The UK is a world leader in genome sequencing research. Our major peer in Europe in this field is the Netherlands. The initiatives in these two countries benefit greatly from sharing information internationally, as it is not possible to validate a genetic sequence for a suspected impact on health without further examples of its occurrence.

14. The sheer numbers of individual rare diseases mean that experts cannot be in every Member State and travel may be necessary for patients to access effective treatment. Patient communities may be too small in individual Member States, and benefit from making contact and collaborating across borders.

Collaboration and its influence on the UK approach – *UK Strategy for Rare Diseases*

15. In response to the EC Communication on Rare Diseases: Europe's Challenges the ministers for health from all four nations of the UK published the *UK Strategy for Rare Diseases* in November 2013. It is the first time since the establishment of the NHS that patients and families affected by rare conditions have a clear and strong commitment from Government that their healthcare needs will be met. It is a shared vision for improving the lives of all those affected by rare conditions to ensure "no one gets left behind just because they have a rare disease".[4]

16. The EC Recommendation has raised the profile of rare disease within the UK, to the benefit of the whole rare disease community, which includes patients, families, carers, clinicians, researchers, industry, and healthcare commissioners.

17. Effective implementation of the *UK Strategy for Rare Diseases* will improve the diagnosis and treatment of all patients affected by rare conditions. It will help to ensure that patients who are affected by rare conditions receive the care and treatment they require.

18. The strategy recognises, that through specialist clinical centres, the **"UK wants to support the sharing of information, data, knowledge and best practice in treatment nationally, across Europe and further afield"**. And in order to deliver this and improve the healthcare that patients receive, the strategy notes that "**Centres should have connections to others across the UK and in Europe"**.[254]

European Reference Networks and the Expert Group on Rare Diseases

19. The EU directive on cross-border healthcare[255] provides incentives to Member States to develop European Reference Networks (ERN). ERNs seek to identify already established centres of expertise and to encourage voluntary participation in a Europe wide collaboration with other centres of expertise. ERNs for rare diseases will serve as research and knowledge centres, updating and contributing to the latest scientific findings, treating patients from other Member States and ensuring the availability of subsequent treatment facilities where necessary.

20. ERNs will be ideally placed to facilitate improvements in access to diagnosis and delivery of high-quality, accessible and cost-effective healthcare especially in the case of patients that require a particular concentration of expertise or resources including patients affected by rare conditions.

21. The UK is well represented on the Expert Group on Rare Diseases which advises the EC on issues relating to rare diseases. This membership demonstrates the expertise within the UK on rare disease issues. Involvement at this level f*urthers relationships in the*

254 http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/260562/UK_Strategy_for_Rare_Diseases.pdf

255 http://www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:088:0045:0065:EN:PDF

*research and treat*ment spheres, where the UK is one of a few nations taking the lead in innovation in this area.

Regulation

22. We have already discussed the value of European regulations to collaboration in the rare disease sector in paragraphs 10, 11, and 13.

Medicines

23. The European Union's regulation of medicine in Europe, overseen by the European Medicines Agency (EMA – based in London), creates the largest single regulatory environment for developed nations' populations, with a population of 500 million. This infrastructure is attractive to pharmaceutical companies wishing to bring medicines to a significant market. The European Union can leverage this critical mass to provide incentives for the development of orphan medicines and for advanced therapy medicinal products.

24. States outside of the EU (such as Norway and Iceland) may still benefit from the EMA's regulatory environment, but they cannot have any influence in decisions made by EMA.

25. The UK's participation in the EU's centralised procedure for the evaluation of medicines gives a benefit at both ends of the product development pathway. For innovators in the UK, we are part of a large market with a harmonised regulatory approach, that as we will argue in paragraphs 29-32 (Scientific Advice), we are able to influence. For patients in the UK, we are part of the same market, which is usually either first or second (after USA) on the list of markets that an innovator would seek to launch their products in.

26. The orphan medicinal product regulation provides incentives and support for the development of treatments with indications with a prevalence of fewer than 1 in 2,000. To date this has supported the development of 114 treatments[256] for patients affected by rare diseases.

Organ, blood, tissues and cell donation

27. The UK's membership of the EU Tissue and Cells regulatory system increases the potential pool of donors for haemopoietic stem cell transplantation (HSCT) - one of very few effective treatments for genetic conditions - for UK patients and is therefore a significant benefit to our patient community. European regulation allows cross-border transfer of cells for clinical use, which is highly beneficial to the search for a matching donor.

Scientific Advice

28. (We note that the term "Scientific Advice" is a term used by the European Medicines Agency to describe their programme of interactions with academia, small and medium enterprises and the pharmaceutical industry, aimed at facilitating the development of research studies to satisfy their regulatory requirements.)

[256] http://www.ec.europa.eu/health/human-use/orphan-medicines/index_en.htm

29. Some may argue that the points raised so far in this response would be, to some degree, possible without UK membership of the UK. We believe it would be to a small degree, but must concede this point to an extent. However, we should acknowledge that we are referring to an EU that the UK has been a member of for 42 years. The UK has had an enormous impact upon the EU's outlook with respect to science, innovation and research.

30. The UK's third sector's influence on the Clinical Trial Regulation and the Data Protection Regulation (currently ongoing) has been seminal and powerful. Without our voices, the EU would undoubtedly be a worse place to do research, and cross border collaboration would certainly be much more difficult. The Medicines and Healthcare Regulatory Authority (MHRA) is a key opinion leader at the EMA and has played a significant role in creating the regulatory environment that we have in the EU today.

31. Leaving the EU would almost completely end our influence over policy development in the EU. The large consortium of countries on our doorstep with harmonised approaches to research and medicine regulation would begin to change significantly. The UK has a world leading approach to the regulation of innovative approaches in research and healthcare; this voice is crucial in the balance of attitudes on our continent.

32. An EU without the UK would eventually become an EU with which collaboration would have little value. Consequently, the argument that the UK can continue to benefit from the EU from outside will, at least in a health research and medical context, be shown to have been incorrect.

20 November 2015

Geological Society (GSL) – Written evidence (EUM0061)

1. The Geological Society (GSL) is the UK's learned and professional body for geoscience, with about 12,000 Fellows (members) worldwide. The Fellowship encompasses those working in industry, academia and government with a broad range of perspectives on policy-relevant science, and the Society is a leading communicator of this science to government bodies, those in education, and other non-technical audiences.

2. We have not responded to all of the questions outlined in the Call for Evidence but instead have commented on the issues raised as they relate to geoscience in the UK and EU. It is worth noting that the points raised in this response are not a description of the consequences of the UK leaving the EU but rather potential risks and scenarios that could arise from leaving. The impact of many of these potential outcomes would be dependent on the terms put in place in the event of a 'No' vote and the new ongoing relationship with the EU which is established in its place. If these terms were particularly disadvantageous in the context of trade, freedom of movement and research funding then many of the concerns raised could come to pass.

3. Geoscience, in both in its research and industrial applications is an inherently cross-border discipline. The structure and composition of the landscape and subsurface transcends state borders and topography. For this reason, successful research and technical application of geoscience skills requires innovative approaches to funding and industrial collaboration across borders.

Impact on UK Research and Funding

4. We received a number of responses from our Fellows working in research and academia regarding their concerns about the impacts of leaving the EU on research funding, UK science and cross-border working.

5. Currently, science funding within the UK is considerably below the European average and that available in most other developed countries. Access to EU funds is making up for that to a significant extent. The enhanced collaboration across the EU, supported by the funding structures, generates significant inter-European competition that raises the level of research and supports the dissemination of best practices. Research programmes like Horizon 2020 allow us to compete on scale and impact with the USA, without which some UK research communities would be relatively isolated and lack capacity and impact. With the funding and the added benefit of English being the dominant language of research, the UK succeeds and in many instances can take leadership roles in European consortia.

6. A critical aspect of EU membership and UK science concerns human capital. There has developed a single European community of researchers, especially early career researchers who move around the EU university system. The networks that are supported by programmes such as FP7 and Horizon 2020 have created a community

that more than rivals that of the USA. Incoming researchers from elsewhere in the EU help the UK to flourish scientifically by becoming part of the teams that are found in our research laboratories.

7. Many academics and researchers raised points about the significant loss of funding for UK science that would result from leaving the EU and the associated benefits that come from the EU funding models. For example, for one top 10 Earth Science department in the UK, the loss would be huge. They have regularly been securing projects of the order of €1million and also have joint-funded schemes for Junior Research and International Senior Fellowships. It is well-documented that the UK performs very well when competing for EU funding and the UK geoscience research community has a good track record in winning this funding, which forms a vital part of the geoscience research portfolio. Horizon 2020 provides a mechanism to do this without complex double- or multiple-jeopardy approaches via national agencies.

8. The breadth of programmes and the variety in emphasis on the EU funding programmes support a lot of UK science that would otherwise go unfunded via the current UK funding system. For example, the European Research Council (ERC) funds a lot of UK science that is of the very highest international standing and is seen to focus on more "risky" science and so allows new researchers to pursue novel projects. Research programs such as the Marie Curie fellowships are considered to be some of the most useful and productive because of their enhanced knowledge exchange and program of small workshops. These fellowships bring the cream of European young scientists to work in UK institutions and develop many collaborations with UK researchers that will continue for decades. It is not only European collaboration that is enhanced. EU programs such as the European Cooperation in Science and Technology (COST) also encourage non-EU participation and so the benefits and impact are broadened even further through EU membership. The benefits to the UK in terms of maintaining a competitive edge to our university research and the knowledge exchange and commercialisation that flow from these programs would be very difficult to quantify, but are undoubtedly immense.

9. Significant funding has also been provided for regional geoscience surveys in the UK by the European Regional Development Fund (EDRF). Reports indicate that the bureaucracy involved in execution and auditing was very onerous yet the extent of independent monitoring of the resulting science was minimal.

10. One significant benefit to EU membership which would be problematic to replicate is the research frameworks that are inherently cross-border and are beyond the means of one country. One example of this is the collaboration over research into new wave theory, an intrinsic part of geophysics research. In the UK we currently have little or no capacity to do sophisticated experiments in wave theory. Many geophysicists and others working across a wide range of fields (including hydrocarbons exploration, communication, military applications, non-destructive testing, etc.) use science that depends on these theoretical advances, and in Europe there are sophisticated laboratories conducting experiments that are changing the way seismology and electromagnetics are used in geophysics. One of our respondents reported having an

EU project that uses 15 PhD's to link theorists with wave laboratories across Europe. Without this kind of collaboration the UK would risk becoming irrelevant at the cutting edge of wave theory very quickly. This kind of longstanding research partnership is very easy to lose but would take some considerable effort to rebuild at some future date.

11. Aside from the partnerships that are set up as a direct result of EU funded or enabled collaboration, there are also a significant number of working agreements set up with European based institutions and organisations on the basis that they are regional or sector leaders in given areas of science. While these relationships and agreements would not be hampered directly by the removal of access to EU frameworks, they may be impeded by disadvantageous changes in the freedom of movement for EU citizens.

12. There are many additional positive effects that result from operating in an EU-wide research framework. The wider research community benefits considerably from the improved interoperability of data and infrastructure that comes from cross-border working, and associated technological advancements such as investment in e-infrastructure. Operating within an EU framework also aids the process of collaboration across borders and opens up avenues for research which might not otherwise be considered.

13. EU membership also facilitates the creation of intrinsically cross-border institutions and activities that require financial and organisational collaboration to develop infrastructure beyond the capacity of one country. A useful example of this is the Tyndall Centre for Climate Research at the University of East Anglia. Climate research is an inherently cross-border research theme that requires collaboration both across the EU and internationally. A large proportion of the centre’s income is via the EU and this in turn puts the organisation on an international footing that is beyond Europe. Because of this reach, the centre is able to do more wide-ranging, interesting and policy relevant research for the UK and internationally that would not be possible if the centre was bidding for funding through the current UK funding mechanisms. The Tyndall Centre is also now the Future Earth European Regional Centre for all of Europe (Future Earth being a new planet-wide coordinating body for global environmental change research). This is a significant leadership role which would not be possible if the UK was outside of the EU.

14. Beyond the risks around funding, there are also broader issues around freedom of movement and associated cultural shifts that could have a detrimental effect on the UK’s research sector. Leaving the EU would send a strong professional and cultural message to the UK’s international researchers and workers which may result in many deciding to leave. Many have written to us to say they would strongly reconsider their current residence in the UK in the event of a withdrawal from the EU, due to the impact on their professional work but also because of a perceived sense of alienation in the UK.

15. The experience in Switzerland, when their ERC funding was removed, is worth reflecting on. Following a referendum in 2014 Switzerland over immigration, restrictions were put in place on Switzerland's eligibility to access the EU's Horizon 2020 program of funding. While part of this access has now been restored, the withdrawal of access has had some considerable affects on Swiss science that were not well-anticipated by the Swiss research sector. For Swiss researchers, it is much easier to obtain national funding than get the extremely competitive ERC funding. This reduced the visibility of Swiss research and in some cases meant that the quality of research could not compete on the world stage. The removal of free movement across borders has also had a knock-on effect in terms of collaboration and attracting the best scientists to Switzerland.

16. Some of the aforementioned benefits may continue in the absence of EU membership. We cannot prejudge what arrangements will be made with the EU in the event of a 'No' result. Important research collaboration may continue through pervasive and existing co-operation at European meetings such as the General Assembly of the European Geoscience Union, an annual geoscience conference in Vienna that has become a major international gathering of over 12,000 scientists, and previously established networks. The advent and spread of internet access and fast, cheap travel may at some stage mean that EU membership is not a critical component for continued interaction.

Impact on UK Industry and Skills

17. Geological science in the UK underpins the creation of a significant proportion of the nation's wealth and raw material security. Most obviously, this has been through oil and gas, where the experience gained from the North Sea during the last 50 years has given us a world-leading position that enables UK companies to function (and flourish) globally. Much of this is in partnership with other bodies in Europe, where Eastern Europe continues to offer interesting opportunities. In mining, we are seeing new mines opening in the UK in connection with the strategic necessity to have a secure supply of raw materials, such as tungsten (Drakelands Mine, Plymouth, opened in 2015) and potash (Sirius Minerals now has planning permission for a new deep mine near Whitby). The secure supply of geological raw materials is an example of the practical value of EU science, given the scientific programmes that exist to ensure that EU industry has access to the materials it needs in a global market. Clearly, the UK on its own cannot ensure domestic security of supply of all mineral raw materials, given the nature of our geology.

18. In addition to metals, mining of aggregates for construction is very much a European industry, with multinational companies trading throughout the EU. The science involved focuses less on exploration and production, and more on remediation and environmental protection. Both the supply of groundwater for drinking and management of waste in landfill call upon EU-wide science reflecting the European nature of the drinking water supply and waste management industries. The UK's engineering and environmental consultancy sector is a significant employer of geologists throughout Europe, using their science to support infrastructure and

environmental projects at a range of scales. Without access to EU systems, processes and resources, the UK's science base and ability to generate wealth through industry will be severely handicapped.

19. The UK government is engaged in a number of large infrastructure projects that have important EU components. Currently, UK policy calls for the implementation of nationally important strategic projects including Carbon Capture and Storage (CCS) and Radioactive Waste Disposal. Successful development of these industries requires cross-border collaboration in terms of knowledge exchange and funding as well as access to the required natural resources. CCS in particular has received considerable EU funding for CO_2 pipeline scenarios that would not have been funded by the UK government alone. The free movement of knowledge and expertise and beneficial trade agreements underpins many important and technical industries in the UK and working cross-border on strategic projects allows the UK and the Euro zone to develop and invest in industries of societal importance that would be beyond the means of one country. A steady supply of expertise and materials requires freedom of movement and beneficial trade agreements. Comments from contacts at BG group, a multinational oil and gas company, stated that ease of movement of talent and funds is particularly helpful to big industry, as are the relationships built over years which would be much more difficult to manage in the event of the UK's exit from the EU. It is their view that the free movement of EU citizens has a positive impact on the quality of science in the UK.

20. There may also be some considerations around energy security. Britain is linked to the international oil and gas business through the North Sea which is a very mature field where future investment will be in decline. Ensuring energy security in the coming decades involves good relations with the EU as well as favourable trade agreements. The UK imported 477.2 Terawatt hours (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/416310/PN_March_15.pdf) of gas in 2014, a trend that is not set to diminish significantly in the near future. The gas pipelines which account for a significant proportion of the imports all terminate in the EU and so a good relationship with our European neighbours will be of increasing importance to ensure future energy security in the UK.

21. Changes to the UK's freedom of movement of policy also have implications for UK PLC in the form of current skills gaps in the UK workforce. The shortage occupation list, compiled by the Migration Advisory Committee, highlights a number of technical specialisms where there is a shortage of workers with the required skills in the UK. These skills gaps are currently served in part by EU and international skilled workers. However, a change in the freedom of movement could further exacerbate the issue of skills shortages.

24 November 2015

Professor Dame Anne Glover, University of Aberdeen – Oral evidence (QQ 53-61)

Evidence Session No. 5 *Heard in Public* *Questions 53 - 61*

TUESDAY 19 JANUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Fox
Lord Kakkar
Baroness Manningham-Buller
Lord Maxton
Baroness Morgan of Huyton
Lord Vallance of Tummel

Examination of Witness

Professor Dame Anne Glover, Vice-Principal External Affairs and Dean for Europe, University of Aberdeen

Q53 The Chairman: Welcome, Dame Anne. Thank you very much for joining us today. We are most grateful to you for helping us with our inquiry on the relationship between EU membership and the effectiveness of science, research and innovation in the United Kingdom. We are being broadcast, so, perhaps for the record therefore, you could introduce yourself. If you would like to make any opening statement, do feel free to do so.

Professor Dame Anne Glover: Thank you. I am Anne Glover. I am the vice-principal for external affairs at the University of Aberdeen; also dean for Europe. Prior to my returning to my home university, for three years I was the Chief Scientific Adviser to President Barroso at the European Commission. In that context, as my main responsibility in the chief scientific adviser role was to look at the provision of evidence for policy-making, I feel that I was absolutely submerged in the EU environment, particularly with a view to how evidence is used in policy-making. It was not so much my responsibility to look at policy for science, which is the funding of the Horizon 2020 programme, but inevitably I had some involvement in that. I think I will leave it there.

The Chairman: Thank you very much. Clearly that is enormously relevant to our inquiry. If I may say so, your previous incarnation in Scotland, as chief scientist, is also relevant. Perhaps we can ask your advice on that perspective as well, as to the impact on European research and funding in that country.

Let me start with a general question. Given your experience in Europe, clearly, you are familiar with the different mechanisms of advice in different member states and they can be very different. Indeed, the new regime is a rather different model from the one under which you operated. Would you like to tell us how you expect the mechanisms of advice to influence the effectiveness by which scientific advice contributes to public policy?

Professor Dame Anne Glover: It is an interesting question, because I am not sure it is the mechanisms which affect how evidence is used in policy-making; it is probably more the philosophy of the government concerned. If you look across the European Union, there are 28 member states and probably about 26 different mechanisms for provision of science advice. For a long time, the UK has had a model of a Chief Scientific Adviser supported by chief scientific advisers in different government departments. That is a very Anglo-Saxon model. It is one that is also adopted in Ireland. If we look across the rest of the EU and the member states there, there is a whole variety of mechanisms which can involve sometimes trusted individuals of a particular government being asked to provide advice or procure advice from a broad base. Sometimes it is a learned society, or organisation like that. Sometimes it is a research institution, which a government might fund, or an independent research institution. All of these different mechanisms are used. It is something that I was very interested in. If you look at the mechanism and try to correlate the mechanism with what you see at the sharp end, where government is procuring scientific evidence for policy-making, I do not see a lot of correlation. What is important is that the government wants evidence on which to base its policy, rather than on the instrument that is being used. That is my experience.

The Chairman: Given that there are these different philosophies within the different governments and different mechanisms, do you see a different approach within the Commission to accepting advice or asking for advice from what you would find in Scotland, for example, or elsewhere in the United Kingdom?

Professor Dame Anne Glover: It is inevitably different. If I comment from personal experience, when I went from being Chief Scientific Adviser to the Scottish Government to Chief Scientific Adviser to President Barroso, I can remember having a discussion with President Barroso about a particular issue. I had convinced him of a point where the evidence was compelling and that we should consider how that was used. He said to me, “That’s fine, you’ve convinced me, but now what do we do because there are 28 member states?” That is different from in Scotland, and if I had had the conversation with—at that time—Alex Salmond. I did have a conversation where we talked about an issue and he said, “Right, I accept that. Now, this is how we can go forward”, because he had the authority/autonomy to be able to do that. That is not the case in the European Commission because at the end of the day it is the Council of Ministers, essentially the member states, that decides what is ultimately adopted or not. That is slightly different from how you use the evidence.

The Chairman: I know very well that you were constrained by resources, which were clearly inappropriate for the scale of the job that you had, but you had nevertheless to try and give advice to a council of 28 ministers as well as the President and others at the Commission. What opportunity did you have to give such advice to the Council of Ministers individually?

Professor Dame Anne Glover: Very little to the Council of Ministers. That is why, whilst I was at the Commission, I tried to develop a network of chief scientific advisers, or equivalents, in

each of the member states. The main purpose in doing that was to try to deliberate on issues where there might be some significant uncertainty around the evidence and, where possible, to come to a useful consensus on the evidence, which was then agreed amongst the—I will call them chief scientific advisers of the member states. That was what would inform the Council of Ministers. At the moment, the Council of Ministers does not have formal science advice. What it relies upon is science advice from its own member state, and whatever mechanism that happens to be. My purpose was to try and have a more transparent agreement on the evidence so that the Council of Ministers, when debating issues, might, if you like, take for granted the evidence and not start debating it, but start debating the policy, which is obviously where they are more skilled.

The Chairman: It was not within your gift to be able to nominate such advisers; you had to identify who was fulfilling that role in each member state. Did you have informal meetings with these national advisers to their Minsters?

Professor Dame Anne Glover: Where there was somebody already identified, yes, I immediately got in contact and we discussed what might be possible. Where I had the majority of discussions was going to as many member states as possible to talk to their respective governments—it was normally a science ministry or something equivalent—about the value in nominating someone who would represent that particular member state at a forum of science advisers. When I left the Commission, about 15 member states had nominated someone. They were sometimes the head of a learned academy, sometimes a scientist within government. There was a whole variety of different backgrounds of the people who were nominated. The important thing is they were trusted by that government and that was crucial. I did not mind so much whether it was somebody who was called a chief scientific adviser.

My understanding is that the new mechanism of science advice at the European Commission will also resurrect that European science advisers' forum. It will build upon that to try to develop this opportunity for identifying consensus around the evidence for policy, and that would support the Council of Ministers.

Lord Maxton: You have talked about member states, quite rightly, but how many chief scientific advisers are there within the United Kingdom itself? Does this happen in other countries as well?

Professor Dame Anne Glover: There is a UK Government Chief Scientific Adviser, Sir Mark Walport. My understanding is he is supported by a chief scientific adviser in every department. I do not know the number of departments.

Lord Maxton: You were the Chief Scientific Adviser to Scotland? Is there an equivalent one in Wales, England and Northern Ireland as well?

Professor Dame Anne Glover: Sorry, I misunderstood. There is one in Wales. I do not think there is currently one in Northern Ireland, but I am embarrassed to say I do not know; there may well be. There is not one in England.

Lord Maxton: That is covered by the UK overall. Does this happen elsewhere?

Professor Dame Anne Glover: Not generally. When I first went to the European Commission in 2012 there were only three identifiable chief scientific advisers to governments of the member states. There was one in the Czech Republic, one in Ireland and one in the UK. In terms of identifying them, there were only three.

Q54 Lord Fox: You talked about creating a network and then delivering a consensus. Did you find that consensus process straightforward or frustrating? Was it effective?

Professor Dame Anne Glover: I had not developed the network to the point where we were taking issues of the day, debating them, and providing material that we would then pass on to the European Council. With regard to other areas where we did have some discussions on two or three topics of interest because it would inform policy, but there was some uncertainty around the evidence, it certainly was not frustrating. In a way, that is what we like to do in science. It is almost better if there is some disagreement, because there is nothing worse than talking to someone who thinks exactly the same.

Lord Fox: Except when you are trying to get political acceptance from people?

Professor Dame Anne Glover: I appreciate that. That is always the difference between science and politics. We love uncertainty; politics is slightly different. On looking at delivering consensus, yes, we could. I remember particularly having a discussion with two groups of scientists who were on opposite sides of the argument around endocrine-disrupting chemicals. There was a very public debate across the European Union about what policies the Commission would be bringing in. From the scientific point of view, some people felt they were too stringent, others felt they were too lax. We were able to bring those sides together in an environment with no policymakers present; only scientists talking. We were able to define the questions and, most importantly, define where there was agreement and identify those areas of uncertainty which needed more attention. Instead of saying it was frustrating, it was almost the opposite of that. It was quite uplifting that you could do something so constructive.

Baroness Morgan of Huyton: I am intrigued. When you say it was constructive and you reached a level of consensus, what happened to that evidence? President Barroso gets your pretty consensual position on something like that; how is that then translated to the Council of Ministers? Is that only through the President? Is he the only mouthpiece, in a sense?

Professor Dame Anne Glover: No. In fact, President Barroso was not really involved in that process. First of all, I published the agreement that we came to so that anybody who was interested could see the discussion that we had. That was passed on to the area of the Commission that was dealing with policy development. In that case it was DG Environment which was taking the lead. That went back to them and they acknowledged the usefulness of that and went on to look at how they would construct a consultation in order to refine their policy. The Commission is responsible for developing the policy, which they then present to the Parliament. The Parliament often makes very large numbers of amendments and that comes back to the Commission, so that is an iterative process back and forward. At the end of the day it goes to the European Council, which makes the decision.

Q55 Lord Cameron of Dillington: You have very clearly spelt out the technical framework; thank you. What are your views on the commitment within Europe to the incorporation of science within policy-making. There are three parts. There is the European Parliament, which seems to be much more concerned with policy and, in my view, in the past seems to have slightly ignored the science. The Commission is very good at talking the talk, but not quite so good at walking the walk in some cases. The Council of Ministers "act according to the philosophy of the governments concerned", to quote what you said a moment ago. Are they committed?

In the case of Brexit, do you think that the UK could then get on and really incorporate science within our policy or would we always be looking over our shoulder because we are part of Europe, seeing what was going on in Europe? How would that work?

Professor Dame Anne Glover: If I take that in reverse order. At the moment we have a commitment to evidence-based policy-making in the UK. That would be the same whether or not we are in the European Union. If there was a Brexit, I am sure we would still use evidence in our policy-making. What would be important is what policies were being developed in the rest of the EU in the event of a Brexit, which we would have to adhere to—regulations policies and so on—but we would not have the chance to influence. That would be the difference.

Then you asked whether the European Commission values evidence in policy-making. I would say yes they do, and there is a lot of evidence to support that. Most of the policies that are developed in the European Union are very technical in nature, so because of that you require evidence. If I think of a scenario: if somebody wishes to propose a policy, then one of the first things you have to do is identify if that policy will have impact or not. If the policy will have impact you must do an impact assessment. If you are doing an impact assessment you must gather an evidence base. There is a procedure by which you cannot go forward to develop a policy without producing an evidence base.

I suppose the next question would be how you get that evidence. As we all know, the answer to a question depends on what question you ask. People can be very creative with evidence. If we look at the European Commission, following on from the development of the EURATOM Treaty in the 1950s, which was partly to look at nuclear science, by the 1970s they had the Joint Research Centre, which is the European Commission's science advice service. This is a very large outfit. There are over 3,000 employees and about 2,500 are active scientists. They have a budget of about a third of a billion euros per annum. They are responsible for doing science, for helping to create the evidence around standards, and a very broad spectrum of science from health through energy, cybersecurity, all of these areas. They help to deliver the standards in which we all trade, but, more importantly, we have had a huge influence as the European Union on what the standards are for world trade when it comes to safety of pieces of equipment, pharmaceuticals, and so on. We have a number of agencies that support that. Here in the UK we have the European Medicines Agency, based in London, and that is important for how clinical trials are developed, how the evidence is used, and what pharmaceuticals are ultimately proposed for use in drugs, treatments, medical devices, and so on.

The European Commission has a very strong history of recognising the value of evidence in policy-making.

Lord Cameron of Dillington: What about the European Parliament?

Professor Dame Anne Glover: It is interesting. The Commission highlights the value of evidence and has a number of different structures to deliver that. The European Parliament has the Parliamentary Research Service, which is headed up by a UK national, Anthony Teasdale. It is very much based on the Parliamentary Research Service that we have here in the UK. That provides a lot of the background information for parliamentarians. Do they use that evidence? I do not know, because there are over 750 Members of the European Parliament and they cluster into about 125 political groups—who tend to vote with the political philosophy—which may choose to ignore evidence, but that is the same for every

government worldwide. There are lots of cases, some very justifiable, where you might ignore the evidence because there are other factors—philosophical, ethical and so on—which you may wish to give precedence to.

The Council is completely different. The Council may ignore what Parliament has deliberated—it is the structure of the European Union democracy, which is quite unusual and very different from a member state government. They do not have a scientific advice service in the Parliament, which was why I felt it would be useful having this European science advisers' forum, with a member from every member state, to be able to advise their government and appraise their government of what all the other member states understood the evidence to be, so there was complete clarity there.

The Chairman: You referred to the Joint Research Centre as a very considerable resource available to the Commission. I think you quoted the budget as a third of a billion euros a year. Effectively, this is an in-house capacity for the Commission. Is there a case for saying that science and research within the member states might be enhanced, were some of this work to be put out to member states for their own research institutions, or do you feel that it is more important to keep this central research capacity to the Commission?

Professor Dame Anne Glover: Understanding how the Commission is viewed and how the European Union works, I think it is better to have it in-house. The reason I say that is, for example, if you gave a piece of research work to a member state, and it was on the use of fossil fuels in provision of secure energy supply, if you went to a member state which used substantial fossil fuels and it was very important for its economy, and it came back saying, "It is a very good idea to do that, and we would promote the use of fossil fuels", other member states might be very critical of that and question the independence. Whereas if the work is done internally in the European Commission, the Joint Research Centre is independent. During the three years I was at the Commission, I did not ever see an instance where a scientific report produced by the Joint Research Centre was put under any pressure by Commissioners or other outside forces to alter the conclusions of a piece of evidence gathering. It is rather unusual, in that it is independent within the Commission.

The Chairman: Do you think pressure would be more likely were the research to be conducted in a member state?

Professor Dame Anne Glover: It is hard to judge whether it would be more likely, but there might be a perception that it was more likely, and that could be equally damaging. It might well be that you get a very honest opinion, but I think that other member states might still try to undermine that opinion if they did not like it by raising a concern of conflict of interest. Perception is important.

Q56 Baroness Manningham-Buller: I think you have answered the question I wanted to ask, which was about the value the Commission puts on peer review and dispassionate judgment of the science. I think you said that they have the same policy that you would have in this country on that. Is that true?

Professor Dame Anne Glover: There is an internal peer review system for the use of evidence in policy-making, but when it comes to funding research programmes, for example through the Horizon 2020 programme, you are absolutely right, there are panels, with chairs of those panels looking at the proposals which are put forward. There are very clear and transparent guidelines for how those proposals should be scored. There is also feedback to

applicants, if they are unsuccessful, on what particular parts of their proposals should be improved in future applications.

Baroness Manningham-Buller: Would you be unsympathetic to a Brexit argument that we do it better here? It sounds as though it is well done there.

Professor Dame Anne Glover: I think it is well done. Every peer review system, including our own, has a few warts here and there. Nothing is ever going to be perfect because there is some subjectivity everywhere. I would say Horizon 2020 is a very broad programme in which the UK does very well. In this latest embodiment of research funding, Horizon 2020, we are second in the number of grants awarded and the amount of money awarded. We get far more in funding back from Horizon 2020 than we contribute, or would contribute as an associated country.

The European Research Council funds research purely on the basis of excellence. It is peer reviewed. It has broad support. It is envied in a global context. If I look at the UK's success, the UK is the first in getting those European Research Council grants. I think we have 198 in the first tranche, which is way more than our closest competitor for ERC funding, Germany, which is significantly behind us.

If I may I will talk about that a little bit, because it is an interesting point. ERC funds research purely on the basis of excellence of science. The reason that there is such a strong commitment to that is through ministerial meetings, where the UK has been very active in order to highlight the importance of having a funding instrument which is purely based on excellence. The cohesion member states may be less keen to see that it is based on excellence because they will have an imperative for capacity building. If there were a Brexit, the voice of one of the most important science member states of the European Union would not be there influencing how ERC funding was distributed. The top three science member states are the UK, Germany and France, and we do have a very big voice in all things science at EU level.

Q57 Baroness Morgan of Huyton: Can I ask you more about the structural funds and science. It is clear to us that while we do extremely well in the way you have just been talking about, we do considerably less well on the structural funds side. What we want to understand is, what scientific advice is taken into account regarding structural funds going to support science and research and innovation? Why do we do so badly? Is there anything we should be doing differently to get a fairer share of that—or perhaps we get our fair share? Help us understand. We heard last week in evidence that, exactly as you are describing, in one pocket, in a sense, we do extremely well, but on structural funds we do not.

Professor Dame Anne Glover: I suppose the structural funds and cohesion funds are very much focused on those member states which are less well developed regarding their science and economies, so you might argue that we would do less well in those areas. On the structural funds, what the Commission has asked all member states to do is to develop a smart specialisation policy. In order to support that, they have a smart specialisation panel.

Baroness Morgan of Huyton: Can you explain what that means?

Professor Dame Anne Glover: In the UK, for us, smart specialisation might look at developing an area where we are currently very good, but need more support to become excellent. We are very good in an area, such as developing the concept of personalised medicine, but we might look to the European Commission for more support to develop that even further and

spin that out with other member states looking for partners, or whatever. It can be in any area, not necessarily health; it could be in transport, energy or whichever area. A member state, perhaps one of the cohesion member states, which had less capacity for science might come to the European Commission and they would go to the Directorate-General for Research and Innovation, which is responsible for this, and they might interact with the smart specialisation panel within the Commission, which would give them advice on where they might go to help build capacity and what they might need to put in place to have coherent output in that particular area. I do not know if you would define that as science advice, but certainly it is advice that would allow stronger submissions to that smart specialisation policy.

The Commission has also identified that it is very important that member states, particularly those cohesion states, to build capacity, should be spending structural funds, regional development funds, on science, engineering and technology because that is a sustainable way of growing the economy and then we all benefit, because the market of the European Union becomes stronger, so it is in our interest. There has been a definite shift towards using those funds for science rather than as previously on construction projects—a bridge or roadbuilding, those sorts of things.

Baroness Morgan of Huyton: To your knowledge, are we doing that level of interaction that makes sense for the UK and the position we are in?

Professor Dame Anne Glover: To be honest, because the UK is so smart already in its approach to this, we have very well-established connections. Probably the greater input from the Commission in supporting others goes to those cohesion member states.

Lord Fox: Continuing on this smart specialisation line, there are two things. Are you suggesting that it needs to be in applied science as much as science, in the sense that you need a route to market? Are you also saying that in the event a nation strategy for a smart specialisation is taken, that country then becomes, if you like, the European hub for that particular field or appliance of science, or are there groups of other countries with the same smart specialisation and we are racing against each other? How does it work?

Professor Dame Anne Glover: European funding is targeted towards basic research—that is, more the ERC funding—as well as more applied research. Horizon 2020 has most definitely focused on greater engagement with SMEs, for example, in the funding programmes, which has been largely successful, but still has some way to go. It is an interesting question. I think you are asking me if you develop a smart specialisation hub in Estonia for smart grid or something, does that mean only they do it and nobody else does? No.

Lord Fox: It is only funded that way. Is the European Union then spending its smart-grid funding wherever it sees fit, so to speak, or is it funnelling it into one place?

Professor Dame Anne Glover: There are not pots of money for smart grids, sustainable transport, fuel cells, or whatever, and once that is given for smart specialisation to one country it cannot be given anywhere else; that is not the case. If we look at it in microcosm at the UK level, when we fund programmes on nanotechnology we fund 10, 15, 20 programmes and they tend to be complementary. The European Commission should be in a good position to identify complementarity, which would strengthen the overall European output and European dominance in a particular area. I think that is the philosophy within the Commission in its funding programmes in the structural funds.

Lord Fox: You mentioned identifying complementarity, and that is a fairly complicated thing to do. How does the Commission go about doing that?

Professor Dame Anne Glover: I am not so sure it is that complicated. I mentioned nanotechnology. There might be one group which is involved in nanofabrication, so looking at how you make nanomaterials, and so on. There might be another group that is looking at the environmental impact of nanomaterials. There might be another group that is looking at nanorobotics and how you might use nanorobots in health, so that I can inject myself with such a robot and it might clean up my arteries, for example. That is not on the market yet, I have to say. Those three areas are all nanotechnology, but the reason I have given you those is that I think they are very complementary. You should not be developing nanomaterials if you are not confident that they do not have any unforeseen consequences regarding environmental impact, or the health of the people fabricating the materials. You might also want not only to make the materials but to look at how you apply them in health or catalysis, or wherever. I would say that the European Commission is in an ideal position because it has the database of what has been funded and it can, and does, identify people, across the European Union, who might not know each other and might not be working together and bring them together on a working group.

Lord Fox: Matchmaking?

Professor Dame Anne Glover: Yes, they do a form of matchmaking and it is very successful. The European Union is half a billion people, and they are not all scientists, of course, but it is very difficult to know everybody in one area of science where you work. It is very useful. We do not normally identify that as an accountable value, but it is hugely useful that someone is doing it. I am sure it is not perfect, but they are doing it.

Lord Maxton: If we left, would that not happen?

Professor Dame Anne Glover: I think it would still happen. It would depend whether we were an associated country or not. If we were an associated country, I think we would still hope, and could expect quite justifiably, yes, that such matchmaking would still take place.

Q58 Lord Fox: That feeds into the question that I was going to ask, which is, do we think we could maintain the relationship as we currently have it, at the level that we currently have it, from the position of being an associated country—let us say a Norway or a Switzerland?

Professor Dame Anne Glover: You would be much more knowledgeable about this than I am, but there would be an awful lot of question marks about the chances of being able to negotiate an associated country deal.

Lord Fox: That was my next question.

Professor Dame Anne Glover: Let me be quite mischievous and give you a parallel. There was a referendum in Scotland for independence. The ‘yes’ campaign who wanted independence, quite happily said, “Yes, we will still negotiate to be part of UK research funding and UK research councils, and we will operate our science on that basis”. The rhetoric I heard from the ‘no’ campaign was, “There isn’t a chance of that. What makes you think if you became independent that we would include you?” That was rhetoric around campaigning before a referendum was taken, but I have to say that there is bound to be, and I have heard that there would not necessarily be—although this is a sample size of one, so not that relevant—a huge appetite for giving the UK associated country status. It could well

be that that diminished completely if there was a Brexit and after the event things might change, who knows. That is very uncertain.

Let us say we did negotiate to become an associated country. We would contribute to Horizon 2020 on the basis of our GDP, as other associated countries do. We could get more out of Horizon 2020 than we contribute because when you are an associated country you get all the benefits. If you put in more good, acceptable grant applications than your GDP contribution, you would be winning, because you would be getting more out, but you would have to abide by all the rules. I mentioned the Joint Research Centre earlier—that third of a billion euros per annum. That is funded through Horizon 2020. We could not opt out of that; there is no Horizon 2020 à la carte. We could not influence any of the calls for proposals. It is an area that I am very familiar with in the European Union, where the UK voice is very welcome, very loud, very credible, and it is acted upon. We chair many of the influential committees and, regarding identifying members of the council of the European Research Council, we have members on that council. We help to deliver policy in science funding and where it is spent. That is not available to associated countries.

Lord Fox: So Norwegians or Swiss do not chair committees?

Professor Dame Anne Glover: No.

Lord Maxton: To some extent rightly, you raised last year's referendum in Scotland, of which I was part too, but of course the present First Minister, Nicola Sturgeon, has said that in the event of there being a 'no' vote in this country, in the United Kingdom, then Scotland would hold another referendum on independence and may very well vote 'yes' this time. How would that affect things?

Professor Dame Anne Glover: I am not sure my expertise covers that. What the First Minister said was if the vote in England, Wales and Northern Ireland was to leave, but the vote in Scotland, when you disaggregate the vote in the Brexit referendum, was to remain in the EU, then that would trigger a vote for independence. I know that Scotland benefits hugely from membership of the EU because of its science base. When I was Chief Scientific Adviser for Scotland, I commissioned an independent report to look at the strengths and weaknesses of our science and engineering base in Scotland, and, relative to our GDP, the impact of the research done in Scotland is number one in the world. Number two is Switzerland. If you forget GDP, Switzerland is number one and Scotland is number two. We are incredibly research intensive, which is hugely valuable for the rest of the UK. It means that, as a nation, Scotland depends upon having funding for research to be able to then translate that knowledge generation into impact for the economy and citizens. As I say, that is not my area of expertise. I suppose Scotland has met all the preconditions of membership, but there would still have to be an application of process to the European Union, and I have no idea how that would go.

Lord Maxton: Nor have I.

Q59 Lord Vallance of Tummel: I think you answered this question earlier, but I will ask it anyway. How much influence do UK scientists have over agenda-setting and priority-setting within the EU? What are the mechanisms that are used to exercise that influence?

Professor Dame Anne Glover: We have substantial influence. If I take something that I regard as invaluable as an EU contribution to our research, or science, it is the research infrastructure that the EU delivers and we can all use. Much of science is supported by very

substantial infrastructure and it would be very hard for an individual member state to deliver all the infrastructure needed for a diverse research base, such as we have in the UK. The chair of the committee which looks at European infrastructure is Professor John Womersley, who is a UK scientist, and it is very important that he chairs that committee. We have a whole number of such influences, whether it is on open access publishing or developing strategies for what calls Horizon 2020 will put out to the research community to get good research funding and to support our SME population as well as our European citizens. We have probably more than our fair share of chairs of committees, which are opinion-forming. We have a large membership of committees. I do not have actual numbers here, but the Commission could make those available. We do have substantial influence.

That would be gone at a stroke if there was a Brexit because, although we might still apply for funding, we would have no way of influencing. For example, the UK has proposed a programme on dementia research with the G7 countries and that has found favour with the European Commission, who are going to come in behind that and support a whole number of initiatives. We can do a fair bit with our own funding, but the Horizon 2020 funding that we have already secured in the first round of grant funding is about €1 billion coming to the UK. It is about €4 billion to the grants themselves because there are partners in other member states. For us, it is like having another research council funding our research. In the absence of that, the big question would be, would the UK economy, or the philosophy of whatever Government was in power, feel that science, engineering and technology was sufficiently important to our economy that they would hugely increase the budget, which means they would have to spend an awful lot less on a number of other areas, whereas at the moment we get that funding from the European Commission?

I was a little surprised to discover when I was working in Brussels for three years that, when I went to specialist committees, general committees, or whatever, there was often a UK chair, but most often I saw my colleagues sitting round the table. Indeed, merely by coincidence, on my way here, at Aberdeen Airport I met two colleagues of mine from the University of Aberdeen on their way to expert committees at the Commission. We are very present and very influential.

Q60 Lord Kakkar: I want to turn to the issue of the new Scientific Advice Mechanism that has been established, and in particular the High-Level Group, and seek your views on whether you think that this new mechanism is going to be effective and deal with the issues you have discussed with us. We have heard that this is going to be a reactive mechanism, so they can be called upon to give advice, but they cannot sit round the table together and offer their advice where they see problems and issues arising. Is that going to be a problem? Should there be the opportunity for such an advice mechanism to offer advice because it sees problems in areas where science should be considered? We understand there is a proposal to elect a chair of the High-Level Group. Will that become the new chief scientific adviser, by default, to the Commission?

Professor Dame Anne Glover: I am referring to the previous question. Interestingly, the chair of the group who appointed members to that High-Level Group was Sir David King, so somebody from the UK. That would not have happened in a Brexit. We have Julia Slingo as a member of that Scientific Advice Mechanism High-Level Group, who currently is chief scientific adviser of the Met Office.

Do I think it will be effective? I would be very optimistic. I look at the seven members who have been appointed and they are incredibly impressive people. I would also say that I would regard them as being known for their independence. There is no one on that group of seven whom I would see as a shrinking violet. I am sure that they will not sit by and be told what it is they have to do.

Your question was whether they will be completely reactive. I would say no, but they will be reactive to some extent, as indeed are all chief scientific advisers. I am sure that here, in the UK, Sir Mark Walport reacts to Government saying, "Look, we really need more evidence or some deliberation in a particular area", and he and his team will deliver that. Similarly, he will be proactive and will think of things that perhaps are not visible to Government, but which should be discussed. I have asked this explicitly of the Directorate-General for Research and Innovation, so this is the area within the Commission which will support that Scientific Advice Mechanism, and that group will absolutely have the ability to identify areas that are not brought to them that they identify independently and understand need attention. I think they will be able to do both. I am not concerned so much around that.

Lord Kakkar: Regarding the way that it is positioned, do you believe it is going to be properly resourced to do that important work through the particular directorate? Secondly, will it have access to the Commission more broadly beyond the Directorate-General for Research and Innovation to be able to make its advice heard more broadly?

Professor Dame Anne Glover: To answer the first question, yes, I believe they will get a substantial amount of resource and will be supported by some wider science advice mechanisms in the European Union, namely the European Academies Science Advisory Council, which basically is a group dealing with science advice, but that group is drawn from all the learned academies and societies from across the European Union, or almost all. For example, the Royal Society of Edinburgh and the Royal Society in London are members of that group. Euro-CASE will also provide support for the Scientific Advice Mechanism. They are the more applied academies; for example, in the UK the Royal Academy of Engineering is a member of Euro-CASE, so it is a more applied use of science. My understanding is that they will have between 20 to 25 members of staff who will support the work of the Scientific Advice Mechanism. Seven individuals will be devoting about 20% of their time to being on this High-Level Group. There will be a budget in the order of €6 million per annum to procure evidence, to have meetings, to call for evidence, and so on. I think they will be reasonably well supported.

You asked will the group have a chair. Again, my understanding is that a chair has been appointed and that will be announced when the Scientific Advice Mechanism High-Level Group meets for the first time on 29 January. I am sure it will take a while for them to embed, to find out what they can do. It will be up to them and their support staff to identify mechanisms or instruments to allow them to penetrate into the Commission, not only to be sitting in the DG for Research and Innovation, but to be able to work with the broadest spectrum of policy development in the Commission. I find that challenging. It is not insignificant.

Lord Kakkar: Do you get a sense that there is a broader enthusiasm amongst other elements of the Commission, beyond the DG for Research and Innovation, for this new High-Level Scientific Advice Mechanism?

Professor Dame Anne Glover: That is an interesting question. I do not know. What was very interesting to me was that when I left the Commission when President Barroso stood down, as I was a personal appointment by President Barroso, there was the option for the incoming president, President Juncker, to have a chief scientific adviser to continue with the experiment, if you like, that President Barroso started. He decided that he did not want one single individual as a chief scientific adviser; he wanted the broader mechanism, which is actually more normal within the European Union member states. From my point of view, what was interesting was the huge support right across the European Union, whether it be from think tanks, individual scientists, scientific institutions, universities, businesses, right across the member states, who were demanding having some mechanism. They had seen a chief scientific adviser and they liked this. There was something that was identifiable, which was a way to highlight how evidence was being used within the European Commission or—I think this was the position I was in—somebody who was identifiable as a person with whom a dialogue could be initiated about evidence in policy-making. That same function might be delivered by having a chair of the Scientific Advice Mechanism. The chair will be an identifiable person and would be a way to route inquiries into that High-Level Group.

The Chairman: You pointed out that your appointment was something of an experiment and had not been done before. Do you think that one of the lessons learnt by the incoming president was that scientific advice needs to be properly resourced at the European level? I think it would probably be true to say that you were short of resources.

Professor Dame Anne Glover: I was short of resources. I thought about this a lot when I left the Commission and looked back trying to take stock of what had worked very well and what had not worked so well. For the three years that I was at the Commission, I am not sure whether my lack of resources did not in some way help me. Out of adversity sometimes comes very positive and unexpected activity. I had to focus on what I was doing. I could not do everything I wanted to do, but, perhaps by delegating, I had to decide what I could do that was really important, that was visible, that really made an impact in all the member states in terms of why investing in science, engineering and technology is important, but how useful and important it is to have an evidence base as the platform on which policy-making is developed.

I do not know at the end of the day whether it was a problem. I got huge amounts of support right across the European Union from scientists. I mentioned EASAC and Euro-CASE as two very powerful advice-giving bodies across the European Union, and they certainly supported me. Because I reported directly to the President, I had something that I guess money cannot buy, and that was convening power. If I phoned up and said, "I'd like you to come to a meeting", people came to the meeting. That was very valuable, because I got to speak to people and very quickly got to the sharp end of who is making the decisions and how things are being influenced, and I could be active at that level. We all think it would be great to have a big budget, and yes, a few more staff would have been very helpful—of course, that is resource—partly because my own poor staff worked every hour that was available. They were utterly outstanding, and I certainly could not have done it without them, but perhaps they were working a bit too hard. They were probably very glad when I left; they had a little more breathing time. There are sometimes silver linings.

Q61 The Chairman: Thank you. From the evidence we have received so far it is clear that the science community in the United Kingdom seems more favourably disposed to the EU

than the population at large, if the polls are to be believed. Do you think scientists in this country are doing enough to engage the wider public in their views?

Professor Dame Anne Glover: I realise now I should have said this at the very beginning of the evidence session. I am a member of the advisory council for a group called Scientists for EU. This is a group which seeks to make evidence available and stimulate debate around what would happen to our community, the community of scientists, engineers and technologists, if there were a Brexit. The reason that I felt it was so important to be part of that organisation was that I was at the European Commission when Switzerland had a referendum to limit immigration and overnight, Switzerland's participation in Horizon 2020 was threatened. In fact, it became null and void because an absolute principle of engagement with Horizon 2020 as an associated country is that you allow free movement of scientists in the European research area. If you do not allow that, you cannot be an associated country. When I spoke to my colleagues in Switzerland, the scientists, the national academy of sciences in Switzerland, all had their head in their hands saying, "What did we do? We were completely silent. We didn't talk about the value for us as a community, and for Switzerland as a whole; we didn't speak against that immigration referendum". I think it is important that scientists speak up, because we are a community that tends to be interested only in our science; sometimes, we forget to talk about the value and impact of what we do.

The impact of what I do as a scientist is not for me and my personal gratification. It is for all of you and everybody outside, and citizens globally. Knowledge makes a difference to our lives. For us in the UK, being so research-active, looking at the evidence I have, I regard membership of the EU to be crucial for the health and future prosperity of our science base. I think that our economy in the UK depends upon a good science base. In my view, our sustainable future is on the basis of being smart, not on the basis of making cheap widgets, because somebody will always make those cheaper. Our big resource is being smart. We need as much funding and collaboration as possible to be able to deliver that.

The Chairman: Dame Anne, thank you very much. You have given us some very helpful evidence today. We have particularly benefited from your experience in Europe and, indeed, in your previous career as Chief Scientific Adviser in Scotland. There will be a transcript sent to you for minor corrections. On behalf of the Committee, thank you very much for your help today.

Government – Department for Business, Innovation and Skills (BIS) – Written evidence (EUM0071)

Summary

1. The UK plays a leading role in many aspects of EU Research and Science programmes. These programmes provide access to opportunities at a different scale and scope to those that are possible nationally.

2. The UK received over €7bn in EU funding for science and research during 2007-2013. We continue to perform very well compared to other European Union (EU) Member States (MS). However, there continues to be scope for improvement in the management of science funding in the EU and for simplification of instruments.

3. The Government is keen to ensure that EU decision making is based on the best scientific evidence.

4. The UK has robust systems in place for science advice to Government. Similar systems at an EU level are currently being reformed.

Introduction

5. This is written evidence on behalf of Her Majesty's Government. It responds to the Lords Science and Technology Committee call for evidence for their inquiry into the relationship between EU membership and the effectiveness of science in the UK.

Funding

Question 1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

6. The UK performs strongly compared to other MS because of the strength of the UK's research and innovation base and its success in accessing EU funds. The main EU programme for research and innovation is Horizon 2020 (the successor to the Framework Programmes). The funding is competitive, not pre-allocated geographically. In addition to the EU MS, 12 non-EU countries are able to participate. The programme started in 2014 and it is too early to reach conclusions on the UK's performance with any confidence.

7. More robust data are available on the predecessor Framework Programme 7 (FP7), which ran from 2007-2013. The UK drawdown from the programme was second only to Germany (which has a larger population). The UK received the second highest level of FP7 funding across all MS, totalling around €7 billion. UK projects were more likely than

average to be granted funding[257]. Funding for competitiveness and innovation makes up nearly 18% of the UK's receipts from the EU. EU funding accounts for approximately 16% of UK university research funding.

8. There are other EU programmes and initiatives that contribute towards science and research in the UK. Examples include;
   - the newly established European Fund for Strategic Investments (EFSI), which aims to unlock €315bn of investment across Europe from 2015 to 2017 in a range of sectors including R&D;
   - €7bn in 2014 lending to the UK from the European Investment Bank (EIB) for investment in infrastructure and for support for R&D projects;
   - €1.4bn of European Regional Development Fund (ERDF) funding is available in the UK from 2014 to 2020 to support R&D; and
   - €1.8bn of EU Structural and Investment Funds (ESIF) is available in the UK for business innovation, specifically linked to Smart Specialisation Strategies (S3) to develop regional strengths; with equivalent match funding, this will bring the total for the period 2014-20 to €3.6bn in the UK.

9. The Minister for Universities and Science, Jo Johnson MP, recently provided a submission[258] and oral evidence[259] to the House of Commons Science and Technology Committee's inquiry on the science budget, which gives additional information on the UK science and research budget, its role in economic growth, and the UK's position relative to other countries.

Question 2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

10. The Multiannual Financial Framework (MFF) is the EU's seven year budget. It sets overall ceilings for commitments (the authority to incur new commitments) and payments (the authority to pay out against existing commitments). For the period 2014-2020, the MFF sets a maximum amount of €960 billion for commitment appropriations and €908 billion for payment appropriations (2011 prices). The UK contributes to the EU budget as a whole, and not to individual programmes within it. On the basis of the latest budget for 2015, the UK's share in 2015 is 12.8% and the budget expenditure in that year is €141.3bn[260].

11. Heading 1a (competitiveness for growth and jobs) is the main budget heading for science and innovation and accounts for 13% of the total budget. Horizon 2020, the EU's framework programme for research and innovation, is the biggest item, at approximately €76.4bn for 2014-2020 in current prices (€2.2bn was deducted from the initial Horizon

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[257] Seventh FP7 Monitoring Report 2013 http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf

[258] http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/science-and-technology-committee/the-science-budget/written/20611.html.

[259] http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/science-and-technology-committee/the-science-budget/oral/18733.html

[260] source DAB6/2015 http://ec.europa.eu/budget/library/biblio/documents/2015/DAB/dab6_2015_en.pdf

2020 budget to help fund EFSI). Other notable programmes within Heading 1a include Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME) (a programme that makes it easier for SMEs to access finance), Erasmus+ (an education and training programme as noted above), Galileo and European Geostationary Navigation Overlay Service (EGNOS), two projects to create a new and more precise version of Global Positioning System, and the International Thermonuclear Experimental Reactor (ITER), an experimental fusion reactor.

Question 3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

12. The Government supports steps to improve the efficiency and effectiveness of EU funding. The Commission is making efforts to reduce bureaucracy and increase transparency to modernise and increase efficiency, although this process is sometimes slow. Simplifications were made to the Horizon 2020 compared to its predecessor Framework Programmes, but it is too soon to assess their effectiveness. Further simplification is supported by the Commission and most Member States.

Collaboration

Question 4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

13. The UK has a strong record in securing funding from Horizon 2020 and its predecessors. This reflects our world-class research base. We are in the process of refreshing our evidence base and getting a detailed view of our performance in the last Framework Programme to better understand how the UK performed across the different elements. The outcome of this study is due in 2016 and will inform thinking on the mid-term review of Horizon 2020 and on preparation for its successor programmes.

14. The Global Science and Innovation Forum (a group comprising governmental departments with expertise in international aspects of science and innovation, chaired by Sir Mark Walport) has agreed that collaboration has a wide range of benefits in supporting Government aims - both domestic and international. EU programmes and initiatives provide access to opportunities and cooperation on science and research that are often difficult to provide at national level, either because they are too costly (nuclear fusion, for example) or because the sample size in any one country is so small (rare diseases, for example). Businesses are able to access valuable knowledge and networks from other Member States and harness these to their advantage. The opportunity to make new contacts and explore new markets also often leads to further collaboration or business ventures outside of the programme. EU programmes provide the opportunity for UK Small and Medium-sized Enterprises to access substantial support for innovation that complements the support available within the UK, as well as collaborate with other

companies and institutions and access new markets across Europe[261]. The report 'Ensuring a successful UK research endeavour' by Paul Nurse[262] includes relevant evidence on engaging with Europe and internationally.

15. The UK also participates in all ten voluntary Joint Programming Initiatives (JPIs) in Horizon 2020 to support the implementation of the European Research Area (ERA – in effect a single market for research and researchers). JPIs increase the value of relevant national and EU R&D funding by concerted and joint planning, implementation and evaluation of national research programmers, while the impetus remains at national level, the aim is to minimise duplication of effort and maximise synergies between national programmes.

16. The European Research Council (ERC) is an initiative under Horizon 2020 with a budget of €13.1bn between 2014 and 2020. The ERC funds ambitious 'frontier research' proposals submitted by a single Principal Investigator, if necessary supported by a team, in any area of research and without predefined priorities. The sole criterion is excellence; it is not a mechanism for fostering collaboration. The dominance of UK university participation in ERC is helping to shape the direction of frontier research in Europe.

Question 5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

17. EU membership helps the UK to form strong bilateral collaborations with other MS, and non-EU countries, both within and outside EU instruments. Assuming all collaboration partnerships are regarded as comparable, the UK's five largest collaborative partners during 2008-2012 were the United States, Germany, France, Italy, and Australia[263]. EU membership allows the UK to influence key EU instruments that support bilateral collaboration. With strong UK encouragement, EU research, innovation, and education instruments are increasingly taking a global perspective rather than a narrowly European one.

18. In addition to EU programmes, the UK is also a member of the separate inter-governmental initiatives like EUREKA (helping small businesses innovate across borders) and COST (Co-operation on Science and Technology, supporting networking of national research). Both allow companies and national funding bodies to collaborate across borders.

19. The UK is a global player and punches above its weight in science and research. The UK research base produces 16% of top quality published research findings, even though we

[261] https://ec.europa.eu/research/evaluations/pdf/archive/fp7-evidence-base/national_impact_studies/impact_of_the_eu_rtd_framework_programme_on_the_uk.pdf
[262] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/478125/BIS-15-625-ensuring-a-successful-UK-research-endeavour.pdf - pages 11, 13 and 25.
[263] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf

have less than 1% of world population.

Question 6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

20. The UK was the fastest growing G7 economy in 2014 and the Organisation for Economic Co-operation and Development (OECD) forecast this to continue in 2015. This Government's ambition is for Britain to be the most prosperous major economy in the world by the 2030s, and the best place in Europe to innovate, patent new ideas, and grow a business. The UK's world class higher education sector will play a vital role in meeting that objective. Reform in Europe reinforces our aims. The EU market represents almost half of British exports: reform and growth on the continent are good for British business.

21. The UK is a world leader in science and innovation and has the most productive science base in the G7. We have three of the world's top ten universities and since 2003 we have won 13 Nobel Prizes in science.

Question 7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

22. EU Membership, and the programmes supported through Horizon 2020 and previous Framework Programmes, supports collaboration on research infrastructures in Europe. Funding support is based on the principle of transnational access to facilities, which means that UK-built facilities have a wider customer base, and ensures that UK researchers have access to the best facilities elsewhere in Europe. The planning of new multinational facilities has been stimulated by the formation of ESFRI (European Strategy Forum on Research Infrastructures) and the provision of funding to enable collaborations to form for the selected projects and create strong single proposals for consideration by national governments.

23. The UK's overall approach is to seek out the best route for global cooperation according to the science in question, whether via the EU, or other intergovernmental arrangements. The UK also remains a destination of choice for researchers: we support international research collaborations between the brightest and best scientists in Europe and around the world.

24. The UK participates in ITER (an experimental fusion reactor previously mentioned in paragraph 13) as part of the EU, via the JET (the Joint European Torus which supports work on nuclear fusion power) at the UK Atomic Energy Authority's site near Oxford. JET is testing materials and robotics which will be used in ITER.

25. The UK is also involved in its own right in international projects such as the Square Kilometre Array (SKA, a radio telescope), CERN (the European Organisation of Nuclear

Research) a number of nuclear research reactor projects that focus on materials science. The UK also hosts the European Centre for Medium Range Weather Forecasting, whose membership is wide.

26. The EU has several flagship space programmes: Copernicus, for Earth Observation, and Galileo, the European navigation system. The Horizon 2020 space programme funds R&D that feeds into these programmes as well as new initiatives such as EU collaboration on surveillance of space and tracking of spacecraft to support safety of space operations.

Question 8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

27. The Government supports international research collaborations between scientists in Europe and around the world. Our science base punches well above its weight and we have one of the most productive science bases in the G7. We value genuine international students and academics that come to this country, whatever their origin.

28. In practical terms EU membership means that the UK can benefit from scientist and researcher mobility programmes such as Marie Skłodowska-Curie Actions (MSCA, part of Horizon 2020), and Erasmus+. MSCA provide funding opportunities for mobility and training at all stages of a researcher's career. In FP7 (2007-2013), MSCA funded 3,454 UK researchers, 1,297 UK fellowships and 21,571 UK staff exchanges[264]. The Review of the Balance of Competences between the UK and EU: Education, Vocational Training and Youth [265] report provided an overview of the Erasmus+ programme and its impact in the UK.

Question 9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

29. The Government supports international research collaborations. The UK focuses on excellence; the result is that collaborations are sometimes within the EU, global, or a combination of both.

Regulation

Question 10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

[264] UKRO Annual Report 14/15

[265] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/388092/2903012_BoC_Education_acc.pdf

30. Research and innovation are discussed in a number of EU fora and therefore engagement with the European Commission, other MS in the Council, and the European Parliament is important.

31. The legal bases for this work are Articles 179-190 of the Treaty on the Functioning of the European Union (TFEU)[266]. Article 4(3) of the TFEU also the EU to have competence in research, technological development and space. However this competence does not prevent the UK from exercising its own competence in that area. This is an area of parallel shared competence.

32. There are many EU regulations that affect R&D directly or indirectly. It is worth noting that in its May 2015 better regulation package, the Commission issued new 'Better Regulation Guidelines' and an accompanying 'Toolbox', both of which include pro-innovation and research measures. For example, where a proposal could have an impact on innovation, the guidelines encourage Commission services to include appropriate analysis in the accompanying Impact Assessment.

Question 11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

33. The Prime Minister has made clear that as part of our renegotiation we want to make the EU more competitive – including by reducing the burden of regulation. We have already seen significant progress in this area, with the number of new initiatives under the new European Commission dropping by 80 per cent. But there is further to go.

34. Article 191 on the Treaty on the Functioning of the EU states the need to consider the precautionary principle when developing Union environmental policy although it is often used for health and related policy-areas. The practical impact of these policy considerations will often manifest themselves in the development of EU regulation and will potentially affect the introduction of innovations based on research into the EU market-place. Organisations offering these novel products would need to comply with these regulations whether they are based in EU Member States or not. However regulations informed by the precautionary principle do not place constraints on the research undertaken that would lead to products that could be marketed in parts of the world with different regulatory regimes, whether or not this research is undertaken within EU Member States.

Question 12. How is the innovation landscape affected by EU membership?

35. Innovation is covered by the Industry title of the Treaty on the Functioning of the EU (Article 173) and as such the EU only has supporting competence in this area. In areas of supporting competence, both the EU and the MS may act, but action by the EU must be to support, coordinate or supplement Member State activities and does not prevent the MS from taking action of their own. Article 173 also allows the Commission to take action under other treaty provisions to achieve the objective outlined in the article.

[266] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

36. The UK innovation landscape is also affected by other EU policies and programmes, such as those relating to the single market and intellectual property.

37. A 2013 report by Ernst and Young noted that public funding for R&D is the dominant mechanism for funding innovation at the EU level.[267] Horizon 2020 provides a significant proportion of the EU-level public funding for collaborative and single company innovation projects. The UK Government influences and shapes the development and scope of Horizon 2020 and related instruments, both during negotiations and through active membership of the Programme Committees that manage them

Scientific advice

Question 13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

38. The UK is rightly recognised as having one of the most robust systems for scientific advice to government in the world. The Government Chief Scientific Adviser, in collaboration with the network of departmental chief scientific advisers and scientific advisory councils, work closely with policymakers to ensure departments have access to the very best in science and engineering evidence and advice.[268]

39. The European Commission has recently launched a new Science Advice Mechanism (SAM) to provide such advice at EU level. The Government considers that the SAM has all elements in place which should contribute to its making an effective contribution to EU policy. The actual effectiveness of the SAM can only be assessed when it has operated for some time.

40. The Commission will utilise the SAM and the Joint Research Centre (JRC) to provide scientific advice, alongside a number of specialist advisory bodies which provide scientific advice relevant to specific sectors (e.g. European Food Standards Agency (EFSA)).

Question 14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

41. UK scientists have a history of making valuable contributions to high level international scientific bodies. The Government regularly seconds experts to the Commission to support EU policy making and ensure that future EU regulations are based on high quality scientific evidence. Additionally, UK scientists are regularly asked to join, and often, chair EU panels to provide science advice to the European and other global fora. This allows the UK to punch above its weight in terms of standing and influence.

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[267] http://www.ey.com/Publication/vwLUAssets/Moving_Europe_forward_Innovating_for_a_prosperous_future/$FILE/Moving_Europe_forward_Innovating_for_a_prosperous_future_AU1571.pdf

[268] OECD report 'Scientific Advice for Policy Making' – April 2015

42. The UK must access world class scientific advice in our policymaking, irrespective of its country of origin. Scientific endeavour is a cross-border process and it is important that we facilitate this. UK membership of the European Union is one route that facilitates collaboration.

30 November 2015

Government – Mr Gareth Davies, BIS, Mr Jo Johnson, MP, Minister of State for Universities and Science, BIS and Professor Sir Mark Walport FMedSci FRS, Government Chief Scientific Adviser, Government Office for Science – Oral evidence (QQ 144-161)

Transcript to be found under Government – Mr Jo Johnson, MP, Minister of State for Universities and Science, BIS

Government – Mr Jo Johnson, MP, Minister of State for Universities and Science, BIS, Professor Sir Mark Walport FMedSci FRS, Government Chief Scientific Adviser, Government Office for Science and Mr Gareth Davies, BIS – Oral evidence (QQ 144-161)

Evidence Session No. 14 *Heard in Public* *Questions 144 - 161*

TUESDAY 8 MARCH 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Hennessy of Nympsfield
Lord Kakkar
Lord Maxton
Duke of Montrose
Viscount Ridley
Lord Vallance of Tummel

Examination of Witnesses

Mr Jo Johnson, MP, Minister of State for Universities and Science, Department for Business, Innovation and Skills; **Professor Sir Mark Walport FMedSci FRS**, Government Chief Scientific Adviser, Government Office for Science; and **Mr Gareth Davies**, Director General for Business and Science, Department for Business, Innovation and Skills

Q144 The Chairman: Good morning, and welcome, Minister, Sir Mark and Mr Davies. We are most grateful to you. As you know, this is our last oral evidence session on our inquiry into the relationship between EU membership and the effectiveness of science and research in the United Kingdom. As always, we are being broadcast, so I am going to ask in a moment whether just for the record you would formally introduce yourselves, and if you would like to make an opening statement, of course we would be delighted to hear it. Minister, would you like to start?

Jo Johnson: I am Jo Johnson, Minister for Universities and Science.

Professor Sir Mark Walport: I am Mark Walport. I am the UK Government Chief Scientific Adviser.

Gareth Davies: I am Gareth Davies. I am Director General for Business and Science at the Department for Business.

Government – Mr Jo Johnson, MP, Minister of State for Universities and Science, BIS, Professor Sir Mark Walport FMedSci FRS, Government Chief Scientific Adviser, Government Office for Science and Mr Gareth Davies, BIS – Oral evidence (QQ 144-161)

The Chairman: Are you content that we go straight into the questions rather than go through an opening statement? Thank you.

We have heard frequently in both the written and oral evidence how well this country does out of the European funding mechanism for science. It is absolutely correct that we have indeed done extremely well out of the various framework programmes over the years, but, of course, there are other sources of funding for business and then there are structural funds that, by their nature, will go to the more deprived regions of Europe, as is intended. We have to admit that we are still not entirely clear how the total level of R&D funding from the European Union to the United Kingdom compares with other countries and what the total is. We would be grateful if you could give us your understanding of how well the United Kingdom performs compared to other member states in total R&D funding. Secondly, is our performance any better or worse than you would expect from a country with a research base of the strength of the United Kingdom?

Jo Johnson: Thank you, Lord Chairman. It is a pleasure to be here and I am glad to have this opportunity to give evidence at the end of your Committee's inquiry into this important and very topical subject.

Turning straight to your question, which is a key one, it is clear that we do very well in winning European research funding. We won about €7 billion under the last framework programme, which ran from 2007, as you know, to 2013, and that made us one of the largest beneficiaries of EU research funding. Putting that in context, we have been winning around 15.5% of these funding streams. In relation to our contribution to the EU budget, that means that we are outperforming our input into the overall EU budget by three or so percentage points. That is roughly in line with our GDP share as an economy of the EU as a whole, and it is in excess of our population share. We are coming second after Germany in the overall quantum and shortly behind it in percentage. Is that about right relative to what you would expect, given the excellence of our research base? I think we are performing very well. It is a system that is serving our science community and our universities well, and we want to continue to be able to perform well within it.

The Chairman: We have certainly been able to verify the United Kingdom's position as a high receiver of funds from the excellent base funding only. Our problem is with the structural funds. When they are taken into account, we find it difficult to assess our performance. Would you expect us to be receiving funding from this source for research and development and innovation?

Jo Johnson: I think it is clear that the structural funds and the regional development funds are performing very different tasks compared to the role that we want the science flows of money to play. As you said, the structural funds are about helping disadvantaged, more deprived areas of the European Union to develop the capabilities to be competitive and eventually to be in a position where they are capable of competing for the science streams of money. They have quite distinct roles. The UK, given that it is an advanced economy with a per capita GDP above the EU average, is unlikely to be winning an outsize slice of those structural funds. Indeed, that is why we are winning only a relatively small proportion of them in areas such as the west of Wales, the valleys, and Cornwall. Relatively few areas of the UK are significantly below the per capita EU average, and I think the threshold is now

75%; that is the cut-off point. It is not surprising that we get relatively little of those streams of money.

We want to see a continued approach that maintains a clear distinction between them, and we want to see the science money from the EU continue to be very clearly focused on funding the best science, wherever it is in the European Union, regardless of geography, and regardless of what you might call purely pork-barrel pressures. We want the best science to get the science funding, and other streams of money can address issues of regional deprivation and levels of economic development.

Q145 Lord Kakkar: I want to explore a bit further the balance between funding levels for Horizon 2020 and structural funding. From the overall UK perspective for research and development, what do you believe the best funding balance to be between those two sources?

Jo Johnson: The good news is that within the EU budget we are seeing an increasing share going to areas of expenditure where the UK does well and that deliver the best value for money, or very good value for money, for the UK. The 2013 multiannual framework agreement that set the budget for the period we are now in saw an overall real-terms reduction in the EU's budget for the first time, so it is now less than 1% of the EU's GNI, and within that smaller budget we saw an increase of about a third of the amount of science funding being spent by the EU, which helps us in two directions: first, towards a smaller overall pot; and within that smaller overall pot a bigger amount going to an area where we outperform. We want to see those sorts of trends continue.

Lord Kakkar: So that is where we outperform: in the competitive, research council-type funding.

Jo Johnson: Exactly.

Lord Kakkar: On the structural funds, one thing we have heard is that the Commission may be exploring synergies between the Horizon 2020 competitive funding and the structural funding through member-state smart specialisation strategies. Does that mean that down the line the approach that looks at excellence as the basis for the distribution of the bulk of science funding through competitive bids might be undermined in some way, and what is our smart specialisation strategy with regard to that European Commission discussion?

Jo Johnson: We see a role for some synergy between these two streams of money, while maintaining a very clear distinction in their overall objectives. If the structural development money is being used to help build up capacity for excellence in areas that are deprived, or are underperforming or that have not traditionally received significant science support, that is consistent with separately continuing to use the science expenditure to fund excellence wherever it is found, and the UK has benefited from some of that synergy itself. I can give you an example. In Manchester we have Citylabs, a newly developed £20 million biomedical centre of excellence. This is a project that sits within Manchester's Oxford Road corridor, including two universities, Central Manchester University Hospitals, and many companies, and it is an example of how these sorts of synergies can be consistent with continuing to fund excellence.

Lord Kakkar: If I may, Lord Chairman, I will ask one further supplementary question. In terms of the structural funding that has been available for some years now, has there been any

assessment at Commission level that the investment of those structural funds in other parts of Europe has resulted in, first, improvement to facilities, and, secondly, the ability of locations that have received structural funding to become more competitive for the research excellence funding?

Jo Johnson: I am not aware of that analysis being carried out, but my colleagues might be.

Professor Sir Mark Walport: No, I am afraid I cannot help.

Gareth Davies: Neither can I.

Q146 Viscount Ridley: I want to ask a series of questions about the implications of Brexit for the science budget, and particularly, in the first instance, your estimate of the likelihood of the Treasury increasing R&D funding to compensate for the loss of EU funding in the event of Brexit. I realise that there may not be a government line on this, but your personal views would be interesting.

Jo Johnson: My personal views, I am afraid, are neither here nor there. As a member of the Government, I am not really entitled to personal views in this Committee. I think it would be inappropriate for me to try and pre-empt future budgets. We simply do not know what kinds of claims or other national priorities there would be in the event of Brexit, as you describe. For those reasons, I am afraid I cannot really begin to speculate on the kinds of decisions which future Chancellors might be taking in that kind of circumstance.

Viscount Ridley: To follow up on that, if we had a Brexit, how likely would we be to become an associate to programmes such as Horizon 2020, as indeed many other non-EU countries are? In other words, how likely is it that we would have to increase domestic spending to substitute when we might still be a full paying member of these programmes?

Jo Johnson: This is one of the unknowns that the Brexit and the Leave campaign face, or we all face, because we do not have a clear sense of what the relationship would be between the UK to the rest of the European Union. The Government have set out a number of alternative scenarios that currently exist around Europe and beyond, and none of them is seen as coming close to matching the advantages that we gain from being in the single market and being a full player.

Viscount Ridley: That is a general point rather than about the science budget itself. There are, I believe, 13 associated countries in the EU funding programmes that are not in the EU. Is that right?

Jo Johnson: I cannot confirm the exact number, but it might be of that order.

Professor Sir Mark Walport: May I come in on that one? That is correct, but of course being an associated country does not give you the same rights with respect to the programmes, you do not have the opportunity to influence them, and the negotiation would be detailed because it depends on how the UK would conform or otherwise to other of Europe's policies, so being an associated member is not entirely straightforward.

Viscount Ridley: I am not quite clear about this business of not being able to influence them, because countries like Norway contribute to these programmes, take part in them, and do indeed sit on the project committees.

Jo Johnson: But they are not members of the Council, and they are not members of the Parliament.

Government – Mr Jo Johnson, MP, Minister of State for Universities and Science, BIS, Professor Sir Mark Walport FMedSci FRS, Government Chief Scientific Adviser, Government Office for Science and Mr Gareth Davies, BIS – Oral evidence (QQ 144-161)

Viscount Ridley: The European Council and the European Parliament are the two distinct bodies, are they?

Jo Johnson: And they[269] do not shape the programmes. Over the years Britain, for example, has argued successfully for EU science funding to flow to where the best science is being conducted, and that benefits us, having a strong science and research base, so the sorts of influences that we have been able to exercise we would not be able to exercise on the outside, not having a seat at the table.

Viscount Ridley: One final point: I just wanted to confirm a particular number. If we did Brexit and if there was a proportion of our science funding that we no longer got from the EU and that had to be replaced, what number would it be? What percentage of total R&D funding in the UK, both private and public, would we have to replace? I have seen the figure of 3%. Is that right?

Jo Johnson: It is always going to be a notional number, because funding on the way in is not hypothecated to specific areas of expenditure, so you are always going to be comparing an infinite number across the entire EU budget—

Viscount Ridley: No, it is an output number that I am looking for.

Jo Johnson: —based on our share of the EU research streams. You are approximately right: 12% and 15% are ballpark estimates of our input contribution to the EU budget and our output share of the specific research funding streams.

Lord Hennessy of Nympsfield: We have had a witness, who is pro Brexit, suggesting that the Treasury would have a moral obligation to keep the science fund up if we left. I admire the Treasury deeply. They are misunderstood people, they get a bad press, but I do not think they do moral obligation, and suggesting that funds are hypothecated for a particular purpose is like holding a crucifix to Dracula for the Treasury, is it not?

Jo Johnson: Indeed. I think it would be rash to pretend that it would be easy to replicate this rich additional funding stream—the three percentage points that we were just discussing—in the event that we were no longer able to win the outsize share of EU science funds that we presently win. As I was saying earlier, we cannot predict what our financial circumstances will be in the event of a decision to leave the European Union, we do not know what condition the national economy will be in, we cannot say now what competing priorities there will be for any resources that become available, so it is very difficult to know what kinds of pressures the Treasury would be under.

Q147 Lord Cameron of Dillington: Sajid Javid, in his evidence to the House of Commons, said, "Whether we are in or out of the EU, we will still be a global science giant". Is that actually the case, and if it is, is the scientific community overstating its enthusiasm for EU membership?

Jo Johnson: I think it is undeniable that we were a big player in science long before the European Union came into existence. Many of our great universities have been around and were successful as centres of learning long before even the countries that are now part of the European Union came into existence, so I am sure we could continue to be a player in science and to thrive in loads of ways. The question for me is whether we would be as strong

[269] Associated countries.

as we could be without access to those additional funding streams that we win in Europe, without access to the shared facilities, which we would find hard to build or construct all on our own, and whether we would be able to replicate easily the kinds of relationships and partnerships that we have built up over many years with other EU institutions. It is not that we would not thrive or that we would not continue to be a player in science; I think that would be to overstate the case. It is just whether we would be as strong outside as we could be, continuing to build on these relationships that we have put in place over a number of years.

Professor Sir Mark Walport: I agree with all that. Science capability is about three things: the funding, which we have talked about; the people; and the facilities. It is interesting to look at the people. At the moment, 30% of European Research Council grantees working in the UK come from other member states; and 15% of UK academic staff are from continental Europe, which compares with 11% of the whole of non-EU, so not only the funding but the people are very important. Then there are the science facilities, where there are many examples of partnerships with EU. We are very good at science, but we are even better at science because of that participation in European science.

Lord Hennessy of Nympsfield: Minister, nobody is prouder than I am, and I am sure you too, of the "thinking heavier than our weight in the world" factor, the extraordinary value that we get from our science. All the metrics are wonderful, it is the greatest success story, but to call Britain, as you did the other day, a scientific superpower since the Enlightenment has a whiff of hubris about it. If we were such a scientific superpower consistently since the Enlightenment, we would not be going through the agony in relation to civil nuclear power, which we cannot do on our own any more, having led the world for so long. I know that in politics you have to overdo it occasionally, but was it not courting misfortune to use that phraseology?

Jo Johnson: I do not wish to come across as hubristic, obviously, but I do think that we are a very strong player in science and there are facts to support that assertion. We have a very high share—16%—of the most important research globally, and we generate that with a very productive research base that receives only 3% of global R&D spend, so we do generate a disproportionate share of the most important research globally. A 16% share of any economic activity calculated on a global basis I think entitles you to claim to having a certain standing in the world of science, and I think we do.

Lord Maxton: One of the things that tends not to be mentioned, and has not been much mentioned on this, is the input of private investment into research in this country: in other words, major global players, big companies, that put money into research. How much is that, and do you think these global companies will continue to put research money into Britain if we left?

Jo Johnson: That is a very important question. The mix in R&D is approximately one-third public and two-thirds private. Of the two-thirds private, Britain is unusual to a certain extent in that a lot of the R&D that comes from the private sector comes from foreign-owned companies, and of that it is reasonable to assume that a certain amount of that inward R&D into the UK is coming because we are in the single market, because we are a bridgehead into the world's biggest trading area and so on. It is obviously very difficult to calculate how much of that would be at risk, but there would definitely be significant uncertainty over

future flows of that proportion of R&D, and over however much of the rest of it—we do not know.

Lord Maxton: Why would they stay investing when they already have footholds elsewhere in Europe?

Jo Johnson: Those are important questions for the people advocating Brexit to answer.

The Chairman: Lord Ridley, I am not asking you to answer that question.

Viscount Ridley: I want to press Sir Mark on a point he just made about the proportion of people in British labs who are from the EU versus other parts of the world. If you are running a lab and you have the option of hiring somebody from the European Union versus a very talented Indian or American, is there a danger that you might, because it is easier to get the EU person in, recruit him, even though he is not quite as good?

Professor Sir Mark Walport: Having spent a career in science, the quality of good scientists means that the brightest minds will be supported wherever they come from.

Viscount Ridley: Even if it is easier to get through the visa process?

Professor Sir Mark Walport: There are ways in which the UK is open to scientists from around the world.

Viscount Ridley: We are constantly hearing that scientists are very upset about how difficult it is to get people through the visa process.

Professor Sir Mark Walport: One would need to look at individual cases, with respect, but I think that overall the UK is open to scientists, and all the evidence is that scientists are very rigorous in recruiting the brightest minds.

Jo Johnson: Can I come in on that for a second? The facts are quite powerful, I think, in this case. We in the UK give over half of all student tier 4 visas that are issued anywhere in the European Union. We have a system that is genuinely open to international students. We continue to make clear that there is no limit on the number of international students who can come here, and no limit on the number who can stay on and find work, provided they get a graduate job with a sponsoring employer. On the movement of scientists, there are also mechanisms in our visa system to give privileged access to PhD-level people from non-EEA countries; they get preference in the tier 2 route. There are also mechanisms for those coming in on temporary research programmes through the tier 5 route, and there is no cap at all on the number of such people who can come in on the tier 5 route.

Viscount Ridley: So we would be likely to apply that to EEA if we were outside the European Union.

Jo Johnson: That is the regime that applies to the non-EEA countries.

Viscount Ridley: No, I am saying that if we were outside, we would still apply it to the EU and the EEA, probably.

Jo Johnson: With respect to the EEA, we have the advantages of mobility within the European Union, an ability for our research community to hire people from across a body of 510 million people, and we have student mobility programmes that are tremendously beneficial. Some 150,000 EU students are presently studying at our universities, enriching them in all sorts of ways. We have had over 220,000 UK students take advantage of the

Erasmus+ programme over the years. These are really important, mind-broadening opportunities that we do not know would continue in the event of Brexit.

Viscount Ridley: I completely agree that they are wonderful programmes. The question, given what you have just said about how easy it is to get the best minds from anywhere in the world, is: why would it be different if we were not in the European Union?

Professor Sir Mark Walport: It is about the overall quality of the environment, and that also goes to the question that was just asked about private R&D investment, because that is important in relation to where scientists move around. I will read you a quote from the BioIndustry Association's 2014 manifesto: "Europe is the single biggest global market, and access to this market is a key reason for global biopharmaceutical companies deciding to establish their European headquarters in the UK and invest in R&D activities … it is vital that the UK remains engaged in the EU and takes a leading role in shaping legislative and regulatory policy developments affecting the life sciences". The evidence that you had from Siemens again reflected that issue for the industry, so where scientists choose to move is going to be influenced by the overall environment: the universities, the international facilities, the industrial R&D. It is an amalgam of all these that is important, and all the evidence is that EU scientists come here in large numbers at the moment.

Q148 Lord Hennessy of Nympsfield: Does BIS have a contingency plan for the science community if we leave the European Union?

Jo Johnson: This is a question for the whole of Government with respect to the EU referendum and possible outcomes of it. The Government are campaigning for a positive vision for Britain within a reformed European Union, and all efforts are focusing on making sure that we have a positive campaign in which the facts are out there and people are able to make an informed choice.

Lord Hennessy of Nympsfield: So that is a no.

Jo Johnson: Again, it is a decision that relates across the whole of government.

Lord Hennessy of Nympsfield: We have had this line from several Ministers. Why can you not just say, "No, there is no contingency planning"? I invite you to say, "No, there is no contingency planning".

Jo Johnson: We are focused on making the most positive case for Britain's future in a reformed European Union, and all efforts are going on that.

Lord Hennessy of Nympsfield: The Bank of England has elaborate contingency plans. Does it not strike people as odd that Her Majesty's Government do not have any at all? It was the same with Scottish separation: there were two Cabinet decisions specifically not to do any contingency planning for Scottish separation. If I were uncharitable, I would say that it amounted to a dereliction of duty, but I am not uncharitable, so I will not.

Jo Johnson: The question whether it is a dereliction of duty is better directed elsewhere than to the Science Minister. This is a broader policy position across government.

Lord Hennessy of Nympsfield: I know you cannot be an individual today, which is a great pity because I would love you to be, but are you actually happy in your heart of hearts that you are doing the square root of damn all for contingency planning for the science community in the case of Brexit?

Jo Johnson: What we are doing is making sure that the British public is well informed ahead of this important decision on 23 June and in a position, on the basis of the best possible evidence, to exercise an informed choice in this important matter.

The Chairman: Lord Hennessy reminded us that the Bank of England has indeed decided that contingency plans in the event of Brexit are necessary and has put them in place. Given the importance of science to our future economy, its critical role in fact, why is a different decision therefore needed for science compared to our financial system?

Jo Johnson: This is a broader question for government as a whole rather than a specific one for science or for BIS, and I cannot really add much more to what I have said already to Lord Hennessy.

Q149 Lord Vallance of Tummel: Can we come back to business for a moment? We heard in evidence that in Germany the relationship between government, business and the scientific community was more closely aligned than it is in the UK, and that does not seem to have done German industry any harm, not least in being able to attract EU funding. I wonder whether the creation of the catapult centres or the move of Innovate UK from grant funding to loan funding will make any difference in this area, and perhaps see the UK collaborate more closely with Germany in business and science.

Jo Johnson: There are many different models for the relationship between business and the science communities across Europe, and each country develops its own model according to its own history and its own economic geography. In the UK we are adapting certain features that bear a resemblance to the Fraunhofer institutes in Germany through our catapult system, which you mention. We have committed in our manifesto to continuing to build that network out, and we have already taken steps in the first few months of this Parliament to do that, with a new precision medicines technologies catapult in Alderley Park, a precision medicine catapult in Cambridge, and others that are coming down the line. We see that as an important means of providing to businesses access to science and to shared facilities which SMEs on their own simply could not afford to build. It is an important way for us of making sure that we pull research out of the labs and get it into a state where it can help companies to develop prototypes, test concepts, and eventually move closer to market.

The catapult network is important, and we are going to be funding it over the Parliament to the tune of over £1.6 billion over the five years of operation. That includes some private money as well. Other countries have their own models, and there can be helpful learning processes for us to examine them, and we are doing just that in developing our new innovation finance products at the moment. We have looked closely at some trends in innovation finance around the world, and noted with interest that many are moving away from a pure grant-led model towards one with more loan products in the mix. Later this year we will be market-testing these new innovation finance products, which are more loan-oriented in nature, to see what part they can play in our portfolio of products that help support innovation in Britain.

Lord Vallance of Tummel: Do you have any means of measuring the effectiveness of these different models between different countries? One could crudely say: how much EU funding does business get? That would not see the UK in a very good light.

Jo Johnson: There are various indexes of how innovative countries are, which we pay some attention to. They have sub-metrics, which are ones to watch: the proportion of spin-outs

per unit of research money invested, the number of patents per unit of research money invested, the rate of start-up growth, the amount of university business collaboration by value that you are generating in your university system every year. We look at a number of indicators to see how effective our innovation spend is, but it is not something that you can put an easy financial value on.

Lord Vallance of Tummel: Professor Walport, you looked as if you were about to say something on that, but maybe not.

Professor Sir Mark Walport: No, but I am happy to make a few comments. The range of ways in which businesses collaborate through R&D with academia in the UK is very broad indeed. You have the Rolls-Royce model of deeply embedded units in universities; the BioScience Catalyst at Stevenage, which is a partnership between GSK, the Government and the Wellcome Trust; the cluster in photonics around Strathclyde; the cluster in biomedicine around the very strong biochemistry at Dundee; the automotive activity in the West Midlands in collaboration with the universities. The range of business and academic partnerships in the UK is very broad indeed, and as we have discussed the catapults are a very welcome addition to that, but there is a very broad range of different collaborative models, and against all the international scorecards, as you have just heard, the UK is doing well overall in the assessment of innovation. I think overall the UK is doing pretty well in this space.

The Chairman: Minister, you reminded us that different countries have different models, and of course we have changed our model over the last 10 years or so. As Lord Vallance pointed out, we have followed the German model in some ways. We now have the catapult centres, which I think we all accept are an excellent innovation. Likewise, of course, it was only 10 years ago or so that the Technology Strategy Board, now Innovate UK, was brought in. In hindsight, it does seem odd perhaps that it took so long for the United Kingdom to bring these bridges between industry and academia together, and of course our model allowed us to have these centres of excellence at the universities that were brilliant, and remain brilliant, in their research output. Quite frankly, the links with industry were very often seen to be less satisfactory than in some other countries. We are learning on this, we are changing, but we do have a concern that Innovate UK is still a fairly tender plant. It is up for review in a sense under the Nurse review, and there is a suggestion that it might somehow be bedded into Research UK. Are you worried that this might in some way reduce its ability to stimulate industry?

Jo Johnson: Sir Paul Nurse's review presented a very compelling vision of a reshaped UK research landscape, bringing the research councils together so they could be more than the sum of the parts while continuing to maintain their individual identities and individual ability to represent their individual communities. He had the idea of one university with seven faculties. We see Innovate UK's role in the proposed RUK as the commercialisation arm, among other functions, of the research councils, so it would sit beneath the seven verticals as a sort of horizontal function, helping them to make the most of their research and helping business to make the most of the important ideas that are being generated in the research base. We see it as playing a really, really important role in bringing out the impact that our research is capable of and making sure that we find real-world applications for as much of it as is possible.

Innovate UK's distinctiveness as an innovation agency will not be lost. We see it as important that we continue to have an identifiable entity within Research UK, and we would continue to want it to have a clear business-facing focus, and to continue to have its own distinct and separate funding stream, because, as you know, Innovate UK is not presently funded from within the science ring fence, so it would be funded distinctly from other bits of RUK.

Q150 The Chairman: I quite accept that Sir Paul was asked to look at the research councils and come up with models that might further the cause, and I think that Innovate UK's relationship with the research councils, from their point of view, is nothing but desirable. We would like assurance that, given that much research funding does not come from research councils—it can come from charities, from business itself—there must be the ability for Innovate UK to keep a close relationship with these other sources of research funding. Are you satisfied that this closer relationship with the Research Councils UK will not inhibit these other connections?

Jo Johnson: Yes, I very much am. I would like to invite, if I may, Gareth to come in on that and add a bit more colour to it.

Gareth Davies: The main thing I would emphasise is that there are already strong working relationships at the chief executive level between the heads of the research councils and the chief executive of Innovate UK. It is a system where, essentially, good people are working across boundaries. As the Minister said, the goal is to make the collaboration simpler between sectors. On your point, which is critical, the heads of the research councils are not only interested in the funding that they are making in their own individual funding decisions, they also need to be leaders of their subject disciplines in the whole country. They should be world-class researchers in their own disciplines. As such, that relationship between the head of the relevant research council and the head of Innovate UK should involve an overview of the whole of that research endeavour to ensure that we are world class not only in research but in translation and commercialisation.

Viscount Ridley: The moment has passed for what I was going to say.

Q151 Lord Maxton: I am a little unclear, because we keep talking about the UK, but, with all due respect to you, Mr Johnson, you are not a Minister for the whole of the UK; you are a Minister for England very largely. Presumably there is devolved power. For instance, the universities in Scotland are devolved.

Jo Johnson: With respect to science and research, that is a UK-wide reserved function.

Lord Maxton: Even in the universities?

Jo Johnson: We fund science wherever excellence is in the UK.

Lord Maxton: In that respect, but part of your remit is not that, is it?

Jo Johnson: On higher education that is clearly devolved, but science and research funding is reserved.

Lord Maxton: Do you benchmark support that government gives to businesses in the way the rest of the European countries do not? Have the changes that have been made in support from the switch from the regional development agencies to local enterprise partnerships made any difference?

Jo Johnson: Gareth has the history of the changes since the changes to the RDA, so I will ask him to come in on that.

Gareth Davies: The critical issue here is the local enterprise partnerships and the role they play effectively in defining and promoting the offer to businesses in their local areas. Some £2 billion of funding—we are looking at growth deals—has gone through those LEPs. Critical, though—and this brings in the wider connection with science and research funding—is the smart specialisation strategy, which we touched on earlier. At national level, we are supporting the local enterprise partnerships in their smart specialisation strategy. This is critical to being able to bid successfully for £600 million of European innovation funding. What is important is that local areas need to know what their comparative advantage is relative to other areas in the country, but also internationally. The Minister recently also launched the science and innovation audits, which are part of that strategy to look not only at the public assets, infrastructure and funding but at the business assets and, potentially, into areas led typically by leading universities to come into consortia to identify what their comparative advantage is from a world-class perspective. I have been speaking to areas in the north-west, Liverpool—Sir Mark and I were at Leeds recently—and looking to them to think about what their comparative advantages are, where they can build on that area of comparative strength and where this needs to go in supporting those areas as they bid in through structural funds but also in giving a longer-term strategy through Horizon 2020 and bidding into our own domestic research funding.

Q152 Lord Vallance of Tummel: This comes back to my question about Germany. In Germany there is a very intimate relationship between government and business, and government will help business in a big way to see its way through to get funding. It is a well-established system. Here one gets the sense that the system is not so well oiled and, indeed, that since the RDAs have disappeared that a cog has dropped out of the engine. Am I wrong?

Gareth Davies: I see this as a critical role for Innovate UK. As the Minister was saying, Innovate UK's relationship with business is key. We have asked them, along with the NCUB, to create smart specialisation hubs, which essentially are the gateway for accessing both how to develop their smart specialisation strategy and how to reach in and access Horizon 2020 and the structural funds. It is very fair to say that we are looking to ensure that Horizon 2020 is as simple and non-bureaucratic a process as possible for business to access. More needs to be done, and our voice through the EU enables us to reform and simplify that programme. Locally, business support comes through Innovate UK, its partnership with the NCUB and the knowledge transfer networks, which recently celebrated their 40th anniversary and are seen as a very successful part of the science and innovation landscape, particularly the partnership with business.

Q153 Lord Kakkar: It has been suggested during this inquiry that the UK Government absorb scientific advice into policy more readily than the EU in general, that therefore there could be a risk that UK policy is made less effective by compliance with EU directives that rely on an EU model of scientific advice that is quite different from our own, and that therefore we are potentially disadvantaged. Minister, do you have a view on that?

Jo Johnson: I can say that we welcome the recent introduction of the Scientific Advice Mechanism and the presence of Dame Julia Slingo as one of the members of the high-level group. It is good that EU policy-making is going to be informed by the best possible scientific

evidence. We welcome this direction of travel. Commissioner Moedas is taking lots of positive steps in this respect, and a lot of his work should be warmly welcomed. If I may, I think Sir Mark has a valuable perspective on this as a provider.

Professor Sir Mark Walport: Thank you very much indeed. First, the Scientific Advice Mechanism has been established in Europe for a much shorter time than in the UK. We have a history of 50 years of a very well-embedded system that involves not only a Government Chief Scientific Adviser but departmental chief scientists, scientific advisory councils and committees. The EU is going through a process in which it started with a single scientific adviser, Anne Glover, who was not supported by a substantive secretariat, to a model that now brings together a committee of seven people, as the Minister has said, strongly supported by a secretariat and by Commissioner Moedas. The UK has had a very substantive feed into that process. Sir David King was involved in advising the Commission and helping to select that group of science advisers, chaired by Professor Wegener.

All the evidence is that the Commission is taking scientific advice very seriously, and there is a new mechanism. It has consulted very extensively. I met Director-General Robert-Jan Smits last June to provide information on the UK system. Our officials remain in touch. As you have heard, Dame Julia Slingo is a member of the high-level group. All the evidence is that it is moving in the right direction.

The second part of your question is whether UK policy is made less effective by compliance with EU directives. In some ways that is a different question. One could look at three areas where the EU directives are very important and the UK has played an important part. One could look at the data protection regulation, the invasive non-native species directive, which was pushed for by the UK, and the clinical trials directive. These are all important directives.

If we start in reverse order, the development of drugs is a global activity, so having a European market and clinical trials directive that works is very important for the UK. As a number of your witnesses have emphasised, harmonisation is extremely important to help this happen. A new clinical trials regulation, which was approved in 2014, comes into force this year, which is aimed at cutting the bureaucracy of the old directive. It streamlines the authorisation process for drugs trials, cuts red tape for products, and simplifies reporting.

On the data protection regulation, where there was a lot of toing and froing and an eventual trialogue, on research the UK played a leading role in Europe in bringing together European science bodies and putting the regulation into a good shape in supporting the responsible use of data for research.

The case of the non-native species directive is an important one, because if there is one group of organisms that does not mind about borders it is invasive species. There is a whole string of those. The UK is widely recognised as having very good practice. It was as a consequence of our pressure that there was a draft regulation in 2013, and it came into force on 2 January 2015. The GB strategy is widely held to be one of the best in Europe, and many of its features formed the basis of aspects of the EU proposal. On 4 December, 37 species were adopted by majority and the UK voted for the list. It is an example of a directive that is important to the UK and that came about by our membership of the Union.

Q154 Lord Kakkar: Could I come back to the new Scientific Advice Mechanism that has been established in the European Commission? We heard some evidence that there are potential concerns about the balance between it being a proactive mechanism that will look at topics

and take them to the Commission, and a reactive one that responds to questions that the Commission may put to it. Do you have a view about that? Secondly, what interaction do you think there will be between other European institutions—the European Parliament, for instance, and the Council—with regard to the Scientific Advice Mechanism as opposed to its relationship with the Commission?

Professor Sir Mark Walport: Dame Julia gave you evidence, and she is the most direct source. The important issue for science advice is that it has a customer at the other end. There is always an element of toing and froing and discussion about the areas where science advice is important. Two areas they have been asked to look at are cybersecurity and real-world CO_2 emissions from light vehicles—a topical topic. I am aware that there is also discussion. It will be an iterative process of discussion between the Scientific Advice Mechanism and the Commission itself.

Lord Kakkar: In our own country with a very mature approach to and mechanism for science advice across all government departments, as you said Sir Mark, what is the opportunity for the scientific advice mechanisms that we have to contribute to thinking about now with this European mechanism as it goes forward? Is there any proposal that national Governments would be able to interact their science mechanisms with what is being developed in Europe?

Professor Sir Mark Walport: The first thing is that they are looking at bringing chief scientific advisers together from different European countries. That was something that Anne Glover initiated, and it is likely to happen under the new mechanism. There will be a direct relationship between the Scientific Advice Mechanism and individual national scientific advisers.

The second thing is that, as part of the Scientific Advice Mechanism, national academies across Europe are also being brought into play. There are many different forums where science advisory systems in individual countries will come together with the European mechanism.

Q155 Viscount Ridley: Can I pick up something you said, Sir Mark? I wonder whether you are putting a slightly different gloss on it from what we have heard. I have no quarrel with the invasive species directive, but in the case of the clinical trials and data protection directives you have made it sound as though there were good directives that we approved and made better. The evidence that we have heard has been compelling that in both cases they were disastrous directives, which we made slightly less disastrous. In the case of the deliberate release of GMO directives, they are still disastrous. We heard that in our previous inquiry on GM insects.

Professor Sir Mark Walport: The issue is where they end up. The data protection regulation started with a position on research that the UK supported when it came out of the Commission. It then was modified in the Parliament to a position that the UK was much less keen on, and as a result of subsequent work with the Government it ended up in a position that the UK is supportive of. Directives always, in their evolution, go through phases that we and other countries may not be happy with.

Viscount Ridley: You say that what counts is where they end up, but in the case of the clinical trials directive a lot of harm was done and a lot of good research was set back by the fact that it came in in a bad form.

Professor Sir Mark Walport: I guess the issue is that whether we are in or out of Europe, the clinical trials regulations in Europe will matter hugely to us because it is one of the major markets of the world.

Viscount Ridley: One of them.

Professor Sir Mark Walport: It is the reason why the pharmaceutical industry has given you evidence that it believes that the UK is an important place to be. Therefore, our opportunity to influence directives is a very important one.

Viscount Ridley: On the deliberate-release directive, we are seeing fantastic British technology having to be tested and applied outside Europe.

Professor Sir Mark Walport: As you know, on GMOs a position of subsidiarity has been reached where individual countries can take their own decisions.

Viscount Ridley: We heard that it is not working.

Professor Sir Mark Walport: The system is that there is a European approval mechanism and individual countries can opt out. This is something that we have discussed here before. Different countries have different value systems in relation to these.

Q156 Lord Hennessy of Nympsfield: Sir Mark, as our inquiry has unfolded, I have acquired the impression—I do not know if my colleagues have—that our scientific relationship with the European Union is much less jagged than so many other of our relationships in this great 43-year psychodrama that we have been living through. Do you think it is a fair observation that this is an area where relative harmony and good things have emerged in contrast perhaps to others?

Professor Sir Mark Walport: I can comment on our science in a positive sense, but I do not think I am qualified to comment on all other areas. It is true that the scientific community works closely in Europe. It influences policies for science in Europe. As you have heard from the Minister, it has been a significant beneficiary of the European funding system for excellence, and it has profoundly influenced it. The European Research Council in its existing form recognises to a significant extent the emphasis of the UK and some other countries in Europe on supporting the brightest and the best. It is true that the scientific community has strong relationships with Europe. I cannot comment on all the rest.

Lord Hennessy of Nympsfield: Have you anything in the back of your mind that if as a country we stay in, on your side of the house, we could bring an initiative to Europe that would not be whingeing, carping or reluctant and that would take them by surprise? Just think of the shock value of coming up with something positive in the aftermath of a vote to stay in. Do you have a cunning plan forming in your little grey cells?

Professor Sir Mark Walport: I was going to say that I thought that was more a comment than a question, with respect. No, I do not think there is a plan at the moment.

Q157 Lord Cameron of Dillington: This question has already been answered, but in case you have anything further to add I will ask it again. Public funding for science is lower in the UK than in other major economies. If you add that fact to Borys's comments—the Cambridge Borys, to use Mr Johnson's words in his article, Professor Sir Leszek Borysiewicz, —that, “The total source of funding from all European-based funding is equivalent to having another research council”. Do you think that those two facts influence the science community's

enthusiasm for EU funding? In other words, is it the lack of UK funds that makes them take their decision?

Jo Johnson: I think it is the additionality of it, and the fact that they are doing important work and we are very successful at winning an outsized slice of this money. Our universities and science base benefits from a very significant chunk of additional money. As I said before, it would be rash to pretend that it would be easy to replace it in the event of Brexit when we would not know what other claims there might be on the public purse, nor what state our economy would be in.

Q158 Lord Hennessy of Nympsfield: If we stay in, do you think we should aim to increase the number of EU scientific facilities based in the UK? I spent a fascinating day on Friday at the Joint European Torus at Culham. I think I am right that it is the only one of any size that we have acquired during our 43 years of membership. It is a remarkable thing, and very significant, but only to have the one over 43 years, given our prowess as a scientific nation, is a bit breath-taking.

Jo Johnson: It is horses for courses. The UK looks at these opportunities on a case-by-case basis, and where it is good value for us to bid to host them, we do. It is good that the JET fusion energy facility in Culham is there and doing important science.

Lord Hennessy of Nympsfield: That was a 1978 agreement that it should come there. That is a long time. We have had none since.

Jo Johnson: That is the whole point; we have access to shared facilities across an entire continent and do not necessarily have to build them all in the UK. Our science base has access to shared facilities of all sorts across the European Union.

Lord Hennessy of Nympsfield: Would you like rather more?

Jo Johnson: Where it makes good sense on a value-for-money basis to locate them physically in the UK, we will certainly continue to look at them, but we need to be in the European Union to have that sort of option.

Lord Hennessy of Nympsfield: Precisely.

Q159 Duke of Montrose: Rather like Lord Cameron, a great many answers have been given to the questions that the Committee wants on the record. I should say that I receive funding under the common agricultural policy and the rural development programmes. We have observed a strong consensus from across the science community—academia, industry, charities—of the value of freedom of movement across the EU for science, research and innovation. Do you agree with that position? Perhaps one of the reasons why researcher mobility is valued so strongly is because the UK's international visa system is not fit for purpose. Is this accurate?

Jo Johnson: No, I really would challenge that. As I said in an earlier answer, there is strong evidence that we continue to punch well above our weight in attracting people to this country from outside the EEA. Half of all EU visas issued to people of university age are issued by Britain. That is an astonishing statistic. They are attracted to the excellent universities that we have in this country and the great higher education that you can receive here. After university age, as I said earlier, we have adjusted our visa regime to make it easy for people with PhD qualifications and eminent scientists of all sorts to come here. Special

privileges are accorded to them in the tier 2 route, and the tier 5 route is available for those coming on more temporary exchange programmes. We do feel that we have a competitive offer. We are always looking for ways to illustrate that we are open and that we want the brightest and the best to come and study and train our young people.

Duke of Montrose: Can I come in with a supplementary of my own? At the moment a great deal of our economy depends on our service industry, which will probably be shortly taken over by IT where a little man somewhere on the other side of the world will press a button and get the answer that presently comes from a very knowledgeable person in London. In the event that we have to think of where the emerging economies of China and India are going to take us, is the scientific community better in Europe or outside, free from the various constraints that you have given us?

Jo Johnson: I think we will develop faster relations with these big emerging or emerged economics if we are in the European Union, because we will have the full weight of the trade bloc behind us when we are negotiating access to their markets. That will strongly facilitate our entry into these markets. We will get better trade deals as part of the EU than we would negotiating them as an economy of 70 million people. It is not mutually exclusive. Our membership of the European Union facilitates better relations with these markets for our exporters, and in the other direction it is unarguable that we get this outsized slice of inward investment from India, for example, that invests more in the UK than it does across the rest of the European Union, because we are in the single market and their firms can use London and the rest of the UK as a bridgehead into the rest of this big trading area that is the European Union.

Q160 The Chairman: Could I move on to a very topical issue, which is relevant not just to this inquiry but to all inquiries of Select Committees, and that is the guidance issued by the Cabinet Office on 6 February to government departments requiring them to add an anti-lobbying clause into the conditions attached to all new or renewed government grants to public bodies and charities. I understand that this clause is intended to prevent these bodies from using public funds to influence Parliament, Government or political parties. While one immediately realises that this is a perfectly well-intentioned proposal, it might have impact on evidence to Select Committees such as ours. In this inquiry, we have had evidence from organisations in receipt of government-department grants. The devil is clearly in the detail. There is a lot of concern about unintended consequences and enforcement difficulties. We are aware that BIS is working to address this situation. What type of solution, given the opportunity for total chaos, is BIS coming up with?

Jo Johnson: We recognise that this is an important issue. The Government are introducing this measure to address the potential for the misuse of public funds—money being used for purposes for which it was not granted. We are looking very carefully at the guidance issued by the Cabinet Office on exemptions to this policy. We are in discussions with stakeholders to determine exactly how this might apply to the research base, knowing, as we do, that the research base, scientists and academics make a tremendous contribution to the development of evidence-based policy. We want to put in place an exemption that continues to allow that to be possible within the framework of tight management of public money. If I may, I will invite Sir Mark to give his perspective on this question as well.

Professor Sir Mark Walport: Thank you very much indeed, Minister. In the context of R&D by individual government departments, that is commissioned to answer the scientific questions that they face on bovine tuberculosis, climate or other areas. There is an important distinction between the communication of the evidence, which obviously government wants to be done and needs to be done in as transparent a way as possible, and there is the lobbying for advocacy for individual policy positions, which is slightly different. The purpose of the R&D is to provide the evidence that the Government needs. That is the key issue.

The Chairman: It is the key issue, and that clearly is what Select Committees will be concerned about, as indeed will academia and other organisations. We need to understand much better. I think it would have been helpful if there had been much wider consultation before the Cabinet Office came up with this worthy cause. When you say that there will be exemptions, are we talking about blanket exemptions, case-by-case exemptions? What happens when exemptions are not given? What additional administrative workload will fall on BIS, or for that matter the Government Office for Science, in monitoring and enforcing these new clauses? How will this be funded? What penalties will you impose on bodies that do not adhere to these conditions of grants? These are all important issues that we need to understand.

Jo Johnson: Indeed they are, and they are the issues that we are discussing now with the Cabinet Office: how we might secure exemptions and/or qualifications to the clause. We will be discussing exactly how exemptions or qualifications might work for the stakeholders, so we address the concerns you mention.

The Chairman: What impact do you expect it to have on the ability of Select Committees to do their work?

Jo Johnson: We would not expect it to have an impact. That is not the intention of the policy. We will give consideration to that in light of your concern.

Lord Hennessy of Nympsfield: I am sure you have very powerfully picked up the anxieties in the learned societies about this, as indeed I have. I have two points. It struck me, when it first emerged, as showing a remarkable lack of self-confidence on the part of Her Majesty's Government. In an open society, you put up with that, do you not? It is part of the toing and froing. It might be deeply irritating, and the form in which lobbying can take would put your teeth on edge, but surely in the norms of an open society it is rather central. Where does the duty of speaking truth unto power, which Mr Davies and Sir Mark have in abundance in advising you, for example, end and lobbying begin? How on earth can you police that boundary?

Jo Johnson: These are important questions. The intention of the policy, as the Chairman said, is to make sure that money is spent for the purposes for which it was allocated. When money is allocated for research, the money should be spent on research; it should not be diverted to objects not related to the original grant. That is a fairly important principle of managing public money, and we want to make sure that applies consistently.

Viscount Ridley: In contrast to my neighbour here, I am impressed that this is not about stopping people lobbying but about stopping people using money that was given for one purpose for lobbying instead. There is nothing to stop an individual from an organisation

using his own money to buy his own train fare in his own time to come and lobby a politician. Is that right, or have I misunderstood?

Jo Johnson: The finer details are to be determined as we take this forward and it is introduced. I do not want to give any definitive statement on that.

The Chairman: The words "sledgehammer" and "nut" come to mind. As I understand it, this is seeking to address inappropriate lobbying with public funds. To what extent has this been a problem?

Jo Johnson: It is important to make sure wherever we can, at a time when we are making significant savings across government, that public money is spent for the purposes taxpayers understand it to be allocated for. That is pretty important. We want to make sure that wherever there is misuse of public money we crack down on it. Clearly, where it is going to create problems for academic freedom of expression we will take that very carefully into account in discussions with the Cabinet Office as we consider requests for exemptions or qualifications to the clause.

Q161 The Chairman: Clearly the opportunity for unintended consequences, as I think you have recognised, is very great. There is a responsibility somewhere in government to come up with a solution to this self-imposed problem, as I would describe it. Where does the authority for coming up with a solution lie?

Jo Johnson: It will be collectively agreed across government. It is a Cabinet Office-led policy, but all requests for exemptions would be agreed on a cross-government basis as usual.

Lord Hennessy of Nympsfield: I cannot believe that it would have been generated in your department. Did it come as rather a shock to you when it emerged from the Cabinet Office?

Jo Johnson: We recognise the strength of feeling and legitimate concern in the scientific and academic communities generally. We do not want to limit freedom of expression or constrain academic research in any way. We will make sure that the exemptions have that effect. It is legitimate for government to crack down on abuse of public money wherever it is in the system, and the anti-lobbying clause that is coming into force has that objective in mind.

Lord Hennessy of Nympsfield: Has the National Audit Office produced any evidence that there is this level of abuse?

Jo Johnson: That is for the Cabinet Office to comment on. I am not aware of it, but I am sure that officials and Ministers in the Cabinet Office will be across that.

The Chairman: Perhaps we should ask your colleague from the Cabinet Office to come and give evidence to us.

Lord Maxton: You are publicly funded.

Jo Johnson: We are publicly funded, yes.

Lord Maxton: So you cannot lobby.

Jo Johnson: Mark?

Professor Sir Mark Walport: My job is to provide advice to government. I do not comment publicly on government policy, as you know.

Government – Mr Jo Johnson, MP, Minister of State for Universities and Science, BIS, Professor Sir Mark Walport FMedSci FRS, Government Chief Scientific Adviser, Government Office for Science and Mr Gareth Davies, BIS – Oral evidence (QQ 144-161)

The Chairman: We have probably exhausted this. We have concerns, and indeed the concerns are widely shared. I am confident that you will be addressing this issue with your colleagues in the Cabinet Office. We wait with interest to make sure that it does not impact on our future work. We have exhausted our questions. I hope we have not exhausted you. Thank you for the very forthright way the three of you have answered the questions. We are most grateful. We now have to go away and write our report. Thank you very much indeed.

Government – Professor Sir Mark Walport FMedSci FRS, Government Chief Scientific Adviser, Government Office for Science, Mr Gareth Davies, BIS and Mr Jo Johnson, MP, Minister of State for Universities and Science, BIS – Oral evidence (QQ 144-161)

Transcript to be found under Government – Mr Jo Johnson, MP, Minister of State for Universities and Science, BIS

Professor Robin Grimes, Foreign and Commonwealth Office (FCO) – Oral evidence (QQ 117-127)

Evidence Session No. 11 *Heard in Public* *Questions 117 - 127*

TUESDAY 23 FEBRUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Kakkar
Lord Maxton
Baroness Neville-Jones
Lord Peston

Examination of Witness

Professor Robin Grimes, Chief Scientific Adviser, Foreign and Commonwealth Office

Q117 The Chairman: Welcome back, Professor Grimes. It is splendid to have you back in our midst, particularly to help us in our inquiry on matters concerning the European Union and science in this country. We are particularly glad that you are able to help us today. We are being broadcast in the normal way, so to start proceedings please introduce yourself for the record, and if you would like to make any opening statement, please do so.

Professor Robin Grimes: I am very grateful to have the opportunity to give evidence to the Committee as the FCO Chief Scientific Adviser, following permission from appropriate Ministers in the FCO. My remarks are also going to be informed by my experience of working with EU and non-EU partner countries through my role as a professor at Imperial College. As the FCO Chief Scientific Adviser, I work very closely with the UK Science and Innovation Network, which I know you are familiar with. It has about 90 officers in a variety of different countries, but 15 of those officers are based in eight EU countries, and they are co-ordinated by a lead based in Berlin. That network promotes policy exchange as well as partnerships in science and innovation with traditional scientific powers, but also in key emerging economies, which is very important.

I have been in the FCO for three years. My other day job, as it were, is as Professor of Materials Physics in the materials department of the Faculty of Engineering at Imperial College. I run a research group using advanced computing techniques to predict materials' performance. As an academic, I have published work with colleagues in France, Germany, Spain and Sweden as well as with other people from countries outside the EU.

The Chairman: Thank you very much, Professor Grimes. That is a very helpful start. I would like to start our questions by touching on what one might describe as science diplomacy, particularly whether as a country we are making the most of the international scientific diplomatic opportunities afforded by our membership of the EU, and in particular the opportunities we have from the European Union's involvement in the UN agencies. Perhaps I should declare an interest, because at one time I served on one of the UNESCO committees, the Commission on Ethics of Science and Technology. But it is really wider than that. We are now members of UNESCO, the World Health Organization, the Food and Agriculture Organization, the World Meteorological Organization and such like. Would you say that we are making the best use of our membership of these organisations, and how does our membership of the EU impact on this?

Professor Robin Grimes: We have excellent scientific connections with all the countries in the EU. I have already mentioned the Science and Innovation Network as being at the fore in promoting these. Of course, there is also our involvement in the research councils and other agencies, and you have mentioned some. While it is always possible to do more, and clearly we are always looking for new opportunities, I think we are taking opportunities and using robust evidence to underpin our science diplomacy efforts.

You asked about science diplomacy specifically, and it is useful to try to define what we mean by science diplomacy, because it is a bit of moveable feast at the moment, as I will explain. A didactic definition would be science in diplomacy, which is evidence-based policy-making where the science informs policy objectives. Then there is diplomacy for science, which is making sure that we in the FCO in particular are taking action to support scientists so that they can achieve their goals. Finally, there is science for diplomacy, which is the idea that scientists get on with their collaborations across borders. That can give confidence to negotiations and relationships between countries. It is a sort of beachhead, particularly in more politically difficult circumstances. That is one way of looking at it.

I want to get on to an idea of a less prescriptive definition, because we are in the process, with our colleagues in the EU countries, of getting a much richer definition of what science diplomacy means. This is going to emerge, particularly in the way science diplomacy and, for example, international development diplomacy start to overlap. That relationship with our colleagues in other EU countries is very important in allowing us to do that.

The Chairman: Thank you for that. I suppose the matter of the greatest interest to the Committee is the extent to which our membership of the European Union helps in our interactions in these areas of science diplomacy. Clearly, whether we are in or out, we are going to be members of the WHO and of UNESCO, one imagines, but in your perception is there anything added by our membership of the European Union? Are we more effective as a contributor? How do we compare with other member states in impact?

Professor Robin Grimes: From my perspective as FCO Chief Scientific Adviser, I think we capitalise very well on these activities. I do not know of any other state that I would say capitalises more than we do. There is no formal EU programme called EU Science Diplomacy at the moment, but there are areas where our science evidence will underpin diplomacy that we have carried out bilaterally and as part of the EU, and we are more powerful as a result. A good example of that would be climate diplomacy. Key to this is the fact that we work hard to ensure that the scope of framework programmes is in line with UK priorities; and because the UK has many world-recognised scientists, UK scientists occupy key positions in a range of

EU research and advisory bodies. An example is Dame Julia Slingo from the Met Office, who is one of the seven members of the new EC Scientific Advice Mechanism's High-Level Group, which is a bit of a mouthful. Of course, we also lobby bilaterally, such as through our overseas network, which I just mentioned, and which helped recently to secure the headquarters of the Square Kilometre Array, so we have both these activities.

Q118 The Chairman: This Committee has wrestled recently with the issues of genetic modification and the failure, quite frankly, of the Commission to persuade the Council of Ministers, and certainly the European Parliament, to take the line that it would have preferred. We saw evidence therefore that there was disinvestment in Europe, particularly in this country, where, not unnaturally, some of the companies involved in this area decided it would be preferable to make their investment elsewhere. It was clear from the Ministers that we were making common cause with some but by no means with all countries. A number of countries clearly adopted a policy that did not appear to be evidence-based. In these circumstances, how do we make common cause within the European Union with countries that might be more likely to follow an evidence-based policy?

Professor Robin Grimes: We are not obliged to follow a relationship with all the countries in the EU. We can follow bilateral agreements as we wish to, so there is nothing stopping us from separating out certain issues, such as the one you have mentioned, to discuss with specific bilateral countries.

Lord Hunt of Chesterton: I used to represent the UK at the WMO, and we always had observers at those meetings who came from the EU or European institutions. Clearly, the European Commission has observer status sometimes and the European Centre for Medium-Range Weather Forecasts would come and so on. My impression then and now is that that needs to be thought about. Do you have a view about that? In another Select Committee we heard about the European Commission wanting to have observer status in the Arctic Council, where it does not have it for certain reasons. Do you have a view on this triangular relationship between the UK, the EC and UN bodies?

Professor Robin Grimes: I think we gain tremendously from being able to negotiate as part of an EU bloc. We were specifically part of that bloc for the negotiations for COP21, for example, which gave us considerably more clout, and the negotiations were very successful. However, as I said, we can also have separate negotiations with countries and come to bilateral relationships, and we can act through the UN. I have no doubt that we will continue to make the most of those three areas together, and being part of those three areas gives us a synergy that we are able to exploit more readily. We are also able to gain information from being part of those three groups and to compare and contrast.

Lord Hunt of Chesterton: You have chosen the climate example, which seems to be an ideal area where everybody worked together on policy. But in dealing with, say, nuclear waste or GMOs, there seem to be some big strategic scientific diplomatic issues, which, as our Chairman pointed out, are not so satisfactory, or not so clear anyway.

Professor Robin Grimes: We always have to make sure that we adhere to the principle of robust scientific evidence. We must continuously collect that evidence and put that evidence forward. It always has to be predicated on the best-quality science. In the UK, we are very fortunate that we have many outstanding scientists, universities and research institutions that can collect that evidence on their own, as well as through bilateral relationships and

mechanisms such as the framework programmes, to give us the body of evidence that we can continue to use to forward our claims and wishes with regard to all the issues that you have talked about.

As you are well aware, science is not something that you come to an immediate consensus on. It takes quite a long time. Sometimes the evidence that you get allows you to modify your position, and you are required to modify your position because that is what the evidence tells you to do. It is not a single thing; it is a continuous process.

Lord Hennessy of Nympsfield: Can I follow up with a thought on what you just said about robust scientific evidence predicated on the best-quality science? I am an arts and humanities person, and I have often been intrigued by the nature of science, without understanding it. One of the fundamental characteristics of the EU is the consensual approach that you have just described. I remember the line of the great Richard Feynman when he was part of the investigatory team into the Challenger disaster. Somebody was trying to influence the nature of the report, and he said, “Nature is not fooled”. In arts and humanities, you can play around and it is part of the nature of the game to do all this, but in science I have always thought that if you have a consensual organisation it could be nonsense on stilts because it does not fit the evidence, but it is still a consensus. Is it not a perpetual problem for you that you have people such as yourself in Europe and your fellow chief scientists here who are evidence-driven, which is the alpha and omega of your craft, and you have a political class that very often goes for policy-based evidence, and it can sing itself the most deceptive lullabies? How do you reconcile that, because above all as a scientist you have a duty to speak truth unto power?

Professor Robin Grimes: You do. The position Feynman was in was that they needed to come to a position with respect to the Challenger disaster and they had to do it quickly, so they had to formulate and present the evidence they were gathering within a short period. Often science evolves, and I am not sure that humanities and science are always quite as different as they are portrayed. Personally, I am not a believer—and I wear a very personal hat here—in the two societies type of approach of—

Lord Hennessy of Nympsfield: Two cultures.

Professor Robin Grimes: Thank you, the two cultures of CP Snow. I am afraid I do not adhere to that at all. I think there is tremendous commonality. With science, over a period, as evidence is collected, the position can change. You are right that we have a duty continuously to produce and argue that evidence, but we have to make people understand the nature of that scientific process, and I think the new body of scientific advice that I mentioned earlier on with the long name is one way in which we will do that. The EU is currently going through the process of understanding what that new committee will do and how it will work, and it is experimenting to a certain extent with how to get scientific evidence in. So I am very positive that this is going in the right direction.

Q119 Lord Peston: I have always taken it for granted that scientists engage in the pursuit of truth. They do not necessarily find it, but that is the business they are in, whether they are natural scientists or social scientists. Having advised Ministers myself, my experience is that that is not what Ministers are about, and the problem is that if you insist, especially as a junior adviser, on telling them the truth, you know exactly what will happen: they will not listen to you any more and you will not be invited to meetings or anything. Does that

correspond at all to your experience? If you were to tell the Foreign Secretary this or that and he just did not want to know, what would happen?

Professor Robin Grimes: That is a different issue with respect to the European agenda that you are talking about.

Lord Peston: I know, but some of it arises in a European context, as you will see when we come to the question that I will put to you about the deal that was done. There is a European context for all this.

Professor Robin Grimes: I am a Chief Scientific Adviser, and as such it is my job to advise Ministers within the Foreign Office so that they have access to the best evidence and the best networks of scientists in order to inform their policy-making. It is not my business to tell them what the policy should be; it is just to make sure that they have that evidence. If they choose to use that evidence, that is good. If they are unable to choose to use that evidence in those circumstances, they are the Ministers and that is their decision, and as a Chief Scientific Adviser you must accept that.

Lord Maxton: As possibly the only member of the political classes in the Committee—

Baroness Neville-Jones: No, I, too, have been a Minister.

Lord Maxton: You have, that is right, but could I ask that very basic philosophical question: what is truth?

Professor Robin Grimes: What is truth? Gosh, there is a question I was not expecting to get this morning.

Lord Maxton: I am afraid Lord Peston raised it.

The Chairman: Shall we allow you a stay of execution on that? I think we will leave that one on the side, if you do not mind.

Lord Hennessy of Nympsfield: Tell us the meaning of life while you are at it.

Professor Robin Grimes: I think this is one of those questions where I have to say that I will get back to the Committee with an answer when I have worked it out.

The Chairman: All you need to do is refer us to some philosophical works.

Lord Kakkar: Could I pick up on this question of scientific advice in the development of policy? There will be policy development at a European level that eventually results in directives or regulation transposed into UK domestic law, and that will be informed by a European scientific mechanism. Do you think there has been a tension here and that if those same policy issues were being formulated at a UK level, the degree of scientific input in forming that policy would have been different and might have resulted in different legislation that might have been better informed?

Professor Robin Grimes: I do not have any evidence to hand to support that either way. At the moment there is a process evolving for scientific evidence, but of course that is on top of the ability of scientists to provide evidence, both written and oral, to the EU. We wait to see how it evolves over time. I am satisfied that we can get our evidence through a number of different mechanisms, and in collaboration with our colleagues in other countries in Europe, to where it needs to get to. So I am not overly concerned at the moment. It is different for the UK, but different does not necessarily mean worse. In fact, having different ways of doing these things is often beneficial.

Q120 Baroness Neville-Jones: Professor Grimes, you said earlier that nothing stopped you from having bilateral consultations with other member states, and evidently that is the case. I would have said that bilateral lobbying and consultation are normal parts of the way in which legislative proposals come about. It is a dialogue sometimes between Commission officials and member-state officials. How big a part does the role of talking to other member states play in the way in which the UK goes about trying to get the right outcome on a directive or a regulation?

Professor Robin Grimes: Specifically for the EU?

Baroness Neville-Jones: When it is important to try to get the right scientific input into a particular legislative proposition or proposal, how active is the UK? You have talked about the network. How actively do you mobilise that in order to get the right outcome?

Professor Robin Grimes: The Science and Innovation Network, for example, works very hard to ensure that UK scientists spend time in a number of different countries, including meeting Science Ministers and senior officials in other countries to try to get our ideas over to them on a bilateral basis—I have done a lot of that sort of work over the last three years—and to ensure that when Ministers, particularly Science Ministers, from other countries come to the UK they can get their points of view across. The Science and Innovation Network in particular is a very effective way of doing that.

Also, of course, organisations such as the research councils have been very good at ensuring that our scientists talk to scientists from other countries, and we have bilateral missions all the time. Of course, the scientists themselves in those countries influence their Ministers, so there is also a second-order effect in how we get that influence in. The movement of those people backwards and forwards has been very successful indeed. Of course they do that normally through conferences and so forth, but, as I said earlier, you want lots of different mechanisms that you can exploit, because the synergies between those mechanisms really work to our advantage.

Baroness Neville-Jones: Is there anything missing in the scenery that you would like to see?

Professor Robin Grimes: I do not think there is anything missing, but, again, I go back to the concept of the evolution of the process. Because science is evolving all the time and there are new challenges occurring all the time, I am sure that this time next year we will be concerned about another scientific issue that we are not even very aware of yet. Talking to those countries, and developing those foresight activities in particular, will give us a better forward look. People learn science in different ways in different countries. They approach problems in different ways. They have different problems. The fact that we can interact with them, particularly through framework programmes, means that we get better forward understanding of what might be coming up. That is one example of the synergies that I talked about.

Q121 Lord Hunt of Chesterton: From my experience of being at the Met Office, which is a government public body that does a lot of administration as well as science, that works very easily into the UN system and is much more powerful. For example, the World Meteorological Organization spends six times more on meteorology than it does on hydrology, which I think is a scandal. The reason why so little money is spent on hydrology is because back in the UK this is under the research councils, and the research councils, in my experience, are much less interested, if not uninterested, in the role of UN agencies as

compared with government agencies such as the nuclear regulatory people. Our question here is: does the FCO scrutinise the budgets and priorities of UN agencies? In my experience, the answer is no or not very much.

Professor Robin Grimes: I would disagree. I think the FCO scrutinises closely all the international budgets for which it is responsible.

Lord Hunt of Chesterton: There has never been an a priori discussion about how much we should spend on meteorology or hydrology, for example.

Professor Robin Grimes: I do not know the specifics for meteorology and hydrology, but we discuss and co-ordinate with our EU partners on international organisations' budgets where appropriate, although I admit I do not know the details of what you are talking about.

The Chairman: Baroness Neville-Jones, perhaps you should ask the rest of the question.

Baroness Neville-Jones: Yes. Thank you, Lord Hunt. Can I return briefly to the question of the relationship between EU membership and activities with the UN agencies? In a sense, this is a mundane "How does it work?" question. Is there co-ordination between EU member states when you are looking at the work of the UN agencies or trying to persuade them to do something, and is that co-ordination effective?

Professor Robin Grimes: We have bilateral relationships, and those bilateral relationships also work through the EU in our national capacity. I would say that the EU is an important vehicle for delivering the UK's objectives through the UN. It co-ordinates closely on a whole range of issues. Again, I would come back in particular to the UN climate convention as an excellent example of where it has worked very well indeed.

Baroness Neville-Jones: Can you give examples of where it has failed to work?

Professor Robin Grimes: I was thinking earlier about where it has not worked well, and from personal experience I cannot think of an example where it has worked badly.

Baroness Neville-Jones: Really?

Professor Robin Grimes: It could always do better.

Baroness Neville-Jones: If the UK had an objective that not many other member states shared, how much would we be able to persuade others nevertheless that what we wanted was a good idea for them all to agree to help us with?

Professor Robin Grimes: In that particular case, I am inevitably going to come back to the issue of the evidence base, because I would find it very hard to believe that we would have the evidence so badly different from all the other member states. That is because essentially our scientists are working through the framework programmes to such an extent now with their partners in Europe on developing that evidence base that we should have access to the same quality robust evidence base as they have, so I find it very difficult to believe.

Baroness Neville-Jones: It sounds rather as if what you are saying is that because of the degree of interaction between member states and institutions, in fact the priorities are already so shared that when it comes UN agencies there is no great difficulty in agreeing on where you should try to push.

Professor Robin Grimes: I am talking about our relationship with EU member states.

Baroness Neville-Jones: Yes, and I am talking about that, too.

Professor Robin Grimes: Outside the EU we may have other disagreements, and of course political issues can come to bear as well, but the point is that science should impact on this through that evidence and its quality. By the way, by working together there are better science-measured outcomes as well, so there are good reasons for working together, which people are exploiting more and coming to understand more, and this will become more so as time goes on.

Q122 Lord Hennessy of Nympsfield: Could I ask you about the Whitehall co-ordination of scientific advice and activity at the international level? Are you and the Foreign and Commonwealth Office in the lead, or is it Sir Mark Walport at BIS as Government Chief Scientific Adviser? How does it work?

Professor Robin Grimes: I work very closely with Sir Mark on a whole range of different issues. The Chief Scientific Advisers have a network that meets every Wednesday morning at a quarter to eight for breakfast, where we talk to each other over a cup of coffee and discuss the issues at hand. So it is not only me working with Sir Mark; it is will all the other CSAs as well. That is a relatively informal process in which we can talk to each other. We also have monthly meetings, which are more formal but again are between all the Chief Scientific Advisers. We also have cross-government scientific interests internationally; there is the Global Science and Innovation Forum—GSIF—which Sir Mark chairs and which I and numbers of others will go to. That is a longer-burn type of priority-setting organisation, and Mark and I work together very strongly on that.

There are also rather acute challenges, and we have the Scientific Advisory Group for Emergencies, which is concerned with crisis processes. In that case, the Foreign Office will work with SAGE through its Crisis Management Department, so we get immediate evidence on which to base our response. Of course, the Science and Innovation Network works on an intermediate scale. There are lots of mechanisms that work for us.

Lord Hennessy of Nympsfield: Chairman, could we ask for an organogram of how all that works? You described it very clearly, but it would be nice to see a spatial expression of that. Can you do that?

Professor Robin Grimes: Absolutely. There are a number of different organisations, the Natural Hazards Partnership and so on, so that would be quite useful.

Lord Hunt of Chesterton: There is an organisation that as I understand it still exists, not in your department but in another part of the Foreign Office, which used to be called the UN department and is now called the non-governmental organisations department or something. To some extent, it co-ordinates the UK governmental and non-governmental bodies that go to the UN agencies, and it is separate from the chief scientists' network—or has that now all merged?

Professor Robin Grimes: That comes back to the diplomacy-for-science arguments that I talked about at the beginning, which is the way people in the Foreign Office are working to ensure that scientists have the sorts of agreements and relationships that they need in order to progress their work. Again, we would work through people in the Foreign Office, through Sir Mark at the Government Office for Science, to ensure that the thing is joined up and that we are developing those relationships. Some of these relationships also relate to other departments such as the Department of Energy and Climate Change, which has just done an

agreement with India on nuclear security. That is another example of where the Foreign Office worked with Sir Mark's office and with DECC to make sure the thing was linked up.

Lord Maxton: I notice from your own biography that you are into computer sciences as well as science itself. To what extent are the new media and the new technologies part of this interchange between different departments and scientific advisers et cetera, and other countries?

Professor Robin Grimes: How does the new technology impact on the relationship between the different departments specifically? Gosh, that is a multilevel sort of question. First, there are the issues of making sure that we have access to and the forward looks on the right sorts of technologies and that we have access to computer facilities, for example, across the world. We also have to ensure that we have the right kinds of people working in the right departments to be able to exploit the big data issues. That is a very multifaceted issue indeed.

Lord Hennessy of Nympsfield: Do you think that the way Whitehall organises its science through the network of Chief Scientific Advisers that you have described gives us a great advantage internationally? Is it your impression that other countries are not quite as well organised in the way that we are? It is a very well-settled way of proceeding, and the impression I get is that it yields dividends because of the nature of the organisation and the closeness of you all.

Professor Robin Grimes: Although it seems settled, the process is still developing, and so it should do, because as those challenges change, the type of approach has to evolve to be able to meet them. Of course, it reflects the underlying structures of the UK and the way we have developed our industry research activities, our national laboratory activities, our university activities, and how that relates to government. That has influenced the development of the Chief Scientific Advisers' network. Other countries, Germany and France for example, have different structures for carrying out science and a different emphasis on where their research is carried out, and as a consequence it is not necessarily true that a mechanism like the Chief Scientific Advisers' network would be appropriate for those countries.

One thing we spend time on is ensuring that other countries understand our structure so that we understand how we can plug into the science advice processes in other EU countries. Again, the Science and Innovation Network is absolutely at the fore in trying to make sure that we are appropriately joined up. It is true that a number of countries are interested in our mechanisms for science advice, and we are very happy to explain how we do that in case it would be appropriate for those countries to take on structures that are similar to ours, but we should not assume they are going to be identical; they may take certain aspects.

Q123 Lord Peston: Professor Grimes, the background to my question is Mr Cameron's deal with the EU. I might add that whereas all other commentators seem to understand the deal perfectly, I do not understand large parts of it. But that is neither here nor there. As I understand it, a main part of the deal is that our country totally rejects the original Monnet idea of ever closer union and does not want to be a part of it. I think I am right that as part of the deal we have said we are opting out of that. Given that, assuming for a moment that we stay in, how will that affect science diplomacy? Will us not being part of the ever closer

union advantage or disadvantage the other member states? Will it advantage or disadvantage us? Can you throw any light on that at all?

Professor Robin Grimes: It is very difficult, and I do not think I should speculate on processes that have not occurred yet, but I do not see necessarily why that should have a large impact on our improving and ever-evolving science relationships in Europe.

Lord Peston: You mean that even if we have opted out of ever closer union, which we have clearly said we will, that will not affect the ability to do all the different versions of science diplomacy with what would still be our partners? How could we get involved if we were part of it but not part of the most important bit: ever closer union?

Professor Robin Grimes: In a way, this goes back to the science issues being separate from the political issues in a way. I think that our scientific relationship with EU countries is strong and will only get stronger.

Lord Peston: So speaking as a scientist, and an important scientific adviser yourself, you feel that you, your staff and the equivalent in other departments would still be able to play a major role in science diplomacy, in collaboration both within Europe and the rest of the world. That would not worry you. I can see there is a political aspect that you do not want to get involved in, quite rightly, but what matters to us is the future of science in Europe, and we would not like to feel that we were a party to or were in agreement with things that might damage science in Europe. That is the bit we would like you to throw some light on.

Professor Robin Grimes: I feel certain that the UK's focus on excellent science within Europe is going to ensure that we will continue to be a country that all other member states will wish to collaborate with most strongly.

Lord Peston: That is the sort of answer I wanted. Thank you.

Lord Hennessy of Nympsfield: I am interested by your distinction between science issues and political issues—that they are separate, as I think you put it. Is my impression justified that when it comes to science diplomacy within the EU, it is qualitatively different from a lot of British political diplomacy within Europe? We have been the permanent awkward squad in Europe for the bulk of the 43 years since we acceded to the EU, and, to adapt PG Wodehouse, it is always easy to distinguish in Brussels between a ray of sunshine and a British Prime Minister bearing a grievance. There is this kind of permanent drizzle of complaint. I get the impression that your world is rather exempt from that and that the atmosphere is different. Am I right?

Professor Robin Grimes: Scientists get on with the science, and I believe very strongly that it tends to be a very bottom-up type of activity. People work together on scientific issues, become friends and colleagues, and develop relationships that last their entire lifetime, and they see those relationships and concentrate on them. We are now back to the definitions of science diplomacy, and that is one of the aspects of it. I should say that these relationships go on for generations; PhD students work with the PhD students of those people, and so forth.

Lord Hennessy of Nympsfield: So it is a great success story within our rather patchy membership of the European Union.

Professor Robin Grimes: I would say that it is a great success story, and leave it at that.

Q124 Lord Kakkar: May I turn to the question of the impact of our nation's membership of the European Union on bilateral relationships with non-EU countries, particularly those that are seen as important powerhouses in science, such as the United States and China?

Professor Robin Grimes: Of course, those nations have made it clear that they believe that our membership of the Union is important, particularly from a scientific point of view. I think that is an important point, and the Prime Minister made that point quite firmly. To give an example of how we sometimes use our EU membership to enhance a bilateral relationship—you mentioned China—we work with the EU in China to maximise our policy impact and our influence in China to make changes to the enabling framework, which allows better conditions for UK-China collaboration, including on intellectual property protection, for example, where we align our lobbying with the EU and use the EU-China dialogue to push forward on that sort of difficult issue. Again, we come back to the point that it really complements our bilateral activities in this regard.

Lord Kakkar: The corollary of that is: if the opportunities from UK membership of the European Union were to diminish or be lost, would that affect our bilateral relationships with large science countries such as the United States and China, or would there be opportunities for those to be maintained?

Professor Robin Grimes: A good example would be that China has committed 200 million renminbi[270] to match Horizon 2020 programmes, and we would like to partner China in some of those Horizon 2020 programmes. That is an example of where things would change. I probably should not speculate as to what might happen if something occurred.

Q125 Lord Hunt of Chesterton: This is a question about the UK as a gateway to Europe. We had interesting evidence from Professor Russwurm of Siemens, who commented, as you heard, that Siemens would continue to work well with the UK if the UK left the EU but would welcome participation. If the UK remained part of the EU, it would help his company, for example, and he said that as people were beginning to talk about Brexit, he felt in his brain—he tapped his head—that there were trends. Is the gateway to Europe a very strong part of our connections and benefits, and will that continue if we cease to be a member of the EU?

Professor Robin Grimes: It is certainly true that the UK can be viewed as a sort of landing point in the EU which non-EU countries can access. We have a lot of very long-standing historical collaborations with many countries around the world, and indeed new relationships as well. R&D into Europe through the UK generally is a very strong factor indeed. A lot of the standards and regulations issues, for example, are developed in the UK, so again that makes the UK a natural place for multinational collaborations into the single market.

Lord Hunt of Chesterton: There are some big institutional differences. Germany has very large government laboratories and systems and we have fewer of them. Institutionally, we are quite dissimilar in many ways in relation to the way they are still doing things on the continent. Do you see some sort of convergence? Do exterior companies coming into Europe

[270] During the period from 2016 to 2020, the European Commission expects to continue spending over 100 million Euros per year for the benefit of Europe-based entities in joint projects under H2020 with Chinese participants. China will match corresponding resources and expects to spend 200 million RMB per year for the benefit of Chinese based entities that will participate in joint projects with European ones under Horizon 2020.

want to have to choose between these different models of how science and application works?

Professor Robin Grimes: It is true that Germany tends to have a model whereby a lot of their research activity takes place in central laboratories, and that the UK, in engineering-like activities, has to a certain extent moved away from those sorts of models and much more of that work has tended to be done in universities, but by no means universally. In another area, such as biomedical, a lot of the activities in the UK are co-ordinated and take place in large laboratories. It is very topic specific, so it is very hard to say that the UK does it in this sort of way and Germany or France does it in another way. It depends on which topic you are talking about. Again, it is about our relationship with EU countries. How can I put this? You can cut the cake in a number of different ways to try to understand that way of working. Again, the fact that we can do that with those countries, particularly through framework programmes—where, by the way, we do extremely well, and I am sure you have had lots of evidence as to just how effective we are at gaining access to collaborative funds through Horizon 2020, for example, and we have maintained our share of that, compared with FP7—gives us confidence.

Lord Hunt of Chesterton: But globally we still have the problem that the investment in R&D in the UK is significantly less than we are seeing in France and Germany. Is that a problem? If we are a country that is not putting in at the same level as others, does that militate against our gateway role?

Professor Robin Grimes: You have me at a disadvantage; you are asking a scientist whether or not he feels there ought to be more funding for science.

Lord Maxton: The answer is always yes.

Professor Robin Grimes: There is certainly an answer that I can think of, yes. We have to be careful about using simple numbers with overall analysis to try to understand the landscape in the UK and how that fits in. We would always need to do more work to try to understand the subtleties of those individual relationships. We do very well at that, and the extent of our funding shows that we do very well on that. There are not just the framework programmes; there are numbers of other programmes that we benefit from, particularly with respect to industry collaboration, where our SMEs in particular are starting to do very well. We need to keep working at it, but that is always going to be the case.

Lord Hennessy of Nympsfield: I was interested in your phrase describing the UK as "a landing point" for science in Europe. Do you think it is fair to describe it as a concept where we have intellectual inward investment as well as industrial inward investment in the UK because of our membership of the EU? If you think there is something in that notion, can you outline the magnitude of it?

Professor Robin Grimes: I do not have those specific numbers with me, but I do think that is the case. The types of investments by companies such as Tata into Jaguar Land Rover, which is something I know a bit about, and how successful that has been for the UK, and now the kinds of collaborative relationships with Warwick University and the catapult in particular there, are great examples. Also, companies such as Rolls-Royce have access to a lot of research that is being carried out in Europe, and they bring that back to their manufacturing bases in the UK. There are lots of great success stories.

Lord Hennessy of Nympsfield: I was thinking as well of scientific labs in universities and a wider concept of intellectual inward investment than merely the industrial.

Professor Robin Grimes: Again, we are going back to those inter-generational collaborative relationships between ourselves and established research groups in Europe. I am really excited about some of the research activities in other emerging countries in Europe and how that is going to become important for us.

Lord Hennessy of Nympsfield: Can you give examples?

Professor Robin Grimes: I would say countries such as Romania, and to a lesser extent Bulgaria, which are emerging. I am not sure they would be very happy for me to say they are emerging, but they have particular strengths. Then there are more established countries with strengths, such as Hungary. Hungarian mathematics has been absolutely excellent for generations. Again, we are developing relationships in those strengths. I have just been to Poland, and I was most impressed with the quality of activities and the way UK scientists are increasingly going and collaborating. There is a really rich landscape.

Q126 Lord Maxton: The evidence—I had better not say overwhelming evidence—from the science community, including, I have to say, from you, is that we benefit from being part of the European community, but you only have to look behind you today to see that that is not part of the debate that is going to take place on Europe, either within government or within the media. How does the science community start to get that message across both within government and elsewhere?

Professor Robin Grimes: The learned societies in particular have a very important role here, and they need to continue to get these messages out. I know that a number of them have given evidence to this Committee in this regard. That is very important as they are very influential. University Vice-Chancellors, who are becoming more vocal about that, also have an important role to play. A lot of that is already in hand. I think you will see more in the media from those people, and they should be encouraged to do so.

Lord Maxton: You are a chief scientific officer. Presumably you discuss these things with the other chief scientific officers and the head himself. Are you getting that message across within the departments that you represent?

Professor Robin Grimes: I believe that offering that advice and ensuring that people are aware of that is in hand, and that it takes place. Again, it is a question of ensuring that people have access to our evidence base. Some of the evidence base you have collected here should form part of that.

Lord Maxton: Do you think it will?

Professor Robin Grimes: Yes, I do.

Lord Maxton: Are you hoping that it will and that it will be part of the wider debate that is going to take place within government itself?

Professor Robin Grimes: It is relatively early days yet, and it is hard to speculate, but I would certainly hope so. I believe that people are starting to take action to ensure that is the case.

Lord Kakkar: What reaction has the Foreign Office received or understood from science diplomats in Brussels, member states and non-EU states with regard to the fact that we are going to have this referendum?

Professor Robin Grimes: I think there is a strong desire for interactions with the UK on science and innovation, and I do not think we have seen any change in that as a result of this announcement, but it is early days. Certainly my general sense is that the science community wants us to remain in the EU, but we have seen that more broadly from the reactions from other non-EU countries. It seems to me that there is an analogy here with what the Prime Minister said yesterday. I have the wording here, but it is something to the effect that he cannot think of any of our friends—I think it was Australia, New Zealand, Canada and America he quoted specifically—who would want us to leave the EU. It seems that is the case for our scientific colleagues specifically.

Q127 Lord Hunt of Chesterton: Could the UK science community develop healthy relationships with the EU, and presumably continue our existing ones, if the UK became an associated country like Norway or Switzerland? What prospects would there be for some kind of renegotiation on the scientific side? Have you thought about that?

Professor Robin Grimes: I genuinely do not think it is appropriate for me to speculate on the referendum. However, I note that there are some non-EU countries that are part of the European research area and they sit on the European research area committee, but they do not get a seat at the table when the Council of Ministers or the Parliament are setting the rules or deciding on budgets and planning programmes.

The Chairman: Professor Grimes, I think we have exhausted all the questions that we had for you, unless any of my colleagues want to come back on anything. We are most grateful to you. You have been very helpful and we have covered a lot of ground. It will certainly help to inform our report when we come to draft it. Please do not bother to tell us what “truth” means.

Professor Robin Grimes: I was hoping you could help me with that one.

The Chairman: Thank you.

Heptares Therapeutics Ltd – Written evidence (EUM0014)

Author: Dr Fiona Marshall, Chief Scientific Officer

Background Information
The answers below relate to our experience at Heptares a biotechnology drug discovery company based in Hertfordshire. The company spun out of the MRC Laboratory of Molecular Biology in Cambridge in 2007 and raised over £40million in Venture capital investment from UK, US and Corporate investors. In 2015 Heptares was acquired by the Japanese biopharmaceutical company Sosei. Heptares employees over 70 people from across Europe and is developing drugs for Alzheimer's disease, schizophrenia, cancer and migraine. I have been a member of several grant funding committees in the UK and the EU.

Funding

- What is the scale of the financial contribution from the EU to UK science and research.

Heptares are frequently sought after to participate in EU collaborative projects due to their position as an SME involved in cutting edge science in the area of protein X-ray structures. We are a member of an EU Innovative Medicines (IMI) group – K4DD. The Innovative Medicines Initiative (IMI) is Europe's largest public-private initiative aiming to speed up the development of better and safer medicines for patients. The IMI supports collaborative research projects and builds networks of industrial and academic experts in order to boost pharmaceutical innovation in Europe. IMI is a joint undertaking between the European Union and the pharmaceutical industry association EFPIA (http://www.imi.europa.eu/). We have a fully funded post-doctoral researcher working at Heptares on this project for 5 years (total funding 440k euros).

- What is the effectiveness and efficiency with which these funds are managed in the EU compared to management of science funding in the UK. Particularly when administrative overheads, quality of decision making and advisory processes are considered?

Applying for any EU grant is an onerous and time-consuming process – this is largely because the grants tend to directed towards consortia with many different groups and countries involved in the application. In addition to the successful IMI grant we have also been involved in a number of applications which have not succeeded. Usually one person takes the major responsibility for writing and putting together the application. This is normally an academic who has come up with the proposal – we have avoided doing this ourselves due to the amount of time required and focussed on writing only our own part of the application/work package. Once the grant is awarded we have not seen any differences in the running/management of the funds compared to any UK award.

I was one of two UK representatives on the advisory board of the EU Framework VI program with the responsibility of setting priorities. It was noticeable that representatives from other member countries came to the meeting having been given a clear view/steer on areas they

should be promoting. Although I consulted with representatives from UK research councils prior to the meetings I was told that I should put forward my 'own' views rather than a 'UK' view.

Collaboration

- What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

We benefit significantly from collaboration and funding programmes within the EU. The IMI network has allowed us to interact with not just academic groups (in Vienna, Leiden, Amsterdam, Heidelberg, London, Oxford, Nottingham, Dundee) but multiple Pharma companies in Europe (Bayer, Roche, BI, AZ, GSK, Janssen, Merck Sanofi) and this has improved our understanding of their requirements and scientific methods which improves our own way of working. This increases our changes of successful collaborations with such companies. We are also involved in the GLISTEN Network – this is a COST (European Co-operation in Science and Technology, http://www.cost.eu/about_cost) group. COST provides funding for meetings and networking events bringing together researchers working on common areas of interest. The GLISTEN network is directly related to our drug discovery research work on G protein coupled receptors (GPCRs). This has resulted in a number of academic collaborations, joint publications, exchange visits and has contributed to recruitment of researchers across Europe. Our own staff greatly benefit from attending the GLISTEN meetings.

- What is the influence of EU membership on bilateral collaboration between the UK and other EU member states. Are collaborations with member states stronger than with non-EU countries as a result of the EU membership? Or are bilateral collaborations with member state inhibited by requirements to work through EU mechanisms?

As noted above EU funded networks increase collaborations between the UK and EU member states so that these are stronger than with non-EU countries. We have no experience of EU mechanisms having a negative impact on such collaborations.

- How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership. How does EU membership affect the growth of research-intensive UK companies.

Heptares was funded by a group of Venture Capital Investors from which we raised over £40m. One of our major investors was the Swiss Pharmaceutical company – Novartis and we were also offered investment from other European investors. We were also funded by UK, USA and Japanese investors. Our position in Europe, our ability to freely recruit staff from across Europe and our network of European interactions certainly contributed to our ability to raise money from Europe as well as leverage funding outside the EU and contributed to our ability to grow the company. Receiving EU funding through the IMI scheme has boosted our list of publications and presentations, which are important in promoting our scientific profile and attracting investment. Growth in the company was also facilitated by funded collaborations with EU based Pharma companies which brought in additional investment.

- How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership?

Heptares has first-hand experience with EU funded international facilities. Since the founding of Heptares access to synchrotron radiation has been critical to our scientific activities. We mainly use the Diamond Light Source in Oxfordshire, but have also accessed the European Synchrotron Radiation Facility (ESRF) in Grenoble. The ESRF was established as a joint European project, which included the UK, and the ongoing UK contribution is essential to keep it operating (note however that Heptares does pay commercial rates for synchrotron time).

A possible successor to synchrotrons as radiation sources is X-Ray Free Electron Laser (X-FEL) technology, which offers several advantages, but is currently unproven and very expensive (hundreds of millions of pounds per facility). Rather than commit to a facility in the UK, UK funding agencies have very wisely decided to join an EU-funded project building an X-FEL in Hamburg. This will give UK users access to the facility for evaluation and data generation. Should the case for X-FEL be made and capacity at Hamburg be insufficient, the UK may then commit to its own facility.

- Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

Not in our experience – In practice we prefer to use the closest suitable facilities for logistical reasons. However we are free to be involved in and use international facilities outside the EU. In addition to the Diamond and ESRF synchrotrons we have made use of the Swiss Light Source, which is not EU supported.

- What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and no-EU countries such as the USA, India and China.

Heptares works in a very specialized area of protein crystallography and biophysics. It is impossible for us to recruit sufficient people with relevant experience from within the UK. We have recruited 14/74 (19%) of our staff from EU countries other than the UK. We have 3 members of staff recruited from non-EU countries (Australia, India and USA). It is essential to our business that we continue to be able to freely recruit staff from Europe. Although we do get applications from non-EU countries in general the quality and amount of relevant experience of these applications is lower than it is from with the EU. In our experience people from countries across Europe are very keen to move to the UK (in particular to areas including London and Cambridge).

- Does EU membership inhibit collaborations with countries outside the EU for example by requiring UK to adopt EU-wide immigration polices rather than bespoke ones for the UK

Not in our experience, and we cannot imagine this inhibiting collaborations.

Regulation

- How is the innovation landscape affected by EU membership.

Knowledge and technology transfer is an essential component of the innovation cycle. We have an extensive network of collaborations throughout the EU which include those funded via EU schemes, ones which we fund as well as academic partnerships. This has resulted in extensive knowledge transfer in our area of science which increases our competitive edge. Our networking in Europe has facilitated collaborations with EU Pharma companies including Novartis and AZ (in the latter case it was the site in Sweden that we mainly worked with). In addition, we have worked extensively with networks of clinical experts in the Alzheimer's disease field which led to us conducting one of the first clinical trials of our Alzheimer's drug in Netherlands.

18 November 2015

Imperial College London – Written evidence (EUM0015)

Executive Summary

1. The College considers there to be very significant benefits to EU membership in relation to the effectiveness of science, research and innovation in the UK.

2. EU membership strongly supports international collaboration and researcher mobility, building the quality of the UK research base, and its international network. This international openness, which so greatly benefits the UK research base, could be severely hampered if the UK left the EU.

3. Global challenges cannot be tackled by the UK in isolation. EU membership and funding programmes play a crucial role in supporting and facilitating collaborations to effectively address these challenges.

4. In response to the specific question about whether EU membership inhibits collaborations with countries outside the EU, in the College's experience this is certainly not the case. In fact, EU membership can be beneficial in our attempts to form collaborations outside the EU, for example in countries such as India, China and the USA, because the UK is seen as a gateway to the rest of Europe.

5. EU funding not only represents an increasingly vital source of research income for UK higher education institutions, but also supports cutting-edge research of significant social and economic impact.

6. Should the UK leave the EU, in the College's view science, research and innovation in the UK could be severely impacted, putting at risk the UK's world-leading position in research and leading to a long-term decline in the UK's global competitiveness.

Collaboration & Mobility

7. As well as the funding opportunities available through EU membership, the intangible benefits associated with the collaborative nature of EU funding programmes and mobility supported by the free movement of people within the EU greatly support the effectiveness of science, research and innovation in the UK. Not only does EU membership enable the College to recruit high-calibre academic and research staff from the EU to work in the economically and socially important fields of science, technology, engineering, medicine and business, it also enables us to attract and engage with talent globally through, for example, collaborative cross-continent programmes and the Marie Skłodowska-Curie fellowships (see paragraphs 9 and 10 for more details).

8. The Government review on the Balance of Competences between the UK and EU in R&D[271] highlighted that "international collaboration and researcher mobility have been

[271]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/279331/bis_14_592_balance_of_competences_review_government_reponse_to_the_call_for_evidence.pdf, page 29

found to be correlated with high research quality, and also appear to be key factors in explaining the UK's high research performance". EU membership strongly supports international collaboration and researcher mobility. It provides opportunities for UK researchers to move freely between research institutions within the EU, developing their knowledge, expertise and international academic networks, further enhancing the UK research base when they return. EU researchers who come to the UK often establish long-lasting connections which continue as they move through their academic careers across the world, further extending the international network of the UK research base. EU membership, including the free movement of people within the EU, is essential in supporting the UK in engaging with and attracting the best researchers, regardless of their location within the EU. Much university research is highly specialised, and even on a global scale, the number of academics and researchers with the specific skill set and expertise required to undertake cutting-edge research in a particular discipline tends to be small. Given the competition for academic talent globally, reducing EU researcher mobility has the potential to hinder further the global competiveness of the entire UK research base. Furthermore, the international openness which so greatly benefits the UK research base could be severely hampered if the UK left the EU.

9. Collaboration across a diverse community of talented academics and researchers brings wide-ranging perspectives to bear on global challenges, and promotes open-mindedness of thought. EU membership plays a crucial role in supporting and facilitating such collaborations, and enabling the UK research base to address global challenges, which cannot be effectively tackled in isolation. For example, in order to improve the quality of preventive cardiovascular disease healthcare, College researchers have developed an innovative cardiovascular disease prevention programme called EUROACTION. This was developed in response to the results of a survey of preventive cardiology practice across 24 European countries and was trialled across 8 European countries, with EU membership being key to enabling this work. The one-year trial outcomes showed that patients with coronary disease in hospital, and those at high risk of developing cardiovascular disease in general practice, together with the partners of both, achieved healthier lifestyles. The findings from EUROACTION have now been adapted for use in the NHS[272]. The EU has also been working to facilitate collaborations across continents in order to address health challenges on a more global scale. For example, the European and Developing Countries Clinical Trials Partnership (EDCTP), in which the College is involved on a number of projects[273], was established by the EU to fund research into the prevention and treatment of HIV/AIDS, tuberculosis, malaria and neglected infectious diseases in sub-Saharan Africa, bringing together in partnership 14 European countries and 14 African countries. A further example is the European AIDS Vaccine Initiative (EAVI2020), launched in November 2015 and funded through the Horizon 2020 programme[274]. The EAVI2020 consortium, which is led by the College, brings together leading HIV researchers from public organisations and biotech companies from 22 institutions across Europe, Australia,

[272] http://impact.ref.ac.uk/casestudies2/refservice.svc/GetCaseStudyPDF/42210
[273] http://www.edctp.org/web/app/uploads/2015/01/EDCTP_project_portfolio.pdf
[274] http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_30-10-2015-11-31-34

Canada and the USA in a focused effort to develop protective and therapeutic HIV vaccines, pooling their knowledge and expertise to develop novel candidate vaccines that can be taken through to human trials within five years. It is important to note that EU membership also facilitates collaborations with non-EU countries outside these specific EU-supported programmes. In the College's experience, EU membership can be beneficial in our attempts to form collaborations outside the EU, for example in countries such as India, China and the USA, because the UK is seen as a gateway to the rest of Europe.

10. Participation in the EU funded Marie Skłodowska-Curie fellowship programme is extremely beneficial to the UK research base in bringing talented researchers not only from the EU, but from anywhere in the world, to work in the UK. From the College's experience, the prestigious nature of these fellowships enables us to attract some of the top researchers globally in their respective fields, who can then go on to gain permanent posts at the College. The benefits extend to the research teams they join, where they contribute to cutting-edge research by bringing their experience to bear on new challenges, creating a connected network of ideas and increasing the speed at which knowledge and expertise is transferred. The research group in the College led by Professor Molly Stevens[275], which works on innovative biomaterials design for regenerative medicine and bio-sensing, has on its own benefitted from 17 Marie Skłodowska-Curie fellows. A fellow within the group, Dr Roberto de la Rica, together with Professor Molly Stevens and further collaborators within the EU, developed a cheaper and more sensitive HIV detection test[276] than any identification method used to date.

11. The international connections fostered through EU collaborations often continue long after initial projects have ended. This is particularly beneficial where partnerships are created between, for example, institutions or SMEs who might not otherwise have found or engaged with each other. EU funded projects can also stimulate collaborations with industry where the UK may lack the right industrial partner for a specific project. This enables institutions to work with suitable partners, and can encourage academics to engage with industry when they may have not done so otherwise. This greater connectivity increases and strengthens the UK's international network, with consequent benefits to the UK research base. For example, Professor Norbert Klein and Professor Neil Alford, two academics currently at the College, collaborated together on an EU funded project whilst at different institutions in Germany and the UK respectively[277]. On moving to the College, the partnerships they established with researchers in Poland and Slovenia were retained, and collaboration with them continues over ten years later. Furthermore, Professor Klein's research supported the spin-out of the company EMISENS[278], based in Germany, which now collaborates with the UK-based SME Link Microtek, to develop, manufacture, and

[275] http://www.stevensgroup.org/
[276] http://ec.europa.eu/research/mariecurieactions/news-events/news/2012/marie_curie_researcher_develops_cheaper_and_more_sensitive_hiv_detection_test_en.htm
[277] http://cordis.europa.eu/project/rcn/61604_en.html
[278] http://www.emisens.com/history.html

commercialise sensor products based on the patented microwave evanescent field sensor technology.

Funding

12. A report commissioned by BIS on the international comparative performance of the UK research base in 2013[279] found that the UK "punches above its weight as a research nation"; with just 0.9% of the global population and 4.1% of researchers, the UK accounted for 11.6% of citations and 15.9% of the world's most highly cited articles. Such a strong research base is essential for supporting the innovation that will drive long-term economic growth[280]. However, as the report notes, the UK may not be able to sustain its position as a world-leading research nation on the basis of broadly stable or decreasing R&D expenditure. Between 2009-10 and 2013-14, the College's research income from EU Government bodies (the vast majority of which comes from the European Commission) has almost tripled, from £15 million to £42 million, whilst funding from UK research councils has remained flat. As a result of the frozen UK research budget, EU funding therefore represents an increasingly vital source of research income for UK HEIs, as recognised in the Government review on the Balance of Competences between the UK and EU in R&D[281]. The review further notes that, whilst difficult to calculate a definitive answer, there was agreement that in relation to R&D "the UK gets more out of the EU budget than it puts in", with the CBI observing that the UK "receives a proportion of funding which is greater than would be implied by the ratio of its GDP to the aggregate GDP of the EU as a whole". Should the UK withdraw from the EU, there is considerable uncertainty as to whether the Government would be able or willing to provide this level of funding from its own sources. Furthermore, any replacement funding is unlikely to have the associated collaborative and mobility advantages which the UK research base benefits from so greatly.

13. EU funding programmes such as Horizon 2020 and its predecessors are targeted at addressing big challenges with large collaborations, thus fostering multiple strands of interdisciplinary research. Interdisciplinary research is vital for addressing global challenges but the UK research funding system does not always support it effectively. Additionally, the size and type of grants awarded through, for example, the European Research Council (ERC), and the Marie Skłodowska-Curie fellowships mean that there is more latitude for blue skies research, which again is not always readily funded from other sources but can lead to significant innovation and impact.

14. Funding through the ERC is of particular importance, and has been highly beneficial to the UK research base. ERC funding is awarded solely on excellence, judged by international peer-review panels. The UK has a number of world-leading universities who win a disproportionate amount of this funding, with Oxford, Cambridge, UCL and

[279] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf , page 2
[280] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32445/11-1386-economics-innovation-and-research-strategy-for-growth.pdf , page 7 onwards
[281] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/279331/bis_14_592_balance_of_competences_review_government_reponse_to_the_call_for_evidence.pdf , page 32

Imperial all ranking within the top 10 institutions overall for ERC grants awarded under the FP7 programme[282], and in total, the UK ranked 2nd in budget share for the FP7 programme. This excellent performance has continued into the first year of Horizon 2020, where the UK maintained its rank of 2nd in budget share[283]. Such success in these schemes both sustains the excellence of the UK research base through additional funding and, by providing a clear benchmark of that excellence, enhances the UK's reputation to potential partners and collaborators within and outside the EU. The nature of ERC grants, awarded over an extended period of time and directly to individual researchers, means they can have a long lasting impact on supporting the career progression of rising academics, who go on to undertake ground-breaking research, acting as a magnet to attracting world talent. For example, in 2008 Professor Andrew Davison of the College's Department of Computing was awarded a five year ERC Starting Grant to support his research into robotic vision. Subsequently, in 2014, Professor Davison was made Director of the Dyson Robotics Lab, a research centre established at the College following a £5 million industry investment from Dyson[284], to develop computer vision programs that will enable robots to move beyond controlled environments and successfully navigate the real world. Professor Zoltán Takáts, of the College's Department of Surgery and Cancer, has developed an "smart" knife that can tell surgeons immediately whether the tissue they are cutting is cancerous or not. Professor Takáts benefitted from both an ERC Starting Grant and an ERC Proof-of-Concept (PoC) grant, and has stated that the "Starting Grant gave us a huge opportunity to set up the research group and do the science, but we really needed the PoC funding to look into regulatory issues, intellectual-property management and starting up a company to bring the instrument to market"[285]. In 2013, the College was awarded a prestigious ERC Synergy Grant worth €7 million for research into an intelligent implant to tackle obesity[286]. Awarded to Professor Sir Stephen Bloom and Professor Chris Toumazou, of the Departments of Medicine and Bioengineering respectively, the project was one of only 11 in the EU to receive this stream of funding, out of 710 applications received during the call for proposals[287].

15. There are many examples which demonstrate how EU funding has supported research leading to a significant impact on society and the economy. From 2004, building on extensive experience in modelling both seasonal influenza and emerging infections (e.g. SARS and H5N1 avian flu), Neil Ferguson, Professor of Mathematical Biology at the College, led an extensive research programme to improve understanding of the epidemiology of pandemic influenza and the evidence base for interventions to mitigate the impacts of influenza pandemics, of which key funding included a €1.6

282 https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf#view=fit&pagemode=none , page 50

283 https://www.ffg.at/sites/default/files/downloads/page/horizon_2020_first_results_1.pdf , page 19

284 http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_10-2-2014-10-26-45

285 https://erc.europa.eu/erc-stories/%E2%80%98smart%E2%80%99-knife-fight-cancer-crime-and-contamination

286 http://horizon2020projects.com/es-european-research-council/erc-obesity-research-grant-awarded/

287 https://erc.europa.eu/projects-and-results/statistics

million EU programme grant[288]. As a result, during the 2009 H1N1 pandemic, real-time research provided the first estimates of key epidemiological parameters of the new pandemic virus, demonstrating the low-to-moderate severity and lower than typical transmissibility. In the UK, US and other countries, these data informed public policy decisions to pull back from use of economically costly interventions, and focus on targeted use of vaccination as the principal pandemic mitigation measure. In another example, research carried out within the College's Department of Life Sciences led to a collection of new kit solutions to screen the crystallisation conditions of various membrane proteins[289]. The underpinning research was supported by a €110,000 grant as part of a large EU consortium project. These screens were exclusively commercialised by Molecular Dimensions, a UK company, under licence from the College, and are the primary commercially available screening kit in membrane protein crystallisation. They have helped to screen the crystallisation conditions of a wide range of membrane proteins, leading to many new structures. Membrane proteins perform a variety of functions in our body, and more than 50% of commercially available drugs target these membrane proteins. Structural information of membrane proteins therefore plays a vital role in medicine and in pharmaceutical drug discovery programs. In a further example, a US$1.5 billion clean coal project at the YiHe Coal Field in Inner Mongolia was established in June 2011 as a joint venture between UK based Seamwell International Ltd and the state-owned China Energy Conservation and Environmental Protection Group. This was the first commercial project to employ the novel "Linear Underground Coal Gasification (UCG) Gasifier" design developed specifically for use under extremely weak underground roof conditions by a research team within the College's Department of Earth Science and Engineering. The underpinning research included that carried out by the team as part of a large EU programme[290]. Underground gasification under such conditions is made possible solely because of the novel gasifier design, which has opened up the potential to transform over 720 million tonnes of coal resource, which would otherwise have remained trapped, as a clean coal energy source for the next 20 years.

16. EU funding also supports the work of the European Institute of Innovation and Technology (EIT), a body of the EU which aims to enhance Europe's ability to innovate. It brings together leaders in higher education, research and business to promote innovation in Europe, through its Knowledge and Innovation Communities (KICs), of which the College is a core partner of three: Climate-KIC; EIT Health; and EIT Digital. A Climate-KIC project to develop a tool that uses multiple climate and environmental models to calculate the property damage and financial costs resulting from catastrophes, called the "Oasis Loss Modelling Framework", is led by the College[291]. The tool was named "Innovation of the Year 2014"[292] at the London Market Awards and has been described as "the most significant development in the modelling of financial losses as a result of natural catastrophes for 20 years"[293]. The project received

[288] http://impact.ref.ac.uk/CaseStudies/CaseStudy.aspx?Id=42223
[289] http://impact.ref.ac.uk/CaseStudies/CaseStudy.aspx?Id=42241
[290] http://impact.ref.ac.uk/CaseStudies/CaseStudy.aspx?Id=42156
[291] http://www.climate-kic.org/projects/open-access-catastrophe-model/
[292] http://www.climate-kic.org/news/climate-kics-oasis-project-hailed-as-innovation-of-the-year-at-industry-awards/
[293] http://www.climate-kic.org/news/climate-kic-project-revolutionises-the-catastrophe-modelling-market/

€2.8 million in funding from Climate-KIC and is now co-managed by a group of insurers, reinsurers, brokers and Lloyd's of London through a not-for-profit company. The KICs can be particularly helpful in bringing a coherent focal point for collaboration, with added leverage for funding. The College's involvement in EIT Digital has allowed us to expand our corporate network, resulting in new collaborations with BT, Intel, Vodafone and IBM, and has also provided a mechanism for collaboration with small digital companies. EIT Digital is also fully linked with the Digital Catapult, a national centre aimed at rapidly advancing digital ideas to market which is part of Innovate UK's Catapult programme[294]. Furthermore, the organisation of the KICs, with co-location centres across Europe, can allow us to connect with partners in Europe whom we might otherwise not have reached, thus growing our collaborative network further.

Conclusion

17. Based on the evidence we have provided, the College's view is that EU membership significantly benefits science, research and innovation in the UK. Should the UK leave the EU, science, research and innovation in the UK could be severely impacted, putting at risk the UK's world-leading position in research and leading to a long-term decline in the UK's global competitiveness.

19 November 2015

[294] https://www.digitalcatapultcentre.org.uk/digital-catapult-becomes-member-of-eit-ict-labs-node/

Innovate UK and EEF–The Manufacturers' Organisation – Oral evidence (QQ 77-89)

Evidence Session No. 8 *Heard in Public* *Questions 77 - 89*

TUESDAY 26 JANUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Baroness Manningham-Buller
Lord Maxton
Baroness Morgan of Huyton
Baroness Neville-Jones
Lord Peston
Viscount Ridley

Examination of Witnesses

Professor John Latham, Board Member, Innovate UK and Vice Chancellor, Coventry University, **Ms Felicity Burch,** Senior Economist, EEF – The Manufacturers' Organisation

Q77 The Chairman: Welcome to our witnesses, Professor John Latham and Felicity Burch. We are being broadcast, as you will have gathered from the earlier session, so I am going to ask if you would like to introduce yourselves formally for the record. If you would like to make any introductory statement, please do so. Professor Latham first perhaps.

Professor John Latham: My name is John Latham. I am on the board of Innovate UK. I am also Vice-Chancellor of Coventry University. I think it is fair to say I have spent probably most of my career operating within the space of supporting science, technology and innovation, mainly from a UK base, operating in several European countries. I have operated and lived in Spain, Portugal, Germany and France, and I have expertise and knowledge of their systems, but I have also had spinout activity in places like Singapore, I have worked in the US, and I was a research fellow for BT for a period of time, so I have quite a wide breadth of experience within the area of the discussion today.

Ms Felicity Burch: Good morning. I am Felicity Burch. I am a senior economist at EEF, the manufacturers' organisation. EEF represents a very broad spectrum of manufacturers, from some of the industries you have already heard from this morning such as pharmaceuticals,

food and drink, all the way through to things like aerospace, metals, et cetera. Manufacturing accounts for the broad brush of business expenditure on R&D in the UK; it is about two-thirds of total business expenditure, so this inquiry is very relevant to our sector, particularly because, as we have heard from people already this morning, and I know other people who have spoken to this Committee, collaboration is increasingly important for manufacturing and innovation as it is for science, and really Europe and the European Union facilitates collaboration for manufacturers in a number of ways: through funding, through co-ordination of collaborative partnerships and through the free movement of people and access to a single market.

Q78 The Chairman: Thank you very much. That is most helpful. I am going to start with a very general question, which might get our discussion going: does the United Kingdom's membership of the European Union have a significant effect on science and research in the private sector? If so, could you spell out what the main influences are? Could you also refer to the effects and whether there is any difference between large and small companies? Do SMEs do better than the larger companies, for example? Would Professor Latham like to start?

Professor John Latham: Yes, I would be very pleased to do that. There are a number of things that Europe brings. I think it is important to put Europe in context. There is a national agenda, there is a European agenda, and there is a global agenda, and most companies, particularly large companies, are operating within a global agenda. There are certainly some benefits for organisations based in the UK in terms of the opportunities that those different platforms offer, whether it be UK national funding, European-related programmes or global programmes.

I think one of the advantages that we do have being part of the EU at the moment, certainly around the Horizon 2020 offering, is that it does give companies, organisations and universities access to knowledge, markets, customers, suppliers and expertise relatively easily within the constructs that the EU operates. There are some elements of collaboration that potentially are easier because of the way in which the science base is set out and the way in which people operate and collaborate. Slightly differently to some of the comments that were made earlier, I think there are some real benefits around collaboration that currently takes place, certainly around some of the approaches to regulation and to IP—intellectual property—and the way in which perhaps companies can work together, particularly, for me, where you have some large companies wishing to work with some small SMEs. There is certainly some benefit to the way in which some of the constructs have been put together at the European level to help that collaboration take place where, if that was not in place, it might be quite difficult to do.

The other thing that is quite interesting is that there is certainly a difference between the way in which large companies tend to engage within EU funding, but that is also true perhaps for some of the national funding and global funding that exists, and the ways in which SMEs engage. That also depends partly on the sector they are in and on the speed at which that sector evolves its life cycle and therefore whether the bureaucracy which is operating at national, European or international level allows a company in a certain sector to engage with a programme of science and funding. For example, I recently had a meeting around a collaboration to put a funding proposal to the EU where we had individuals from the mobile telecoms industry, the automotive industry and the energy industry, and

although they were all talking around and using the same language, the mobile phone industry was talking about a life cycle of six months and therefore applying for any funding was almost irrelevant, depending on where it was; the automobile company was talking about a 10-year life cycle; and the energy company was talking about a 25-year life cycle. Some of them could see that it was much easier to go through the structures of the EU and maybe some of the other global structures than it was for somebody from a different sector. So I think it is quite a complex three-dimensional matrix around whether it is good or bad for a company, large or small, depending on the structure that exists.

The Chairman: Ms Burch, would you like to comment?

Ms Felicity Burch: Yes, I would. First, I very much agree with Professor Latham on the comments about Horizon 2020 facilitating collaboration and providing companies with access to funding for innovation. For EEF members that is particularly important. About 16% of our members in total have used EU funding at some point for their innovation. To put that into context, that is actually the third most used innovation scheme behind the R&D tax credit and KTPs. Our data does not show particularly that large companies are struggling more than small companies to access support, though I know the broader data looking at the whole economy does. In fact, about 20% of our larger members have used EU support compared with about 12% of our smaller members and, looking at the smaller company side, there have been a lot of improvements to Horizon 2020 to help them to access that.

The benefits of the EU are not just about access to collaborative funding mechanisms, or indeed more simple funding mechanisms. The free movement of people is particularly important in enabling collaboration. We have heard already from the previous committee session that companies like to be able to talk to people when they are innovating, and it is not just over the phone or on Skype. Although our members are certainly increasingly making use of those mechanisms, they want to visit their customers overseas, and indeed they want their customers to come over and visit them.

We have heard stories from members about complications with relationships outside of Europe. For example, one of our members highlighted the fact that he wanted a one-hour business meeting in Beijing in order to sell the innovative product that he wanted to explain, and then he needed a visa in order to do that. It is not a surprise that he needed that to go to Beijing but you do not need that in order to go to Europe. In terms of just getting an individual to come over and work for a few weeks, it is very simple if they are EEA, much less so if they are from outside of that area. So that facilitation of relationships through the free movement of people is very important.

Finally, the single market more generally making selling your goods simpler is important for manufacturers. The key reason that businesses are innovating is because they want to satisfy their customers, existing ones and new ones, and European customers are easier to access. Very often the first export relationship that a manufacturer will have is with a European company, because it is easier to sell to them, and that will help them as a launch pad to the rest of the world. So the EU has a broad range of benefits for innovative companies and for supporting innovation, including but not limited to funding schemes.

The Chairman: Professor Latham, you drew a comparison between the motor industry and the mobile telephone sector, where clearly their time spans are very different. Would you like to tell us which business sectors you think find most significant advantages from the European Union funding arrangements?

Professor John Latham: I think the answer to the million-dollar question is that we do not always have a million dollars to spend on everything. I think part of the process that we have within the Commission and the way in which it has structured its approach to developing its view of the grand challenges that Europe could make a mark in could create what is sometimes called its niche dominance, and the UK is part of the European playing field at the moment. Certainly a lot of our research council funding—we put funding together outside of the research council but developing certain sectors is quite key—is where you have fundamentally base science that takes a long time to develop, maybe a long time in the lab or a long time either going through a testing process of getting to market. Certainly we see a lot of benefit coming out for those sectors where longevity is going to be a key part of the development and the basic science still needs to be developed.

If you look at the mobile phone industry as an example, in terms of new product to market, it is very quick; the cycle is probably about six months. Some of the underlying physics that is required to develop the new products of the future takes years. I think what you have to understand is that part of the development cycle, part of the overall product development cycle and some of the science cycle, where maybe you are taking an invention from one sector and moving it into another, can happen quite quickly. So it is very difficult to say for a particular sector that all of its science would be good in terms of going through a Horizon 2020 or a European scheme or a global scheme, and some of it will be very much near market driven.

A lot of the activity we have heard about, a lot of the EU funding as well as a lot of the UK funding, is about pre-competitive research; it is about collaboration that moves forward the whole science agenda, enabling a number of products to be developed and eventually taken to market. Some of those developments actually might be focused on a particular sector when the initial idea is put forward, but actually the exploitation takes place in another sector or in another market.

I think what we have within the EU is a series of programmes that complements the programmes that we have decided are the priority areas for the UK, and also complements some of the other priority areas that take place in the rest of the world. The EU and its funding programmes, for me, is part of a patchwork of overall global issues that needs to be addressed. Within my own university, if I use that as an example, we have 13 centres of excellence. Probably six of them use EU funding as their driver. Three or four of them use global funding because they are about things like water security and food security and developing post-conflict. One or two of them focus primarily on UK-type funding streams, and I think that is true whichever market you are in. The question is whether you are in Europe or you are not in Europe. What you have there is a structure that facilitates the delivery of certain levels of science in certain sectors at this point in time. There is not the money to do everything for everyone; it is about making sure that we use that as appropriately as we can and, if I am being honest, from a UK plc point of view, to make sure that our support infrastructure, whether it be Innovate UK or research councils, in some ways hides the wiring behind, but enables organisations to engage in research in the most effective way they can through the most effective forms of funding available to them.

Q79 Lord Hennessy of Nympsfield: I have a question for Ms Burch. I was very struck in your evidence with that statistic you quoted at the beginning, that manufacturing accounts for

69% of business expenditure on R&D, and I think manufacturing now as a proportion of our national output is about 15-16%, something like that?[295]

Ms Felicity Burch: Yes.

Lord Hennessy of Nympsfield: Going back to the great debate just over 40 years ago, before we went into the EEC, one of the great arguments for joining the dynamic six, as they then were, was the cold douche theory—we were already worried about our manufacturing prowess being seriously on the wane and, if I remember, the level of R&D was falling behind where we wanted it to be already then. The cold douche theory was meant to shock us into a new, invigorated competitive activity, including R&D. You are a professional economist. Do you think it turned out that way? The proportion of manufacturers within our economy is much shrivelled. I know there are many, many factors at play here, but the cold douche theory, some would argue, almost gave us a fatal chill when it came to manufacturing.

Ms Felicity Burch: It sounds like we need another boost like that, in fact. I do not think manufacturing is to blame for that. You are right; the sector has shrunk as a proportion of the economy, but when it comes to research and development, it is still very much punching above its weight, and the same comes to exports.

I think there is a more general systemic problem for the UK: we do underinvest in R&D compared with competitor nations. Our manufacturing sector is much more comparable in R&D intensity with competitor nations, so I do not think the problem is there per se. That said, there are some real challenges for innovators, not necessarily unique to us, for other European countries as well. I doubt if I have to tell the Committee this but innovation is not easy and it does require access to resources, be they collaborative resources, expertise, skills, et cetera. These are challenges for anyone who is innovating, and access to innovation support makes a big difference, be it support from the UK or support from Europe, and what we need is more of that in both forums if we are going to boost the level of innovation that the whole economy does.

Q80 Lord Peston: My question is also to Felicity Burch. When I was an economist, I used to teach the students that it does not matter what you produce as long as it is where you have a comparative advantage and so on. My main question is: if you were to consult—or perhaps you know already—the members of the EEF, and your criterion was science research and development, would we be better off out of the EU? If that were your only criterion, would the majority say yes, no or don't know?

Ms Felicity Burch: Certainly our research with members more generally has been broadly supportive of staying in the EU anyway. I think when it comes to science and innovation, actually, the response would probably be more emphatic. The availability of support for funding, as I have already mentioned, from the EU is very valuable to our members, as is the access to the single market and the skills base from the European Union.

Lord Peston: So the answer was yes, it is beneficial.

Ms Felicity Burch: Yes.

Viscount Ridley: I just wanted clarification of vocabulary, if possible. We keep talking about Europe, but talking about the lack of need for visas and collaboration and so on, Ms Burch

[295] The correct figure is 10%.

mentioned the EEA. Is there really any difference between Switzerland and Norway and the rest of the EU in this respect—the ability to collaborate?

Ms Felicity Burch: I am afraid I do not have masses of detail on this one but I do know that Switzerland has had difficulties engaging with Horizon 2020.

Viscount Ridley: I meant from a British perspective, if you want to collaborate or visit Switzerland and Norway, does it really feel any different from collaborating with or visiting the rest of the EU?

Ms Felicity Burch: I am afraid it is not something I have had any feedback on from members either way.

The Chairman: Would Professor Latham like to have a go at that one?

Professor John Latham: Yes. Looking at a personal view from there, we operate in many parts of the world. There are certainly some advantages in collaborating within the EU within the Horizon 2020 programmes, going back to pre-agreed, pre-arranged—

Viscount Ridley: Is Horizon 2020 open to non-EU members as well?

Professor John Latham: It is. I will come to that in a moment. You are pre-empting part of my answer. One of the advantages, if you like, of looking at Horizon 2020—I will start from its entirety in terms of where you are—is that it gives you a framework within which to operate. For people who come to the ball, whether they be within Europe, in the EEA or in one of the countries that are allowed to play within the environment, it gives you a structure that enables you to take things forward much more quickly than if you were not part of that construct.

I will give you a very live example that I have at the moment. I have two programmes going on at the moment, one between an SME which I am a director of as a spinoff from the university, working with a very large British telecoms company that covers the whole of the UK—you might work out who it is. We have currently been in negotiations for about nine months and, as a small SME, we have next to no power and no control over where we are going; we are in a very difficult position. We are doing the same thing in a slightly different area within an EU context, and actually it has taken us three months. Most of the parties know what the constructs of having funding from the EU is about, and we have made very, very fast progress. The SME has almost had the same amount of influence within the collaborative research as the large players in the field.

So I think there are some definite benefits around having a good, well-orchestrated and well-put-together support infrastructure for science and enabling science to happen. That can happen at a national level, and does happen very well within the UK in terms of our agreement, and I think we heard some of that from the previous speaker; it happens at a European level extremely well, and it happens in certain parts of the world, but not every part of the world.

Viscount Ridley: When you say European, do you mean EEA or EU?

Professor John Latham: I think the answer to all of that is, if you wish to do collaborative research, and if the individuals are part of the programme within which you can apply—and I think it is very important to remember that what we are talking about here is that the EU-funded science is an envelope within which people can either play or they can not play —as a scientist, as somebody who is about engaging in science, I fundamentally believe science is

without borders. What you are then working on is the structures within that allow you to collaborate with certain organisations.

If you wish to look at people, we have previously as an organisation, as a university, collaborated with individuals, for example, from Switzerland or Norway or wherever it is, and quite successfully been involved in European programmes with them. We also still have programmes with organisations from those countries, and they operate in a slightly different way depending on the funding stream that we have decided to go for. One of the things for me is that the European Union and its funding streams to support research is one of the platforms that is available to an organisation to engage. There are definitely some benefits to be gained in certain areas at certain times from the constructs that the EU has put together. We have already heard that there are some programmes that operate within the UK that are also very, very popular. We have a lot of KTPs, we get a lot of funding from the research councils and Innovate UK, and in many ways what we are fortunate to have at the moment is a platform of opportunity for UK organisations to engage in the delivery of science. When I talk to people who are well outside—so I go well beyond EEA, into the States or Singapore, where we do a lot of work—they are quite envious of the range of opportunity that exists for organisations within the UK.

Viscount Ridley: Yes, but those opportunities exist for EEA countries that are not in the EU, do they not? I am sorry to press this point.

Professor John Latham: They do, but part of the issue that you have around the construct of where we are is that you have Europe, you have membership of the EEA, and you have global partners who are also part of the European science agenda. It is important to go beyond who can and who cannot be in there to the constructs of what the programme is about, and the fundamental science it is trying to support. It is all about bringing collaborative research together, it is bringing the main parties together, because fundamentally what you do not want to be forced into is a situation where you have to work with certain parties because they happen to be in a geographical location. If you want to actually take advantage of science into the best agenda, you want to be able to have the easiest access to the best partners that you can possibly have.

Viscount Ridley: Wherever they are.

Professor John Latham: Wherever they are.

The Chairman: Can we move on to Lord Hunt?

Lord Hunt of Chesterton: May I say that I once was evening-lecturing at what was then called Lanchester College of Technology and is now the University of Coventry. I was going to say, partly to answer the question of Lord Ridley, the French have this expression "suivre le dossier". The point is it is much easier to "suivre le dossier" if you are in the EU, and our Norwegian and Swiss friends are not very good at "suivre le dossier" at all.

The important question to ask both of you is: do you think that British industry or industrial applications understand as much as they should do about the advantages and the notions? I just give you an example: in the last two days in the BBC there has been a lot of discussion about Iran buying Airbuses, which of course in the French newspapers is a French aeroplane. There has been no mention at all that this is hugely British, and most of our science is in the UK, so is the story about us in Europe being well explained? That is a question that may well affect the conversations about membership.

Ms Felicity Burch: I think for business, certainly from a science and innovation perspective, the story about Europe is reasonably well understood. Actually, it is quite a testament to the framework programmes that European support is one of the areas of innovation support that manufacturers are most aware of, and awareness increases year on year in our surveys of the support that is available there. I am talking about quite an innovative bunch of manufacturers who respond to our survey, so obviously there is a little bit of selection bias there, but for the kind of companies that this support is there for, yes, I think they are aware of it and they do see the benefits of it as well.

Q81 Baroness Morgan of Huyton: You have covered some of what I was going to ask about the EU framework and now Horizon 2020. Our evidence broadly suggests that the amount of funds awarded to UK businesses has been relatively low in comparison to some of the other big countries. Why has that been the case? Do you see signs of improvement and, if so, why? Is Horizon 2020 better than the framework and, if so, why? Are there remaining problems about the programme and what are they? Could I ask also, following on from the previous conversation, who determines what Horizon 2020 is funding? Is it everybody? Bluntly, are Norway and Switzerland part of the decision-making process about what programmes are funded or is that just EU?

Professor John Latham: I will kick off. You have to be within the EU to have a really strong place at the table to make some of the big decisions in terms of where you are. It is very important to understand, I suppose, what is driving the agenda and the overall definition. The UK plays quite a large influencing position because of its science base already in terms of what formulates, so in some ways we play above our weight in formulating some of the programmes. I have been a formulator myself in a couple of programmes and I would say the influence that the UK has had historically has been quite important in that area.

If you look then at our taking part in the process and I look at my experience of working in a number of countries, I think the UK is still on a journey around the way in which the national support infrastructure brings organisations together to enable them to apply for funding. If you look at the improvements through the organisation I represent today, Innovate UK, we have now for the very first time—and it started in 1992—a nationally co-ordinated EEN network supporting companies in the UK to help them. Every other member state that I know of has had that since the mid-90s. We had a distributed model for a long time.

What you are starting to see, with the development of the catapults, which is a gap that probably existed within the UK infrastructure, with the bringing together of a national provision of EEN giving us oversight and more co-ordinated control, and you look at the work of the KTNs, we actually have a way to go. Some of it has been a little bit about us shooting ourselves in the foot by not being as good as we could have been at enabling people to fully understand the opportunities that exist within Europe and how you access them.

I can relate to a very interesting conversation that I had around an SME that we were working with from the UK to set up in Singapore, where we had an operation. We went to Singapore talking about the opportunity for that UK company to go into Singapore, and after about an hour's conversation there were two things that came forward which they fundamentally started to understand. First, they were shown a map of the world in Singapore, which has the UK in the top left-hand corner as a little dot, not in the middle, next to Europe—which you could make out, by the way, whatever it is—so they realised that other people's view of the world is slightly different. What they did understand within the

conversations is that the Singaporean partners could understand what working with Europe was about, and they could understand what being part of that was about. They had had experience of working with other companies from Europe which had that sort of benefit, if you like, so that aided the conversation. That was an eye-opener to the UK SME, that actually there are some other real benefits here. They did get a science contract and are now operating in Singapore.

So there is an issue, which we are addressing: once you have engaged in the game, if you want to call it a game, and once you actually have some experience of being involved in Europe, the take-up and the success of UK companies that has certainly come through from Europe is pretty high and people engage very well. The question is getting them to the trough.

The Chairman: Ms Burch, do you want to come in on that at all?

Ms Felicity Burch: Yes. I do not have much to add. I would like to support in general what Professor Latham said. You are right; our performance with the framework programmes has been better from a science perspective but that is not actually bad news for industry either. A strong science base in the UK, in Europe, is attractive for investors, and the evidence we have from Horizon 2020 is that industry is starting to perform a bit better. Across Europe the proportion of funding to industry has gone up from 24% to 28%. I do not know specifically about the UK but we are receiving 15% of the SME-dedicated instrument funds, which is about in line with the rest of our framework programme funding, and there really have been some improvements to what Innovate UK is doing that our members are noticing.

What is quite interesting as well is that I went to talk to our members about this. I asked them, "Has it got easier to apply for European support? What are your experiences?" and it was very much, "Yes, it has got easier." They were not sure if it was that the process had got better—some thought perhaps it had—or that the more they are engaged with it, the more they are aware of it, the more they understand the processes, and also who they can go to to talk to if they do not understand what the next steps are.

Q82 Viscount Ridley: I think my question follows on very well from Lady Morgan's and from the answer that Professor Latham has just given. It is about whether businesses in the UK, particularly SMEs, are adequately supported by the Government, effectively, in applying for EU funds, and in particular whether or not the abolition of RDAs has had an impact here. We have had written evidence from the Royal Academy of Engineering suggesting that it has. The burden of supporting companies that apply to Europe for funding therefore now falls on Innovate UK, effectively, which perhaps is a bit more like what Professor Latham was suggesting in terms of centralising, but there is a worry here that it could become too London-centric. We have heard that criticism made. As a northerner, I am always cross about that one. What are your thoughts?

Professor John Latham: I think there are two or three approaches here. The companies themselves are driven by many aspects. I am always fascinated about where most of the old English regions came from and, of course, a lot of them came out of Bomber Command regions during World War II, which is not necessarily a good reason for setting them up in the first place. Fundamentally, we have regional boundaries that—

Viscount Ridley: What about the Kingdom of Northumberland?

Professor John Latham: Part of what we have to recognise is that most companies do not recognise the borders that we put in place within the nation and whether they move, whether they come or whether they go. What they are really focused on is how much support, particularly if they are a small company, they can get locally for what they have, as well as access to expertise and the sector support they get for whichever sector they happen to be in or not be in. That is quite interesting in itself and I might come back to that point.

I think the RDAs varied across the UK. We operated in four regions; my own organisation supported companies applying for EU funding in the Midlands but also for a period of time in the south-west, and it was very variable. Some RDAs actually supported what was then the EEN network very well and allowed people to apply for funding; some RDAs did not.

The issue for me is around the relativity of being in a certain postcode, about being in a different postcode. What you can do is set a level of expectation of support that you would get wherever you are within the country, and that should be met as a minimum. There is a lot of work currently going on particularly in Innovate, which has put together its catapult network, which is around the sector specialism and the EEN network, which is completely regional within the UK, to support activities to try to raise the bar—to go up that level of support to be a minimum level of support, depending on which organisation you are and where you want to go. If I compare that to the experience I have in other countries, where they have been much better at it for many years, it is a question of having that local person, whether it be supporting a large company or not a large company, and access to that local person. In most places it might be through, for example, a science park or a university or a regional RTO or whatever it happens to be. It is to enable a client relationship to be developed with companies that allows them the support to enable them to engage within a new programme.

One of the things that I found very pleasing was that there was a small company—I was working for them, developing a product—and there was no interest in the UK for this product at all. It was not a UK product so the UK Government did not see it as a priority. It was a sector that nobody else was in, but Europe was interested because it was an interesting area of development, particularly for some of the Scandinavian countries, as it was about enabling people to survive in extremely cold climates. What we had was the ability from the UK to access support mechanisms across Europe, which gave them an advantage, and was not particularly strong for us.

Viscount Ridley: As a board member of Innovate UK, can you just reassure me that the issue of London-centrism is on the agenda?

Professor John Latham: It is very high on the agenda. Being able to support people where they are, wherever they are within the UK, and certainly that sort of view of regional support mechanisms and potentially regional hubs and the real advantage of having EEN taken on board, is a big, big opportunity.

The Chairman: Whether we like it or not, the RDAs are no longer with us and we have LEPs in place and, again, some of the written evidence suggests that their performance is uneven and that they are sometimes too small to be effective. Would you like to comment?

Professor John Latham: I will declare that I am a board member of Coventry and Warwickshire LEP, which is outstanding in its support, but, fundamentally, I think you have two issues around the LEP agenda. You have areas that have LEPs and areas that do not, so

we have a disparity in terms of what that means. Then you have support programmes coming out of the LEPs, which are still relatively in their early stages. I think some are performing quite well and, all joking aside, I think my own LEP has some good experience. Early on they funded some business support mechanisms through its growth hub to enable companies to apply to Europe, and I know that is not true everywhere in terms of what they are able to provide. In some ways I think what you have is enhanced support in some areas and lack of support in others. There is a requirement for us to get that even-handed approach, which, again, goes back to my view on Innovate UK working with growth hubs, working with EEN network across the whole of the UK, to raise it so that you have at least a minimum level of support to all organisations wherever they happen to be in the UK. That is a priority for us.

Q83 Lord Maxton: Can I just say we are talking here about RDAs being abolished but in Scotland, of course, we still have Scottish Enterprise, which you presumably know, and you talk about Innovate UK. What is the relationship between Scottish Enterprise, which of course puts money into investment, and your own organisation?

Professor John Latham: Number one, they work together. There is a lot of collaboration. If you look at EEN and the EEN network, it is housed within Scottish Enterprise, based out of Glasgow but, again, with a regional structure across most of Scotland. You have similar areas in the other devolved Administrations—I am Welsh by birth so I recognise what is going on there. You have a requirement, which is in the process of being met, of enabling across the whole of the UK, in terms of thinking about UK membership of the EU, a level of understanding where the support to businesses—and I will separate the support to businesses in terms of their understanding and ability to know about what is available to them—is becoming more even. There is of course—and this is something to debate—the disparity between the levels of funding in terms of match and programmes of support, which differs across each of the different devolved Administrations, because they have slightly different priorities perhaps in terms of how they might go about it.

Of course, one of the issues is that you cannot unpick the science agenda from the whole company support agenda. How much venture capital support have we got, for example? Where do people get the funding from to enable them to undertake innovative processes? It differs wherever you happen to be in the country or in whichever part of the Administrations you happen to be. It is quite a complex model that you are trying to unpick, and certainly the science agenda, whether it be UK national programmes or European programmes, is just part of that model.

Lord Peston: On this question of support, one thing that has troubled me for a very long time is, if you look, on the one hand, at the Government and the principal Opposition, virtually none of them has any science or engineering qualifications. If you look at our top civil servants, I think none of them is qualified in science or engineering, let alone my favourite subject, which is pure mathematics. Is this not a major problem in terms of pressing the support agenda, that the people who ought to be giving the support are themselves not really the right people? I am sorry; that is a general question.

Professor John Latham: I think that accident of educational background should not be held against an individual in terms of their ability to understand the problem that might be solved.

Lord Peston: Oh yes it should.

Professor John Latham: To understand the real issue around what support mechanisms are needed to enable something to happen, you need to go back to first principles—what do you need to put in place to enable you to support an organisation to move forward, of which science innovation is part of that overall agenda? Part of what we have within the UK is a reasonably holistic approach. There are some other countries around the world, and there are certainly some countries within Europe, which are extremely envious of our understanding of the complexity of supporting a business to develop, and also therefore to support its science and innovation agenda, So it is about the ability to draw upon expertise where it is required, but also to understand the bare necessity, for example, IP regulations, legal regulations—quite often companies are stopped from doing what they are doing because the lawyers say so, not because anybody else tells them it is a bad idea to do it. There is a real need to understand this, and I think this is true within the infrastructure we have. We have some very highly qualified individuals within Innovate UK actually heading up the lead technologists with background within the specific sectors that the organisation wishes to support. What you also have, which is the matrix approach, is specialists in business support and looking at how the infrastructure support comes in.

There is within the UK hierarchy, I believe, compared to other parts of the world, a pretty good base of advice and support, which enables things to happen. What we have to do, though, is put that into a framework of how much money is available to support the infrastructure and make it happen, and how we focus and make sure we prioritise in the right areas against everything that we are trying to do.

Q84 Lord Cameron of Dillington: I am afraid I am back to the regulatory regime that we made such a big thing of in the last session. We heard then, and also from written evidence we have received, that the commercial R&D—and I stress commercial R&D—in Europe has declined as a consequence of the EU regulatory environment. I just throw this to you and ask for comments, discussion.

Ms Felicity Burch: Our members do have views on this, certainly. Overall I think it is very unlikely that regulation has reduced the level of commercial innovation that companies are doing, but it is highly possible that it has influenced the type of innovation that they are doing. Let me give you an example: about 37% of our members who are innovating said that the driver of innovation was in response to environmental standards and regulations. A big one that stands out here would be the REACH European chemicals obligations, which our members consider to be extremely onerous and difficult to comply with. We have had a lot of anecdotal evidence from members saying that, because they are innovating to respond to REACH, they are not able to do as much innovation in other areas as they might like to do, and indeed, we see that more generally with regulation as well. As I have said, innovation is extremely resource-intensive and for businesses there is only so much you can do, particularly at the smaller end. So I think regulations can impact the type of innovation companies do.

There is a bit of a silver lining here as well. We look around the world, and places like North America, Asia, are now looking at introducing similar chemicals obligations, and EU companies will have a head start because they will already be compliant with these regulations. There is a global need for a certain degree of regulation and so long as the ones

in the EU are well made—and we do need to have a seat at the table to make sure that is the case—many companies might be well placed to deliver and export more in the future.

Lord Hunt of Chesterton: Let me give you an example. It is not always like that. The United States has a much better regulatory framework to stop ship pollution, whereas Europe is finding that very slow.

Ms Felicity Burch: Yes.

Q85 Lord Hunt of Chesterton: May I just ask another question? Do Innovate UK, EPSRC and so on, when grants and programmes are being considered, consider how these will be fitted into European networks? I have good evidence—my European colleagues work in these European networks, and there is not very much impetus from Innovate UK or our research councils. In fact, for example, of 24 leading groups to do with aviation technology and so on, only two out of 20 are UK-led. I wonder whether there is a move in this direction, since you are Innovate UK?

Professor John Latham: I think there is definitely a move in that direction. The UK is extremely well represented, certainly in the area I come from, in our computer scientists and digital technologies—telecommunications is my background. Those figures would be turned round the other way if you were to look at commission-led advisory boards and support mechanisms.

Again, you are highlighting the fact that across Europe there is a lot of sector dominance. Depending on what sector you are in and whether the UK is seen as a leading light within that sector, or whether the individual companies are seen as a leading light within that sector, you will see a different portfolio, and in certain areas, like healthcare, there is quite a lot of activity. Certainly, if you look in the automotive area, for example, there is a lot of German dominance. You can see almost a disparity across.

Trying to make generalist statements is often quite dangerous in terms of the overall representation of where individuals come from. Part of it also goes back to a question that you asked about organisations that were headquartered in one country but do most of their operations out of another. Quite often what you find is UK organisations that are headquartered here but their operations are in Holland or somewhere, and what you have is influence coming through their operations in the other member state rather than just coming from what is going on within the EU.

There are certainly areas of regulation—and regulation and legislation are both very interesting areas—that are always a bind or an issue when they are first brought in to meet. Once you have met them, they always have a competitive advantage, of course, above those that have not yet met them in terms of where they are and what they want to do. Part of the question is around enabling organisations to meet those regulations, and support them to enable them to meet them. Once they have met them, it can on a global scale be an advantage to have met them, because you then become compliant in so many markets at the same time with your product.

Q86 Baroness Neville-Jones: I want to ask you both, if you would not mind, a bit more about your view of the value of the EU supporting competence in the area of innovation. My impression is that you largely regard it as being helpful rather than a hindrance. Am I right in that, and are there any exceptions you would like to point to which are not the case, for, say,

sectoral reasons? As a general proposition, do you think that the support that comes from EU innovation sources is really compatible and complementary with what we do in the UK, or are there areas of conflict or difficulty? If there are, how would you suggest sorting them out? More generally, do you think that UK firms could derive more benefit from more bespoke innovation support rather than the rather generalised EU packages that actually come along?

Professor John Latham: I think generally the addition that we get from the activities that come out of Europe adds value to the whole innovation ecosystem that a company engages with. There are certainly areas, particularly around collaboration partnering, where the opportunity to get access to the right expertise is certainly a benefit. Most of what comes out of Europe complements what we already do in the UK. To go back to a statement I made earlier, it is not going to be the answer to everything for everybody; with the UK national innovation agency, the EU is one element of collaboration it is working with in terms of governmental support. I am doing a lot of work at the moment funded by the Brazilian Government; the work that is going on in Science Without Borders and at some of the innovation support around developing technology and science parks in Brazil is not getting support from the EU innovation system, but the national innovation system is working very well, in collaboration with the Brazilian Government, to enable that to happen. Where we can, we are making very good strides in terms of the complementarity between what comes out of the EU and what comes out of and is supported nationally from the national Government. We have also to bear in mind that national agencies are having to operate and work with other markets and deal with other support.

Baroness Neville-Jones: Is there sectoral differentiation?

Professor John Latham: I think there is, and there is always sectoral differentiation and, as I said earlier, there are also issues around size and scale of company and the life cycle to do with that. There is no doubt that there are some areas or sectors where the EU—

Baroness Neville-Jones: Can you give us some examples?

Professor John Latham: If you look at what we are trying to do in development of climate change, some of the things we are trying to do around healthcare development and the work that is going on around IT, there is a lot of very positive support coming out of the EU. For example, my own organisation is doing some work around water and food security—perhaps Europe could do more with us, but, fortunately, we are doing more with the UN and other funding agencies to enable that work. Effectively, I am going back to that term of hiding the wires behind so that the companies are benefiting overall without necessarily being too bothered about where the support infrastructure comes from.

Baroness Neville-Jones: Are you saying that if innovation support is not available in one particular area, the national system tends to pick it up?

Professor John Latham: Yes, I think the national innovation structure as it stands certainly has a base level of support for anybody who wishes to engage. Obviously, we have a number of nationally recognised priorities where there are additional programmes that are put in place. Certainly, if you look at the complexity, there is Innovate UK, the support coming from BIS, the work of the ODA activities, the support coming out of DfID and other bits of government as well as the support mechanisms coming out of UKTI. Companies in the UK are very fortunate in that they get a lot of cross-departmental support to enable them to

engage with what they need to engage with. That is not necessarily true in other countries, because the innovation life cycle is not just about doing the science; it is about the whole process of developing the underlying science and taking it to market or making sure it is exploited.

Q87 Lord Fox: We have heard about collaboration in answer to a number of questions so, just to round it up, I think I heard you say that EU membership does encourage collaboration with companies within the European Union. How about its effect on companies in collaboration outside the European Union, the USA or China, for example? Does it distract or does it benefit those collaborations?

Ms Felicity Burch: From EEF members' perspective, certainly we have never had feedback from members that collaborations within the EU have distracted them from other collaborations. In fact, I have spoken to US companies working in the UK and collaborating in the EU as well, but I think there is an additional point here. I was making the point about exporting earlier, and accessing EU support. For manufacturers, once you have done something once, it gets easier the next time, so if you are collaborating in Europe, the first international collaboration you do it is a relatively straightforward one, the next collaboration with a country further afield might be a bit easier, a bit less scary in many ways.

I think it is also worth noting that Horizon 2020 is open to the world. Many other countries are involved in it. We have agreements with places like Turkey and Korea that may not be partners in the same way as the UK or an EU member is, but it is about pulling in research from all round the world.

Professor John Latham: Can I add to that? The other hidden benefit quite often is the indirect benefit of collaborating with a company from a certain member state that has a very good relationship with another overseas market where maybe the UK's relationship is not as strong. There is certainly an opening or an opportunity that you find that some of the collaborations that have come together through the EU framework programmes in the past have survived well beyond the collaboration in terms of that science project in itself; they have become long-term collaborations, not just about the science but actually those organisations working together and then going to market together afterwards. There is this pull factor: if you work together initially, come up with the idea, as long as you are comfortable working together, you have a good partnership and collaboration agreement, you then can be much stronger than the individual organisation. Certainly, for most of the organisations I talk to, that collaboration, that partnership, getting the underlying fundamental agreement in place, being forced to go through that good practice of having a collaboration agreement, an IP agreement, and everything else, once it is in place, enables you to go again and again and work together again and again, and it can actually strengthen a company's portfolio.

Q88 Lord Fox: How about the EU's eight public-private partnerships? How do you rate those?

Professor John Latham: Some of them are still in their early days in terms of driving things forward. I think they are definitely of benefit. Organisations that have engaged with them are finding that the whole concept of having these areas of specialisation is adding value and supports their overall development. The gap, of course, is that you could have 16 or 32 if you

wanted to cover everything you wanted to do. You can only do so many. I think those who have engaged have found them positive. I think they are a positive move. They are certainly something that we can play an important part in.

Lord Fox: Is business sufficiently aware of these opportunities?

Professor John Latham: That is the million dollar question. You only know what you know, and part of the issue is about engaging people and helping them through that process.

Q89 The Chairman: The European Union clearly has some excellent schemes for encouraging scientists to move around within member states—the Erasmus scheme and the Marie Curie scheme. Is there any danger that such schemes might disadvantage scientists coming from outside the European Union?

Professor John Latham: I do not think so. I think there are, again, equivalences in many countries. If we look at the Science Without Borders programme, we have a number of individuals currently coming from Brazil, Brazilian students but also academics and support individuals. There is an opportunity through those; I must admit that in my early career I benefited from an Erasmus exchange into both France and Germany, which I found very beneficial in terms of becoming much more of a global citizen, never mind a European citizen in terms of the approach, so I do not think it hinders. It opens up the opportunity for people to take that first step. It is like students at my university who do an international exchange programme; they come back much more able to deal with things than if they had not had an international exchange, and that is true also for scientists and academic members of staff. Once you can engage with them and show them potentially it is not so scary, or there are real benefits of going and working and spending time in overseas markets, that is a real benefit for them.

The framework that Erasmus and Marie Curie, for example, and the old Leonardo programmes used to put together, did open the minds of a lot of individuals, both from the UK but also from other member states coming into the UK. That is very positive; it is quite a positive thing that the EU engages with, particularly around developing science base. As one of the earlier speakers said, what you really need to do is get people to spend some time together. I am a great supporter of technology—I would be, with a computer science background—but, fundamentally, getting people to spend some time together in the same place allows free thought and allows activities and agendas to move forward. If all you are doing is speaking to somebody about a specific topic at a specific time, you do not then get the benefit that you would see within the science and innovation agenda of people working together.

The Chairman: We are most grateful to you. We have covered a lot of ground in this session and you have been extremely helpful to us. Thank you for sharing your expertise with us, Professor Latham and Ms Burch. We are most grateful to you. Thank you.

Institute of Physics (IoP) – Written evidence (EUM0074)

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

1. The UK receives around 12% of all EU R&D budget appropriations, a proportion only behind that of Germany and France (2013 figures).[296] The UK was seventh in terms of its success rate for research proposals to the Seventh Framework Programme (2007 – 2013), with a success rate of 22.6%. Belgium was the top performer with a success rate of 26.3%.[297] This represented around £500m per year (or around 10% of the UK's national science budget), which is a generous return compared to the UK's budgetary input[298]. The UK leveraged an average of around 15-20% of all budgets across the previous three previous Framework Programmes (5-7).[299]. The UK also receives around 25% of all European Research Council (ERC) grants.[300]

2. The total research grant income UK physics departments received from all sources in 2013/14 was just over £285m.[301] Of this, £226m came from UK sources, representing around 79% of all income. Physics departments' funding from EU sources (including government, charity and industry sources based in the EU) amounted to just under £50m, of which nearly 95% came from EU government bodies. This represents around 18% of the total funding received by physics departments in 2013/2014. This is a slightly greater figure than the average across the sector, where around 16% of funds came from EU sources. The difference is slightly greater when only looking at EU government sources: in physics around 17% of total funding was from this source, against around 13% for the sector as a whole.

3. However, there is variation in funding between departments, somewhat determined by the kind of work they perform. For example, whilst some physics departments report that around 10% of funds come from EU sources, others report that around half of their funds come from EU sources (including the ERC, Horizon 2020, ITNs and Marie Curie Fellowships).[302]

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[296] UNESCO. *Science Report 2015: Towards 2030*, 2015: http://unesdoc.unesco.org/images/0023/002354/235406e.pdf
[297] UNESCO, 2015
[298] Technopolis Group, carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS). *The impact of the EU RTD Framework Programme on the UK*, May 2010: https://ec.europa.eu/research/evaluations/pdf/archive/fp7-evidence-base/national_impact_studies/impact_of_the_eu_rtd_framework_programme_on_the_uk.pdf
[299] European Commission Joint Research Centre. *European university funding and financial autonomy: A study on the degree of diversification of university budget and the share of competitive funding*, 2011: http://ftp.jrc.es/EURdoc/JRC63682.pdf
[300] Technopolis Group, 2010
[301] HESA data
[302] Information obtained by the IOP directly from departments.

4. A negligible amount of funding is available from countries outside the EU for UK researchers compared to EU and UK funding sources.[303]

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

5. Member states' contribution to the EU budget is determined by their share of GDP in the EU. The UK contribution to the budget between 2007 and 2013 was just under 11% of all funds.[304]

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

6. The UK is acknowledged as operating an efficient funding system, particularly in the way block grant funding is organised and allocated through the research councils.[305] Compared to other EU member states, the UK performed amongst the best for its effectiveness of public spending.[306] The UK performs particularly well in terms of its research impact, with the highest average citation rate amongst the EU's largest states[307] and for citations among the top 10% most cited papers. This is despite having the 12th most intensive rate of investment in R&D in the EU, behind countries including Estonia and the Czech Republic.[308]

7. The EU offers greater support than the UK for the management and administration of funds, but this must be balanced against a more bureaucratic application process than for UK funds. It may be very difficult for some researchers or companies to access funds as consortia are often large and unwieldy, and access to certain funds is only open to collaborative, often cross-border, proposals. This aids collaboration and the sharing of knowledge, but may be restrictive for researchers and SMEs who are less familiar with the system. The EU also requires all funded researchers to provide evidence that they have worked their allotted time on the projects receiving grant funding, providing a level of transparency.

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

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[303] Vitae. *Where to find sources of academic research funding*: https://www.vitae.ac.uk/researcher-careers/pursuing-an-academic-career/research-funding/where-to-find-sources-of-academic-research-funding
[304] Gabriele Cipriani. *Funding the EU Budget: Moving Forward or Backwards?*, 2014: https://www.ceps.eu/system/files/Financing%20the%20EU%20budget_Final_Colour.pdf
[305] Department for Business, Innovation and Skills. *Triennial Review of the Research Councils,* April 2014: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/303327/bis-14-746-triennial-review-of-the-research-councils.pdf
[306] Joint Report by the Economic Policy Committee (Quality of Public Finances) and Directorate-General for Economic and Financial Affairs. *Efficiency and effectiveness of public expenditure on tertiary education in the EU*: http://ec.europa.eu/economy_finance/publications/occasional_paper/2010/pdf/ocp70_en.pdf
[307] UNESCO, 2015
[308] UNESCO, 2015

8. UK science is extremely collaborative, and UK researchers are amongst the most collaborative of all EU countries. Nearly one in five publications submitted to the Research Excellence Framework in 2014 in physical sciences had an EU collaborator.[309] Over 55% of UK publications between 2008 and 2014 had foreign co-authors, with four of the top five collaborative countries being EU countries.[310] This greatly enhances the global impact of UK research through our collaboration and presence on the international stage. In physics in particular, many areas are extremely collaborative. Research in areas such as particle physics often involves thousands of collaborators across multiple countries and often sharing a range of facilities. Many scientific challenges require interdisciplinary skills and technological pull-through that can be enhanced with a larger pool in which to find expertise, and a larger market for pull-through.

9. EU funds such as Horizon 2020 have been extremely popular and utilised by a large numbers of researchers and businesses that had previously not engaged with EU Framework Programmes.[311] However, these have been vulnerable to changes in personnel and changes in strategic decisions. Horizon 2020 funding was set to be cut by 2.7bn Euros to support the European Fund for Strategic Investment (EFSI)[312], with no guarantee that the equivalent funding would be spent on research and science through EFSI. However, successful lobbying from across Europe ensured the impact of the cuts was reduced, with 500m Euros being ring-fenced.[313] Horizon 2020 did however provide an overall increase in research funding compared to the previous framework programme.[314]

10. The ERC is also an important complementary funding stream for which "excellence is the only criterion".[315] Whilst application is highly competitive, being investigator centred, the bid writing process is relatively straightforward for academics. The ERC also funds a number of areas to which there is little or no comparable UK funding available.

11. EU countries face many common policy challenges which often require collaborative, interdisciplinary research to come to solutions. EU funds incentivise this collaboration across EU countries, and help to inform and suggest solutions to policy challenges including climate change, energy security and transport infrastructure.

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[309] EPSRC. *Investing in excellence, delivering impact for the UK: Insights from the Research Excellence Framework 2014*, 2015: https://www.epsrc.ac.uk/newsevents/pubs/refreport2015/
[310] UNESCO, 2015
[311] European Commission. *Horizon* 2020*: First results*, 2015: https://www.ffg.at/sites/default/files/downloads/page/horizon_2020_first_results_1.pdf
[312] European Commission. *EFSI Factsheet 2: Where does the money come from?*: http://ec.europa.eu/priorities/jobs-growth-investment/plan/docs/factsheet2-where-from_en.pdf
[313] European Commission. *Amending letter no.1 to the draft general budget 2016*, 2015: http://ec.europa.eu/budget/library/biblio/documents/2016/AL/AL1_2016_en.pdf
[314] Universities UK. *Briefing – Horizon 2020* budget: http://www.universitiesuk.ac.uk/highereducation/Documents/2013/BriefingHorizon2020Budget.pdf
[315] European Commission. *Leading experts to carry out the European Research Council Review*, 2009: http://europa.eu/rapid/press-release_IP-09-307_en.htm?locale=fr

12. Innovative Training Networks (ITNs) have played a significant role in allowing many groups to maintain their number of researchers, whilst EU programs such as Marie Curie scholarships provide an opportunity to host high level international researchers and develop international collaborations within the EU and outside, increasing the volume and quality of UK research (e.g. the IRSES program).

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

13. It is easier for researchers in the UK to apply for grants and other support with EU member states than for non-EU member states due each state having to treat other EU countries' researchers largely as they would their own.

14. The EU has a target for states to spend 3% of GDP on R&D, and though the average EU GERD only reached 2% in 2013[316], states including Austria, Denmark, Germany and Sweden are either close to or are exceeding this figure. This push has increased the scope for collaboration in R&D across EU states, particularly in those states that have made greater efforts in increasing their R&R intensity.

15. In addition, the inclusion of associate states[317] and wider access by other non-EU states[318] to EU Framework Programmes helps to promote cooperation with non-EU states within the EU framework without the need to negotiate bilateral deals with individual states or groups of states.

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

16. The UK has very low rates of private R&D investment compared to other countries in the EU – 1.05% of GDP compared to the EU average of around 1.2%[319] - so efforts that encourage further private R&D investment are to be encouraged.

17. Recent research performed for the Department of Business, Innovation and Skills has found that public investment in R&D leverages private investment – for every £1 invested in R&D by the government, private sector R&D output rises by 20 pence per year in perpetuity.[320] There is nothing to suggest that the investment provided by the

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[316] UNESCO, 2015
[317] European Commission. *Associated Countries*: http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf
[318] European Commission. *Horizon 2020 – Work Programme 2014-2015 General Annexes: List of countries, and applicable rules for funding*: http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-a-countries-rules_en.pdf
[319] UNESCO, 2015
[320] Economic Insight. *What is the relationship between public and private investment in science, research and innovation,* 2015:

EU does not bring similar rates of return in leveraging private R&D investment.

18. Many EU schemes are oriented towards SME participation and some SMEs have indicated that income from Framework Programmes has been critical to their research programmes, helping to bolster nascent programmes and secure complimentary investment.[321]

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

19. Membership of the EU has given UK researchers access to a number of facilities based in the EU but outside the UK, has provided funding for a number of UK facilities and allowed UK researchers to participate in certain meetings and networks.

20. EU membership has allowed UK researchers to access facilities including the European Spallation Source near Lund and the TRIGA reactor at Ljubljana for neutron irradiation for CMOS R&D. EU programs such as Euromagnet have also provided very important support for accessing large facilities in Europe e.g. High Magnetic Fields which are not available in the UK. Funding from the EU allows UK participation in EU funding-dependent meetings, such as PLANCK (CMB observatory) meetings.

21. The UK-based particle physics experiment, the Muon Ionisation Cooling Experiment (MICE), which is located at Rutherford Appleton Laboratory (RAL), received EU FP7 support for its radio-frequency (RF) amplifier systems, and to allow European colleagues to travel to RAL to participate in MICE.

22. Various projects, facilities and proposed facilities, of which UK universities and businesses are partner organisations or coordinators, have also received important EU funding under previous Framework Programmes. These include the Large Aperture European Solar Telescope[322], the Einstein Gravitational-wave Telescope[323], LAGUNA-LBNO[324], and the Square Kilometre Array[325].

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https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/438763/bis-15-340-relationship-between-public-and-private-investment-in-R-D.pdf

[321] Technopolis Group, 2010

[322] European Commission. *EST: The Large Aperture European Solar Telescope*: https://ec.europa.eu/research/infrastructures/pdf/est_en.pdf

[323] European Commission. *ET: Einstein Gravitational-wave Telescope*: https://ec.europa.eu/research/infrastructures/pdf/et_en.pdf

[324] European Commission. *LAGUNA-LBNO*: https://ec.europa.eu/research/infrastructures/pdf/FP7_Factsht_Laguna2_31may13.pdf

[325] European Commission. *SKADS: SKA Design Study*: https://ec.europa.eu/research/infrastructures/pdf/skads_en.pdf

23. EU funding also makes it possible to access specific programmes of access such as EuCARD-2[326], which also acts as a networking and joint research programme. EuCARD-2 includes the ISIS neutron and muon source at RAL as one of its three networked infrastructures. Access to some large global programmes are managed through the EU, for example the UK's participation in the ITER fusion project[327], the JT60-SA tokamak in Japan[328], and the HPC-FF supercomputer at IFERC in Japan[329].

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

24. An important driver of the quality of UK research is the ability to appoint the best candidates, irrespective of nationality, and EU and international students and researchers make a vital contribution to UK research. UK research benefits from attracting top talent from across the EU to conduct work and to study in UK universities, bringing a wider range of scientific and cultural experience to departments. The UK has an above average share in published papers with foreign co-authors, with almost 60% of papers published between 2008 and 2014 having a co-author from an overseas country.[330]

25. Approximately 14% of all research and teaching staff in all UK higher education departments are from other EU countries, and around 11% of all staff are from non-EU countries (2013/14 data).[331] Within UK physics departments however, nearly a quarter, 24%, of all research and teaching staff are from other EU countries, with 16% of staff being from other non-EU countries. Some physics departments report that over half of senior independent research fellows originate from non-UK EU countries.

26. In 2013, non-UK EU students made up around 5% of all students at UK universities.[332] In physics departments the situation is similar, with non-UK EU students making up 5.4% of all students in undergraduate departments. This has however fallen slightly since the introduction of the new fees regime in 2012, with the proportion on a rising trend from 4.2% in 2005 to 6.5% in 2010, before falling to 6% in 2011 and 5.1% in 2012.

27. Of the relatively small number of taught master's students in physics (compared to the sector average), 12.3% of all students were from non-UK EU countries, compared to 9.7% across the sector. With increasing numbers of UK students taking up 4-year

[326] European Commission. *Physics and Astronomy: Networks of Research infrastructures supported by the European Union*: https://ec.europa.eu/research/infrastructures/pdf/thematic/KI0414728ENE-astronomy.pdf#view=fit&pagemode=none
[327] ITER: https://www.iter.org/
[328] JT-60SA: http://www.jt60sa.org/b/index.htm
[329] HPC-FF projects: http://www.efda-hlst.eu/hpcffprojects
[330] UNESCO, 2015
[331] HESA data
[332] HESA data

enhanced undergraduate courses with an additional master's year[333], taught master's courses in physics tend to be more attractive to non-UK students and provide extra income to departments, particularly at a time when many departments are in deficit[334]. EU students were an even more significant group in terms of doctoral study, with 17.2% of all physics doctoral students coming from non-UK EU countries compared to 13.1% in the sector as a whole.

28. The UK is attractive to international researchers and students due to its high reputation for excellence in higher education.[335] EU membership makes it much easier to attract outstanding undergraduate students from within the EU because states must treat EU students as they do their own home students.[336] As such, EU students are not charged the usually far higher fees that non-EU students are charged to study in the UK.

29. EU membership also makes it easier to attract talented graduate students from within the EU. Funding of PhD students by the Science and Technology Facilities Council (STFC)[337] and Engineering and Physics Sciences Research Council (EPSRC)[338] is accessible to EU students with UK residency (i.e. those who have completed their undergraduate degree in the UK) and the EU's Marie Curie scholarships and Innovation Training Networks (ITNs) also support PhD students from the EU to study in the UK, bolstering the sources of funding that they can access.

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

30. Collaboration is required to access much funding under for example Horizon 2020, and often this includes collaboration with researchers from outside of the EU. Funding under Marie Curie Actions for example is available to a wide number of non-EU countries under Annex A of the Horizon 2020 Work Programme.[339] Some EU programmes are also targeted specifically to initiate and strengthen collaborations with countries outside the EU, such as the development of COST International Partner Countries.[340] There are no analogues to this in terms of UK funding schemes

[333] UCAS data
[334] Institute of Physics. *The Finances of Chemistry and Physics Departments: Third Review*, 2015: http://www.iop.org/publications/iop/2015/page_66517.html
[335] National Union of Students. *International Student Perceptions on Employability*, 2012
[336] UK Council for International Student Affairs. *Home of Overseas fees?*: http://www.ukcisa.org.uk/International-Students/Fees--finance/Home-or-Overseas-fees/
[337] Science and Technology Facilities Council. *Student eligibility requirements*: http://www.stfc.ac.uk/funding/studentships/student-eligibility-requirements/
[338] Engineering and Physics Sciences Research Council. *Student eligibility*: https://www.epsrc.ac.uk/skills/students/help/eligibility/
[339] European Commission. *Horizon 2020 – Work Programme 2014-2015 General Annexes: List of countries, and applicable rules for funding*: http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-a-countries-rules_en.pdf
[340] European Cooperation in Science and Technology. *COST International Partner Countries*: http://www.cost.eu/about_cost/strategy/international_cooperation/ipc

that support such large-scale international networks.

31. Many strong physics collaborations are built around truly international facilities, for example the Large Hadron Collider at CERN and the ITER fusion project in France, with members from across the globe. In particle physics for example, UK researchers and physics departments are involved in experiments based outside of the EU, at large accelerator laboratories such as Fermilab in the US[341], KEK[342] and J-PARC[343] in Japan, and PSI in Switzerland[344], and other facilities such as SNOLAB in Canada[345], DUSEL[346] in the US, and Kamioka Observatory in Japan[347]. The experimental collaborations for these experiments are truly global with the UK taking on leadership roles in many cases.

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

32. No comment

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

33. No comment

12. How is the innovation landscape affected by EU membership?

34. No comment

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

35. The UK has a long history of having a Chief Scientific Advisor (CSA) within government and been unusual within Europe in this regard, with only the Czech Republic and Ireland having anything directly similar – though certain countries such as Germany have systems in place to provide scientific advice[348]. The UK CSA and the departmental CSAs have often been an effective and independent voice at the heart

[341] Fermilab: http://www.fnal.gov/
[342] KEK: https://www.kek.jp/en/index.html
[343] J-PARC: http://j-parc.jp/index-e.html
[344] Paul Scherrer Institut: https://www.psi.ch/
[345] SNOLAB: https://www.snolab.ca/
[346] Deep Underground Science and Engineering Laboratory: http://sanfordlab.org/
[347] Kamioka Laboratory: http://www-sk.icrr.u-tokyo.ac.jp/sk/index-e.html
[348] James Wilson. *Science Advice to Governments: Diverse systems, common challenges*, 2014: http://www.globalscienceadvice.org/wp-content/uploads/2014/08/Science_Advice_to_Governments_Briefing_Paper_25-August.pdf

of government ensuring that evidence is readily available to inform decisions[349].

36. The position of Chief Scientific Advisor to the President of the European Commission was introduced in 2012 and to some extent paralleled the position of the UK CSA. The removal of the post in 2014 was a step backwards. The European Commission has recently announced the appointment of a High Level Group (HLG) of Scientific Advisors to provide high-level scientific advice. [350] We welcome their appointment and hope that the new group is allowed to retain the independence and focus in its work as was the position of the CSA.

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

37. Perceived barriers to engagement with European policy development include distance and bureaucracy, but UK researchers, politicians and those working on science policy need to remain engaged and create closer connections with EU instruments in order to better feed in to EU policy.

38. The development of the 2004 EMF Directive provides an example which highlights UK researchers' ability to inform public policy at the European Level.[351] The EMF Directive was adopted in 2004 and restricted occupational exposure to electromagnetic fields (EMF), including those used in Magnetic Resonance Imaging (MRI) scanners. Some of the exposure limits threatened to impact on the current use and future development of MRI technology. Whilst there was some limited engagement beforehand, sustained campaigns and actions were not pursued until after the directive was passed. Lobbying by the MRI community eventually led to a delay in implementation until 2012, and in 2013 a new EMF directive was adopted which contains a derogation for most MRI activities, subject to certain conditions. The directive also contains a general power of derogation that allows member states to exempt other activities where there is justification.[352]

4 December 2015

[349] Institute of Physics. *Response to the House of Lords Science and Technology Committee consultation into the role and function of departmental Chief Scientific Advisors*, 2011: http://www.iop.org/policy/consultations/industry_innovation/file_52682.pdf
[350] European Commission. *SAM High Level Group*: https://ec.europa.eu/research/sam/index.cfm?pg=hlg
[351] Institute of Physics. *MRI and the Physical Agents (EMF) Directive*, 2008: https://www.myesr.org/html/img/pool/MRI-Report-Stephen-Keevil.pdf
[352] Health and Safety Executive. *The Electromagnetic Fields (EMF) Directive*: http://www.hse.gov.uk/radiation/nonionising/directive.htm

Institution of Chemical Engineers (IChemE) – Written evidence (EUM0004)

Summary

The prestige of UK research receiving EU funding and the relationships that it creates offset any costs incurred in the funding process.

The UK has benefitted from a large number of EU funding schemes, with its fellowship programmes providing excellent opportunities and prestige for UK researchers.

Collaboration is the key benefit of EU membership for researchers; if the UK were no longer part of the EU IChemE feels that this would negatively impact upon the UK research community.

IChemE thinks that the UK chemical engineering research community would have difficulties operating effectively at the postgraduate level without the flow of EU students, many of whom remain in the system at more senior levels.

The UK alone cannot provide the international academic and industrial networking opportunities that the EU can offer.

Funding

The UK receives a fair share of the available funding from the EU[353]. Some other, less-affluent countries do better, but it is appropriate for the UK and EU to support them in this way.

Levels of funding from the EU and the UK Research Councils (RCUK) are directly comparable, when considering similar funding routes.

A major issue of concern for UK researchers applying for EU funding is that the level of overheads given as a part of EU grants is significantly less than needed to cover full economic costs (fEC). RCUK funding offers 80% fEC, but the EU pays less than this which can discourage UK researchers[354]. Due to this discrepancy some researchers are discouraged from applying for EU funding.

However, the majority of researchers recognise the prestige of receiving EU funding and the collaborations it brings as off-setting this financial penalty. Increasing the level of overheads offer as a part of EU funding would significantly increase the incentives for UK researchers to apply.

The UK has benefitted from a number of EU funding schemes[355] over the years and this promotes EU cooperation (even cooperation with non-EU countries in some cases). IChemE does not think that UK research funding would go up if we withdrew from the EU and did

[353] https://ec.europa.eu/research/fp7/index_en.cfm?pg=country-profile
[354] http://www.rcuk.ac.uk/RCUK-prod/assets/documents/reviews/fec/fecexecsum.pdf
[355] https://ec.europa.eu/research/fp7/index_en.cfm?pg=country-profiles-detail&ctry=united_kingdom

not need to contribute to the central EU pot, so such a decision would be highly detrimental to the UK research base.

The EU research fellowship programme provides funding for academics to focus on their research and are very prestigious as competition across Europe is strong. The fellowship programme offers an excellent benchmarking exercise for UK research versus the rest of Europe. Chemical Engineering has been relatively successful in gaining such awards across UK universities.

Collaboration
Collaboration is the key benefit of EU membership for researchers; the relationships that it creates offset any costs incurred in the funding process. It would be of great benefit to the UK to strengthen further its collaborations and knowledge exchanges within the EU, as these relationships offer advantages to both academics and industrialists alike.

For existing collaborations, EU funding brings in additional resources to RCUK funding and enhances the scope for travel and exchanges to make the collaborations effective and truly interactive. Importantly EU funding acts as a great driver to develop new collaborations within the EU and offers the opportunity for UK researchers to make contacts that would not have otherwise been possible; gives them the use of facilities that they would not otherwise have access to; as well as creating the opportunities for the exchange of researchers to work in EU-wide laboratories.

SoftComp[356] is an EU Research Network that funds exchange of scientists between both university and industrial labs and access to state-of-the-art equipment, in the area of complex soft materials and formulation. It is an excellent example of a very effective network that links UK academics with both other EU universities and multinational companies like BASF, Schlumberger and Unilever. The sustained funding over a decade or so has increased the effectiveness of such a mechanism and enabled leverage of other EU funds and national research council funding.

However, the UK also has significant excellent collaborations with researchers world-wide. But these collaborations, whilst as strong as those with the EU, lack the mechanisms that the EU offers to support these research relationships. Freedom of researchers to travel and exchange knowledge is a major benefit for collaborations of any kind within the EU.

If the UK were no longer part of the EU, IChemE feels that this would negatively impact upon the ability of the UK research community to become involved in these important collaborations and also to develop research networks and access to specialist equipment.

EU projects can make it easier and more attractive for UK companies to work with partners in the EU and vice versa. This has been especially useful in technology areas which have been a lower priority for UK universities and funding agencies in recent years; such as chemical engineering areas supporting petrochemicals and oil refining. If the UK were not in the EU these kinds of relationships would be much more difficult.

[356] http://www.eu-softcomp.net/

UK academic researchers investigating the fundamentals of chemical engineering, including: catalysis and reaction engineering; process engineering; transport phenomena; particle technology; multiphase flow etc, have increased the strength of their research in these area by collaborating with industry in the UK, EU and beyond. This has created research that is competitive on a global scale. It can sometimes be hard for academics to find industrial partners within the UK, the EU offers more industrial partners to collaborate with and this is facilitated by being part of the EU.

Our capacity to attract investment from international companies is largely influenced by the UK's ability to create a world-class research base. There are indirect benefits of EU membership in terms of UK-based research and development having easy access to EU states, but the UK must provide a more attractive environment then all other countries to receive investment from companies for their own R&D activities. IChemE is keen to encourage a better method for companies based in the EU to invest in UK research and innovation; for example by finding ways of encouraging UK academic researchers to collaborate with non-UK-based EU companies (eg EDF, BMW) when submitting applications for RCUK and other UK-based funding.

Schemes such as the Marie Curie Fellowships[357] offer excellent opportunities for movement of both EU and non-EU nationals. The free movement of researchers is essential to maintain the UK's place as a world leader in innovation and research, all research is now international. For instance, students from EU member countries qualify as home students in the UK and this makes exchanges and quality recruitment easier.

Currently it is much easier to get EU researchers engaged in UK work than those outside the EU, with UK visa requirements being seen as stricter and thus more of a hindrance than other EU countries.

Without the recruitment of EU students the UK chemical engineering research community would have difficulties operating at the postgraduate level. Many excellent EU students stay to work in both UK academia and UK industry.

Regulation

Framework programmes are a major, stable source of research funding for many universities. If the UK were to leave the EU the UK would need to overhaul its research funding mechanisms to compensate support for this kind of research. The UK alone cannot provide the international academic and industrial networking opportunities that funding schemes like Horizon 2020 and the ERC offer.

The systems for the provision of scientific advice to Government are substantially different in the UK and in the EU. In the UK, every Government department (other than the Department for Culture, Media and Sport) has a Chief Scientific Adviser (CSA), whose role is to assure the quality of scientific advice in the department. The network of CSAs is overseen by the Government CSA (GCSA), head of the Government Office for Science. The GCSA acts as co-chair of the Prime Minister's Council for Science and Technology, which regularly provides advice on issues.

[357] http://ec.europa.eu/research/mariecurieactions/

In the EU the Joint Research Centre[358] (JRC) is responsible for providing scientific evidence and advice both to the Commission and to the European Parliament. For the first time, the previous President of the Commission appointed his own Chief EU Scientific Adviser, Professor Anne Glover. The current President has removed this role of Chief EU Scientific Adviser[359] and this was a major concern for EU-wide researchers as it was felt to seriously hamper the ability of the research community to interact effectively with the European Commission. The new Scientific Advice Mechanism[360] will go some way in filling this void and providing the EU with excellent and independent scientific advice.

IChemE considers the UK to be less risk averse than the EU. Whilst the European Commission's statement of the Precautionary Principle[361] is fit for purpose, its application by the EU errs on the side of hazard rather than risk management. This can result in stifling innovation (eg GM foods), and increased costs (eg water treatment).

Background

The Institution of Chemical Engineers (IChemE) is the global professional membership organisation for individuals with relevant experience or an interest in chemical engineering. We are the only organisation to award Chartered Chemical Engineer (CEng) status and Professional Process Safety Engineer.

We are also licensed to award the titles Chartered Scientist (CSci) and Chartered Environmentalist (CEnv) to suitably qualified members. Founded in 1922 as the professional institution for chemical and process engineers, IChemE has grown to its current status of over 42,000 members across 120 countries.

Our Royal Charter and charitable status confers upon us an obligation to advance chemical engineering for the benefit of society as a whole and support the professional development of our membership, which spans a wide range of individuals from industry, regulators, academia and consultancies.

We can call upon our members' expertise in these fields without bias or favour, in order to reach objective advice based on sound science. IChemE welcomes the opportunity to comment on this call for evidence.

This submission has been developed by IChemE's UK Research Committee – supported by IChemE's professional policy team – which promotes chemical engineering research with representatives from both industry and academia.

5 November 2015

[358] https://ec.europa.eu/jrc/
[359] http://www.senseaboutscience.org/pages/maintain-eu-chief-scientific-advisor.html
[360] http://ec.europa.eu/research/sam/index.cfm
[361] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:l32042

The Institution of Environmental Sciences (IES) – Written evidence (EUM0072)

Key points

- The Institution of Environmental Sciences represents professional scientists working across the environmental sector, whose work is significantly shaped and influenced by EU regulations and policies translated into UK law.
- EU funding for interdisciplinary environmental research is vital in maintaining the UK's status as a world leader in scientific research and innovation. The competition and partnerships encouraged by EU grant calls drive ambition and excellence in the UK and other member states.
- The UK is disproportionately successful in securing funding for research projects in the environmental sciences and other sectors due to the strength of our science base.
- The science community should not be defined exclusively in relation to research. Applied environmental scientists recognise the value of policy and regulation at the EU scale in tackling trans-boundary environmental problems, and of the strong environmental regulation the EU produces.

Background

1.1. The Institution of Environmental Sciences (IES) is a membership organisation that represents over 3,000 professionals from fields as diverse as air quality, land contamination and education - wherever you find environmental work underpinned by science. A visionary organisation leading debate, dissemination and promotion of environmental science and sustainability, the IES promotes an evidence-based approach to decision and policy making.

1.2. The Committee of Heads of Environmental Sciences (CHES) is the collective voice of the environmental sciences and related programmes in higher and further education. CHES plays a leading role in the Higher and Further Education Environmental Science community and advocates for environmental science within education. After working closely together for over a decade in 2013 CHES merged with the IES and now serves as its education committee. Together the IES and CHES now accredit over 75 degree programmes in the UK and abroad, including more than 20 Master's courses.

1.3. As a professional association representing scientists working in research, industry and a wide range of other sectors in the UK and internationally, the Institution welcomes the opportunity to give evidence on this issue, as the UK's EU membership is a major influence in the work of many of our members.

Funding for research and innovation

2.1. The IES strongly believes that to deal with the major social, economic and environmental challenges we currently face in the UK and globally, it is vital that the strength of the UK science base is maintained. It is also vital that 'challenge-focused' or applied science is adequately funded. Particularly given the context of public sector spending constraints domestically in the UK, it is very important to recognise the

contribution of EU funding for this type of research. Designed to complement the funding systems of individual members states (in theory according to the subsidiarity principle), the EU (through the Framework Programmes, including the current scheme, Horizon 2020, and the European Research Council; ERC) does not tend to fund much basic research, but rather focuses on investigator-led, 'frontier research' which spans the fundamental-applied divide. In this way, funding can be directed to fields which are showing promise with greater flexibility than is often possible through structures such as the UK Research Councils.

2.2. Social and environmental processes and challenges do not respect disciplinary boundaries, so funding for interdisciplinary research is essential. There are well documented deficiencies in the UK Research Council system regarding the funding of interdisciplinary research, which is often considered high risk. The ERC's Scientific Council encourages interdisciplinary applications. In guidance to peer reviewers it is explicitly stated that the priority is to select the best science, "independent of its discipline and independent of the particularities of the review panel structure"[362].

2.3. As others will demonstrate, the UK based researchers have been very successful in winning European research funding. The UK has a strong track record in winning a disproportionately high level of EU research funding relative to its size. For example, since 2007, the ERC Peer Review Evaluation Panel for Earth System Science (PE10; the panel whose remit most closely aligns with environmental science) has awarded funding for 46 projects to UK host institutions[363]. This is a significantly greater number of projects than awarded to institutions in any other Member State, with France the next highest at 25. This success is due to the excellence of UK science.

2.4. Environmental science research in the UK also benefits from significant funding under the EU Framework Programme for Research and Innovation. Under the seventh Framework Programme (FP7) from 2007 to 2013, €1704 million was spent on projects falling under the 'Environment' theme[364]. Of the 4055 projects funded under the FP7-Environment theme (according to the Community Research and Development Information Services; CORDIS), 603 were based in the UK, second only to Germany, with 645[365].

2.5. Not only does scientific research in the UK benefit from significant financial support from the European Funding Council, the increased competition for funding from the ERC which is a product of the large number of eligible institutions across the EU member states, arguably drives up standards and ambition in research. The significant value of EU research grants, which in the 'Advanced' category (for established researchers with strong track records as field leaders) can be worth up to €2.5 million over five years, and increased collaboration with EU colleagues, serve to enable the ambitious research programmes which this competition encourages.

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[362] ERC (2015) *ERC Frontier Research Grants Guide for peer reviewers*, Ref. Ares(2015)1056537, https://erc.europa.eu/sites/default/files/document/file/Guide-for-Peer_reviewers_StG_CoG_AdG_2015.pdf

[363] https://erc.europa.eu/projects-and-results/erc-funded-projects?f[0]=sm_field_cordis_project_hi_count%3AUnited%20Kingdom&f[1]=sm_field_cordis_project_subpanel%3APE10

[364] https://ec.europa.eu/research/fp7/index_en.cfm?pg=budget

[365]http://cordis.europa.eu/projects/result_en?q=(contenttype%3D%27project%27%20OR%20/result/relations/categories/resultCategory/code%3D%27brief%27,%27report%27)%20AND%20programme/pga%3D%27FP7-ENVIRONMENT%27

Collaboration

3.1. For the UK science sector to thrive, we need to be able to attract the best researchers to UK institutes and universities. Free movement of people within the EU is thus very important to the sector, emphasised by the difficulties in acquiring visas for researchers from non-EU countries currently noted by many institutions. To this end, the UK's membership of the EU is an important factor in maintaining our position as a world-leader in science and innovation.

3.2. A major theme in responses to a recent survey of IES members on this topic was the value of partnerships and skill sharing with teams and individuals from other EU member states. It was noted by members that the collaborations facilitated (and often required) by EU research funding programmes tend to generate long-term partnerships.

3.3. For environmental scientists working outside of academia, the free movement of people within the EU is also important, as enables companies to employ the best experts without barriers.

3.4. The Institution of Environmental Sciences is a member of the European Network of Environmental Professionals[366], giving members access to a range of resources and updates on EU policy, as well as a network of professionals from across Europe. Enabling members to engage with the EU policy process, and relevant consultations and debates, as well as groups of professionals in other member states, is very valuable. Although the IES could retain ENEP membership if the UK was not an EU member (ENEP has one Swiss member) which would mean many of the networking opportunities would be maintained, it is unlikely the same level of access to European consortia could be maintained, making the formation of profitable partnerships more challenging.

Innovation

4.1. For innovative companies and research organisations in the environmental sector in the UK, the innovation landscape is very complex. For the very large number of companies involved in the environmental services and water sectors, renewable energy generation and land management, areas of interest to the Institution's membership, support from the UK innovation system has been somewhat inconsistent. Whilst Innovate UK and the Knowledge Transfer Network have provided grant support and engagement activities, their ability to support technological innovation is limited by their size and budget. Even when the financial support from the various Research Councils (NERC and EPSRC in particular) for industry-university partnerships is factored in, the total sums available to support innovation (beyond what companies provide themselves) are dwarfed by funds that are potentially available from the EU, particularly the Horizon 2020 programme. From this financial perspective alone, EU membership is very important to UK organisations, and the UK has performed relatively well to date in winning EU grant support.

4.2. There are nevertheless areas where there is room for improvement. In the water sector, for example, innovation is hampered in part by the lack of explicit UK government support and representation at some of the significant EU committees. Whereas the UK has some winning technologies, and outstanding science, UK organisations are not eligible to bid for some of the funding, and not represented on the bodies that

[366] http://www.efaep.org/

determine the agendas. This makes further progress to the best possible levels very challenging.

4.3. Beyond that, innovation in environmental areas has often reached the position of requiring multinational partnerships to be commercially successful. The EU provides a good platform for these, particularly for small and medium sized enterprises, and for universities, and the UK would be hampered greatly hampered by lack of access to those funded opportunities. As explained above in section 3.3, the Institution of Environmental Sciences supports its Members in their efforts to engage not only with professionals and researchers in other member states, but with European consortia by offering services and networking opportunities through ENEP.

4.4. The UK occupies a very strong position in relation to environmental science research and innovation, and the EU provides a sound basis for further development and commercialization that is not readily matched in the UK.

Regulatory frameworks

5.1. The science community should not be defined exclusively in relation to research. The majority of IES members work in applied science, and a wide range of EU Regulations and Directives shape and affect their work. The work of many environmental scientists in the UK is concerned with the implementation of EU environmental regulation, or in data collection, monitoring or impact assessment associated with it. Important directives include the Water Framework Directive, Air Quality Framework Directive, Birds and Habitats Directives, Environmental Impact Directive, Strategic Environmental Assessment Directive, the Waste Framework Directive, Marine Strategy Framework Directive and many others. Although the provisions of these regulations could be recreated directly in UK law (and have of course in most cases been transposed into the UK statute book), we consider there to be significant advantages to the EU approach.

5.2. The EU has a positive tradition of developing strong environmental regulation, based on consideration of the available scientific evidence. Consequently, the UK's EU membership leads to the translation into UK law of good evidence-based environmental policy. Without this commitment, environmental regulation in the UK could be weakened (a concern voiced by many IES members in a recent survey), thus limiting the ability of environmental scientists to protect the environment. Despite the strong science advice systems in place in the UK, it is also unlikely that the breadth of expertise brought to bear on EU policy by 28 member states could be easily replicated.

5.3. It is clear to environmental scientists that environmental systems rarely reflect political boundaries, and environmental processes and pollutants rarely respect them. As such, regulation and policy developed at EU level is likely to be much more effective in addressing environmental challenges. At this scale, policy makers can take a systems approach to what are essentially transboundary issues.

5.4. As one IES member pointed out in a recent survey, EU environmental regulation such as the big framework directives on water and air quality reflect "bigger visions" based on more strategic and connected science. This "bigger picture" is not currently reflected in UK policy or legislation. On a related note, several IES members also raised the point that as well as regulation and policy, the EU often provides strong leadership on environmental issues, galvanising others to act. Our science is more ambitious, and our environment richer, as a result of this leadership.

5.5. EU leadership is important, but it should also be noted that UK environmental scientists have had significant influence in shaping EU environmental regulation. For example, the Urban Waste Water Directive was strongly shaped by UK science, and staff from the Nature Conservancy Council were instrumental in the development of the Habitats Directive and Natura 2000 network of protected areas.

Skills

6.1. In addition to the points already raised about the influence of EU regulation, and the value of potential collaborations, to non-academic environmental scientists, EU membership is also important if skills in this sector are to be maintained and improved within the UK. There is a recognised stalling in the development of the skills base in the UK, and transfer of personnel across EU borders is essential in maintaining skills in the sector in light of this trend.

6.2. As already noted, outside of academia environmental scientists work in the public sector, industry, consulting, and NGOs, and for these practitioners much of their work relates to achieving or monitoring environmental standards or requirements written into UK law, but derived from EU directives and policies. As one submission to our survey notes, at the same time, many of the activities and services of these practitioners are increasingly now being applied elsewhere in the world, as environmental standards are globalised (a process in which EU leadership has been important), meaning that: “there is therefore an intimate relationship between environmental policy at sub-UK, UK, EU and global levels and the range of environmental science-based services the UK provides. Hence, EU membership is crucial in driving both requirements for environmental science and for supporting skills development in this major sector”.

Science advice

7.1. As reflected in large proportion of EU research funding won by UK scientists relative to other Member States, the UK is a world leader in scientific research and expertise, including environmental science. Given the trans-boundary nature of many environmental challenges, it is in the interest of the UK to feed this expertise effectively in to European Union policy making. We have good track history in the this regard, with Anne Glover being appointed the first Chief Scientific Advisor to the President of the European Commission under Presider Barroso. Although this post has not been maintained under President Juncker, the influence of UK science on EU policy making should not be underestimated. If the UK were to exit the European Union, not only would we lose the ability to politically influence decision making in Europe, UK scientists would be less able to inform the process through formal and informal networks, to the potential detriment of both the UK and EU.

30 November 2015

ISARIC and ERGO at the Centre for Tropical Medicine and Global Health, University of Oxford – Written evidence (EUM0041)

Authors: Professor Peter Horby and Dr Gail Carson on behalf of the International Severe Acute Respiratory and emerging Infection Consortium (ISARIC) and the Epidemic diseases Research Group Oxford (ERGO) at the Centre for Tropical Medicine and Global Health, University of Oxford

Executive summary and recommendations

As directly related to our European research activities and from our experiences in participating as a partner within PREPARE (FP7) and GloPID-R-Sec (Horizon 2020), we believe that EU membership is an asset to UK science and research for the following reasons:

(i) EU Membership provides UK research groups and academic institutions with a critical source of funding that support our core activities and research staff.

(ii) EU Membership strengthens national and regional health security through facilitating European wide research collaborations to understand and respond to infectious disease health threats such as Ebola.

(iii) EU Membership has provided UK research groups and academic institutions with an opportunity to be part of and contribute towards ground-breaking European research collaborations, advancing research into infectious disease, medical management, and control in the UK and globally. It has enabled us to build robust research tools, develop and establish processes which can be applied both in the UK, in Europe and globally.

(iv) EU Membership has enabled EU citizens who have key skills and expertise to join UK research groups and academic institutions which has advanced research in the UK.

(v) EU Membership has allowed novel research platforms to be established that are then adapted and replicated in other regions of the world. The expansion of this will allow for a coordinated rapid, global response to epidemic threats.

Introduction to the groups based at Oxford

i. **ISARIC** (International Severe Acute Respiratory and emerging Infection Consortium) aims to prepare for future pandemics by bringing together all actors whose participation is crucial to a rapid and effective global clinical research response. ISARIC's membership is actively working within 93 different countries worldwide, and includes clinical researchers, infectious disease consultants, public health professionals, epidemiologists, statisticians, ethicists, and virologists. ISARIC's Coordinating Centre is based at the University of Oxford's Centre for Tropical Medicine and Global Health, and the team provides operational and technical support to ISARIC investigators globally, with, for instance, developing the research tools necessary ahead of future outbreaks, and facilitating research collaboration

across borders and disciplines. ISARIC has been very active within the global response to Ebola Virus Disease, MERS-CoV, and avian influenza H7N9.

ii. Epidemic diseases Research Group Oxford (**ERGO**) works in close collaboration with ISARIC and PREPARE. The group is led by Professor Peter Horby. ERGO is engaged in an international programme of clinical and epidemiological research to prepare for and respond to emerging infectious diseases that may turn into epidemics or pandemics. The group is currently conducting research on several epidemic diseases including Ebola, bird flu (H5N1), MERS-CoV and Enterovirus 71. The team members are widespread. The group's base is in Oxford, with centres in Vietnam, Indonesia, West Africa and worldwide collaboration with researchers. ERGO specialises in delivering rapid reaction clinical trials, currently with a clinical trial based in West Africa treating patients with Ebola. ERGO's response team is extremely flexible, evidenced by rapidly moving the study between countries as patient numbers waned in one country and increased in another.

Information about our EC-funded projects:

i. The clinical research response to severe infectious disease outbreaks is often delayed, isolated and fragmented and, as a result, has relatively little to no impact on improving patient outcomes and developing high-quality evidence to inform clinical management strategies to advance patient outcomes and control outbreaks. **PREPARE** (Platform for European Preparedness Against (Re-)emerging Epidemics) is addressing this shortcoming by establishing a European clinical research framework and pan-European clinical networks for harmonised large-scale clinical research studies on infectious diseases, prepared to rapidly respond to any severe infectious disease outbreak, providing rapid, real-time evidence for clinical management of patients and for informing public health responses. The University of Oxford is leading two of these PREPARE studies: MERMAIDS (The Multi-centre EuRopean study of MAjor Infectious Disease Syndromes) and ALIC4E (Antivirals for influenza-Like Illness? An RCT of Clinical and Cost effectiveness in primary CarE). Mermaids consist of three large studies set in the UK and across Europe into three infectious disease syndromes (Acute respiratory infections in adults (ARI), Sepsis like syndromes and ARI in infants and children, and febrile, arbovirus illnesses in adults. The aim of the studies which together, will enrol over 8,000 participants across Europe, is to advance early identification of new, infectious diseases emerging anywhere in Europe, to improve rapid identification, patient outcomes and control of (re_) emerging infectious disease outbreaks, at the same time advance clinical management of existing infectious disease syndromes with high morbidity and mortality in the UK and globally.

ii. GloPID-R-SEC is the Secretariat for **GloPID-R** (Global Research Collaboration for Infectious Disease Preparedness), which is funded by Horizon 2020. GloPID-R brings together research funding organisations on a global scale to facilitate an effective research response within 48 hours of a significant outbreak of a new or re-emerging infectious disease that could cause a pandemic. Its Secretariat, which is run in collaboration between Fondation Merieux and the University of Oxford through ISARIC, is supporting the GloPID-R membership by connecting funders to research

networks globally, and mapping research capacities and capabilities and the political, economic, administrative, regulatory, logistical, ethical, and social barriers to a rapid research response both among funding organisations and within the global research community. GloPID-R-Sec is also supporting the development of a strategic research agenda and readiness plan.

Responses

Funding

1. **What is the scale of the financial contribution from the EU to UK science and research, and vice versa? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?**

i. The University of Oxford is, through the Centre for Tropical Medicine and Global Health, a partner in two high-profile EC-funded projects that relate to pandemic preparedness: PREPARE – Platform for European Preparedness Against (Re-) emerging Epidemics was funded through Framework Programme 7, and GloPID-R (Global Research Collaboration for Infectious Disease Preparedness) is funded through Horizon 2020. Both projects are funded for 5 years each and are currently ongoing.

ii. The call that funded PREPARE, at approximately €24M, was the largest amount of funding ever allocated to Health from the European Commission. Though we are one of several partners from different European countries, the USA and Australia, 9 out of 22 partners are also ISARIC investigators that the Oxford-based groups work very closely with outside of the PREPARE collaboration. Further, Professor Peter Horby leads two of PREPARE's 11 work packages, which has brought Oxford a total of €4.2M in funding.

iii. With the call amounting to approximately €2.9M, the GloPID-R-SEC collaboration is run between two partners, the University of Oxford and Fondation Merieux (France). Oxford's share for this project is €1.14M.

iv. Jointly, our involvement with both projects contributes to the salary costs of seven Oxford-based team members. They are crucial for the running of our research groups, and are essential to retaining a leading presence within local, regional, and international pandemic research preparedness and capacity at the University of Oxford.

2. **What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?**

i. The European Commission initiated the Horizon 2020 Programme partially in an attempt to improve and simplify the administrative processes associated with the programme from those in place for Framework Programme 7. From our point of view, the administrative burden remains significantly more laborious than that associated with UK funding schemes, with financial and operational reporting being particularly rigorous.

ii. It is also sometimes practically difficult to harmonise processes between different European countries and thereby simplify, for instance, the payments to sites (e.g. hospitals) that choose to participate in clinical trials. More participatory and flexible decision-making processes could potentially lead to more context-specific policies that would enable a lower level of granularity and lessen the administrative burden on sites and research sponsors alike. Further, with current political and economic instability across Europe, regularly updated EC-led recommendations for reimbursements for participating research sites would reduce the administrative overheads of individual research departments and sites. Similarly, an overarching sponsorship role for the EC would reduce delays with regards to indemnity insurance across the EU.

Collaboration

3. What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

i. There are clear benefits to UK science and research in that it enables us to connect with colleagues and projects across Europe, and benefit from a highly valuable exchange of ideas. Infectious diseases do not respect borders, with an increase in travel, trade, and with climate change, infectious diseases are spreading geographically and new infections are emerging in new countries. Therefore, regional and international collaboration in pandemic and epidemic infectious diseases research and preparedness is crucial to UK health security.

ii. EU Membership has strengthened national and regional health security through facilitating European wide research collaborations to understand and respond to infectious disease health threats such as Ebola. The PREPARE network led an evaluation of European healthcare facility preparedness to accept Ebola virus disease patients, whilst the European Mobile Laboratory network (EMLab) was a key responder to the Ebola epidemic. There is enormous synergy and efficiency in a European-wide research response to dangerous pathogens.

iii. The current EU funded PREPARE project involves research in primary and secondary care sites across the UK and Ireland. This will improve the identification and clinical management of infectious disease syndromes with epidemic potential, having a direct benefit to the UK population. In regards to strengthening preparedness to (re-) emerging infectious disease outbreaks nationally and across Europe. The research outcomes will also advance clinical management, control and patient outcomes of a range of infectious disease syndromes, including acute respiratory infections, the

most likely cause of the next pandemic.

iv. We are also aiming to use the successful outcomes of our European collaborative efforts as a platform to improve health security in other parts of the world. For instance, rolling out a global adaptive randomised clinical trial for severe acute respiratory infection. Achieving this is crucial ahead of the next infectious disease outbreak of pandemic potential, which is likely to be a respiratory pathogen and will likely spread globally. Our involvement with projects such as these, and the capacity building efforts that they entail, puts the UK in a very advantageous position, which will also benefit research efforts should an outbreak occur and/or spread to the UK.

4. **What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China, and Singapore?**

i. A number of our projects and research activities have benefited enormously through the participation, expertise, and human capital of our team members who are EU citizens, and their ability move freely within a common European labour market.

ii. We have also benefited from the contributions made by our non-EU team members, but as our experiences of responding to the West African Ebola outbreak has shown us, issues concerning visa restriction is making it more difficult for us to work together. This is a serious problem for us as our global pandemic research preparedness efforts depend upon our many global collaborations and connections. It has, for instance, been difficult for us to arrange meetings or training sessions in the UK that include non-EU citizens on short notice – which is something that is often required in preparation or response to outbreaks where events unfold rapidly. Another issue directly related to the Ebola response concerns the ability to be able to return non-EU team members to their country of origin in the event of an emergency.

5. **Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?**

i. The EU membership does not inhibit collaboration with non-EU countries, rather the opportunities that result from Britain's EU membership in terms of EC funding does, for instance, enable us to develop tools and protocols that can be modified for use outside of the EU (as above) and enables recruitment of staff with specific expertise whose participation also benefit our global activities. We have excellent bilateral non-EU collaborations in place, for instance through Oxford's Wellcome Trust funded Major Overseas Programmes and through other sources of funding.

Regulation:

6. **Which EU regulatory mechanisms greatly affect the science and research community in the UK?**

i. The UK has been a key player in a number of EU initiatives, guidelines and regulations that have improved the processes, quality and effectiveness of medical research. Bringing together the knowledge and expertise of UK scientists, researchers and academics with their European counterparts has led to significant improvements in the quality of research, which has had a direct impact on the improvement of health care services across the EU. For example:
   - The EU Clinical Trial Directive including regulation such as Directive 2001/20/EC to Regulation EU No 536/2014;
   - The Community Code for Medical Products Directive 2001/83/EC;
   - The Good Clinical Practice Directive (GCP) 2005/28/EC (including detailed guidelines for good clinical practice as related to investigational medicinal products for human use, the requirements for authorisation of the manufacturing or import of such products)
   - The Good Manufacturing Practice Directive (GMP) 2003/94/EC;
   - The European Clinical Trial Register
   - The International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH)

ii. The mentioned EU frameworks have ensured significant improvements in equity and standards within the clinical research community, which would have been less smoothly achieved between independent states.

iii. Additionally, EU membership has enabled the creation of new guidelines and legislation that have improved the quality of care and clinical management in a range of different medical specialties, such as:
   - the European Organization for Research and Treatment of Cancer (EORTC) initiated a research program to develop an integrated, modular approach for evaluating the quality of life of patients participating in international clinical trials
   - Revised definitions of invasive fungal disease from the European organization for research and treatment of cancer/invasive fungal infections
   - European guidelines on cardiovascular disease prevention in clinical practice (2012)

20 November 2015

John Innes Centre – Written evidence (EUM0010)

The John Innes Centre

1. The John Innes Centre is an independent, international centre of excellence in plant science and microbiology based on the Norwich Research Park. Research at the John Innes Centre makes use of a wide range of disciplines in biological and chemical sciences, including microbiology, cell biology, biochemistry, chemistry, genetics, genomics, molecular biology, computational and mathematical biology. The majority of John Innes Centre funding is won in open competition from funding agencies worldwide, with 6% coming from European Union programmes.

2. In 2010, the John Innes Centre was ranked by Thomson Reuters[367] as the top research performer globally in the plant or animal sciences as measured by publication impact.

Responses

Funding

3. One of the most important principles of successive EU research programmes is that funds are awarded on the basis of scientific excellence with no link to Member States' financial contribution or their need to develop scientifically. On this basis, the strong research system of the UK has traditionally fared extremely well.

4. A shift in EU research policy towards fundamental science and the establishment of a European Research Council have also been of benefit to an internationally excellent UK research community, with the UK receiving significantly more ERC grants than any other Member State.

5. The UK does not make a direct contribution to EU research funding and therefore some assertions with respect to our net financial benefit are over-simplistic, ignoring both the complexity of the EU financial framework and the impact of the UK abatement. Any calculation of UK net financial benefit also overlooks the **additionality** of EU research funding.

6. Direct comparisons between the management of science funding in the UK and the EU are difficult as the two systems have different objectives. However, the fact that the simplification agenda at the EU level has near-unanimous support does imply that improvement is necessary and welcome. The European Research Council has quickly established itself as the gold standard in terms of research management in the EU.

[367] https://www.timeshighereducation.co.uk/news/top-institutions-in-plant-and-animal-sciences/411170.article

Collaboration

7. From the perspective of a UK research institute, the EU research programmes provide the following benefits:

- **strengthening research** – there is an increasing evidence base to show that international collaboration, and the new thinking that international opportunities stimulate, strengthen the quality of UK science;

- **achieving critical mass** – there are some large projects, for which international collaboration is essential;

- **widening competition** – tensioning the UK research system against the best in Europe is good for UK science;

- **increasing mobility** – EU programmes such as the Marie Skłodowska-Curie actions, increase the ease with which the UK can attract the very best and brightest scientists, not only those from the EU but also from other research-excellent countries such as the US;

- **delivering innovation** and economic impact – for example, through joint technology initiatives such as the Innovative Medicines Initiative;

- **training a future generation** of excellent researchers;

- **informing policy** – EU programmes can help inform or deliver UK policy, for example in our research area, EU programmes can support both agri-tech industrial policy and plant health policy.

8. The John Innes Centre's world-leading status is sustained by bringing the best and brightest minds to Norwich. Membership of the EU ensures that the movement of excellent European researchers to the UK is relatively straightforward. However, we believe that UK science will be **weakened** if UK immigration policy results in an effective bias towards EU scientists over others.

Regulation

9. For the John Innes Centre, the regulatory framework surrounding the genetic modification of food crops has a direct impact on our research and on the potential translation of our research for societal benefit.

10. If the UK were not a member of the EU, of course, this regulatory framework could be reformed to the benefit of research. However, the necessary change could equally be achieved from within the EU if the current regulatory framework was implemented as it is intended and written.

Scientific Advice

11. Mechanisms for the provision of scientific advice on matters of public policy are less well-developed for some EU institutions than they are for the UK Government. However, it is clear that the EU institutions are actively seeking to strengthen their performance in this area.

12. In the UK, successive governments' focus on evidence-based policy making and open policy making have strengthened the "**policy-pull**" for scientific evidence in Whitehall. The EU institutions will need to consider this policy-pull aspect of effective scientific advice in parallel to the "science-push" provided by a Scientific Adviser or Science Advisory Committee.

13. It is important to note that one key decision-making body in the EU, the Council of the European Union, must primarily rely on national science advisory mechanisms rather than those at the European level. For example, we would expect UK Ministers in Council to receive bespoke UK scientific advice on issues to be considered.

Declaration of interests

14. The John Innes Centre is funded by European Union's research programmes, including Framework Programme Seven, Horizon 2020 and the European Research Council.

16 November 2015

Professor Jan Kubik, Pro-Vice Provost International–Europe, University College London – Written evidence (EUM0070)

Summary

- **UCL fully endorses the position expressed in the Russell Group response to House of Lords Science and Technology Committee inquiry. This document provides additional arguments.**
- Science and innovative research, including in the social sciences and the humanities, work best when the flow of ideas, people and resources is as unconstrained as possible. Therefore, any form of restriction, however minimal, needs to be carefully crafted and remain as minimal as possible. At the beginning of the 21st century, humanity faces a set of challenges that are and will be best overcome by the concerted action of many people, collaborating with the fewest obstacles possible. Researchers' work is particularly central to those common efforts in today's world; it is also particularly sensitive to the existence of various barriers.
- Brexit would have not only serious economic consequences; it could also introduce to the European culture a tone of doubt in a common future. Such doubt will most likely have detrimental consequences on the short- and long-term cultural and political stability of the continent. And such stability is a prerequisite of urgently needed scientific progress.
- In today's world, networking – particularly across national boundaries – has become a central engine driving creativity, productivity, and effectiveness of scientific work. Since science, particularly in Britain, is a major factor behind sustained economic growth, the building of networks of collaboration should be encouraged not discouraged. Brexit would be a major factor disturbing the maintenance of the existing networks (such as Horizon 2020) and inhibiting the formation of new ones.
- Brexit would also mean a serious disruption in the funding of the UK's science, innovation and technology, while these areas are the engines of the UK's economic growth.

1. Impact of (the prospect of) Brexit on imagination, networks, and resources

1.1. The effectiveness and quality of scientific work depends on two factors: imagination (creativity) and hard, sustained effort. The prerequisite of generating "good" science is thus *creative effort*. In the 21st century, institutional systems that provide optimal conditions for the emergence and sustenance of creative effort are characterized by the openness to and facilitation of the free flow of ideas, people, and resources. In other words, new ideas tend to emerge when human *imagination* is allowed to flourish, people are free to *network*, and the networks are endowed with *resources*. What we need is the optimal institutional conditions for stimulating imagination, building networks, and providing resources.

1.2. A Brexit is bound to create three types of problems whose existence will make it impossible or very hard to continue the successes of British science that has always been a major force behind this country's historical and current standing as one of the world's

powers. These problems are: barriers to imagination, obstacles to networking, and challenges to (pooling) resources.

2. Drivers and barriers of imagination: broader implications of potential Brexit

2.1. Scientists, like all human beings, live in social worlds whose stability, predictability, and openness are essential for fostering creativity, innovativeness, and thus prosperity of broader communities. Brexit would send a powerful signal that an extremely successful process of building peaceful cooperation on a continent once torn apart by devastating wars has come to a halt and may even reverse. It is important to remember that the EU has never been simply about the increasingly tight economic cooperation and progressively integrated political organization; most fundamentally it was created to prevent war, build peace, and facilitate all forms of cooperation and mutual understanding.

2.2. The creation of the EU inserted into the repertoire of Europe's self-understandings a powerful note of hope and revitalisation. Hope that the Europeans, inhabiting a continent notoriously torn apart by wars and conquests can construct collectively peace and coexistence and reimagine their common fate by incorporating the 'what could be' into the 'what has always been'. To realise this programme of hope a set of economic and political tools has been devised. While it is not perfect, this programme of hope has proven to be extraordinarily successful, though – obviously – has not produced an uninterrupted string of successes nor a perfect union.

2.3. At a time of crisis, it is good to have a vigorous debate. The question is what kind of debate we should have in the research community, in scientific centres, at universities. Should it be merely or predominantly about searching for *rational solutions* and carefully calculated *material benefits* of this or that course of action (for example: to exit or not to exit to improve our economic situation)? There is a danger in looking at the issue exclusively in economic terms. We may forget that institutions designed to organise our collective existence, including our economic life, enter our minds, permeate our souls, and define our cultures. A radical institutional change is never without costs in these three dimensions.

2.4. Brexit will suggest a double capitulation of a long and successful project of continental peace building and cooperation: short and long-term. Short-term, such capitulation will be ill-timed. In the midst of the arguably most severe series of crises in the EU's history, derailing the process founded on the bold vision of hope is playing with fire. In human history, *the power of doubt has too often proven to be stronger than the power of hope*. Long term it may be the beginning of the end of the project. Universities and research communities, incubators of imagination, creativity and (increasingly) prosperity are not the place where this *deconstruction* of the project of hope should begin. Imagination and creativity will suffer in the post-exit chaos and the necessity to reconfigure networks of cooperation and to reorganize sources of financing.

3. Factors facilitating or obstructing networking: benefits of EU-level collaboration and drawbacks of Brexit.

3.1. Science is increasingly a collective enterprise. Working in tightly knit networks is not only cost-effective but also beneficial for creativity and innovation. Particularly, when the networks are international. In 2012, 47.6% of all UK scientific articles resulted from international collaborations. Only France can boast about a higher number of collaborative works (50%).[368] Importantly, internationally co-authored works produced by UK scholars have a stronger impact, as measured by the field-weighted citation index.[369]

3.2. Collaborative projects are clearly easier to design, develop, and maintain when the flow of ideas, people and resources is as unconstrained as possible. Not surprisingly, therefore, the majority of internationally co-authored papers produced by UK scholars were written with colleagues from other EU countries.[370] In 2013, UK scholars and research institutions had over 150,000 collaborative links in scholars in other EU countries. Only Germany had more links.[371] At UCL, for example, 88% of international collaborators within FP7 came from the EU.

3.3. The biggest barrier to international collaboration is the lack of freedom of movement, such as is facilitated by the EU, even though the UK does not belong to the Schengen area. As a major study notes: "Administrative matters related to visa applications for non-UK researchers were identified by every interviewee as a significant external barrier to researcher mobility and so to deep, long-term research collaborations."[372] There can be little doubt that Brexit would dramatically worsen this situation.

3.4. There is no evidence that the membership in the EU is detrimental to bilateral relationships with research partners from non-EU countries. UK scholars collaborate in high numbers with their colleagues in the US, Israel, Russia and China.

4. Challenges to (pooling) resources: benefits of EU-level investment and dangers of losing it.

4.1. According to a report summarizing the result of *The Seventh Framework Programme* (FP7), the United Kingdom ranked first among the 28 EU countries in terms of number of applicants and first in terms of requested EC contribution.[373] Among the top 50 higher and secondary education institutes (HES) that received funding, by far the highest number was from the UK (14, while the Netherlands, that came second, was represented by 7 HES).

4.2. The UK performs very well in the area of EU funded research. The UK has secured more than 16% of all FP7 funding to EU Member States and 27% of European Research Council (ERC) funding – this is far higher than the UK proportional contribution to the EU budget (c. 11.5%) or the UK share of overall EU spending (c. 5.6%). Between the years 2007-2011, the UK received €3.7 billion in research and innovation funding from FP7, second only to Germany. At UCL, EU funding represents 10% of our total research grant income, compared

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[368] *International Comparative Performance of the UK Research Base – 2013 A report prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS)*, page 59.
[369] Ibid, page 60.
[370] Ibid, page 69.
[371] *Seventh FP7 monitoring Report. Monitoring Report* 2013, 11 March 2015, page 94.
[372] *International Comparative* Performance, page 75.
[373] *Seventh FP7 monitoring Report. Monitoring Report* 2013, 11 March 2015, page 171.

with roughly 35% from UK Research Councils, 30% from UK charity, and 15% from UK government departments. Thus, an estimated 300 research jobs at UCL depend upon EU funding. We understand the figure is comparable to other UK leading research universities.

4.4. A Brexit would result not only in deterioration of the UK scientists' ability to access EU funds, but – equally importantly – the loss of the dominant position at the scientific decision making fora. This dominance has been achieved over many years and reflects the broadly recognized leading position in Europe of UK's science, technology and innovation. Moreover, as *Scientists for EU* argue: 'There are fundamental advantages to coordinating international collaborations, and such a loss would reshape the UK research landscape. Inevitably, there will be a loss of revenue' (http://scientistsforeu.uk/2015/11/the-brexit-effect-a-blow-to-uk-life-science-leadership/).

30 November 2015

League of European Research Universities (LERU), European Bioinformatics Institute (EMBL-EBI) and Culham Centre for Fusion Energy (CCFE) – Oral evidence (QQ 1-8)

Transcript to be found under Culham Centre for Fusion Energy (CCFE)

Learned Society of Wales, British Academy and Academy of Social Sciences – Oral evidence (QQ 41-52)

Evidence Session No. 4 *Heard in Public* *Questions 41 - 52*

TUESDAY 12 JANUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Kakkar
Baroness Manningham-Buller
Lord Maxton
Baroness Neville-Jones
Lord Peston
Lord Vallance of Tummel

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Examination of Witnesses

Sir Emyr Jones Parry GCMG, President, the Learned Society of Wales, **Professor Dame Helen Wallace** DBE, CMG, FBA, Europe Liaison Chair, British Academy, and **Mr David Walker**, Head of Policy, Academy of Social Sciences

Q41 The Chairman: Welcome to our second session. I apologise that we are a little late, but we will make sure that we do not short-change you on this. As we are being broadcast, I am going to ask if you will introduce yourselves. If you would like to make a brief opening statement at the same time, do feel free to do so. Perhaps we could start with Mr David Walker.

Mr David Walker: I am David Walker. I am head of policy for the Academy of Social Sciences. For seven years, I was a member of the Economic and Social Research Council, where I chaired the Methods and Infrastructure Committee.

Four sentences to begin with. For the principal social sciences—economics, psychology, sociology, probably geography, and certainly business studies—orientation is westwards towards the United States of America. Exchanges and conferences feature the anglophone connection in Britain, Australia, New Zealand and Canada. Of course, there is much rich involvement with the social sciences in the Netherlands, Norway, Sweden, Denmark and Germany, but connections are bilateral. Lord Hennessy said at one of your earlier sessions

that it is difficult to calibrate the EU element in talking/thinking above our weight in the world, and that is my starting point.

The Chairman: Thank you. Dame Helen.

Professor Dame Helen Wallace: I am Helen Wallace. Until recently, I was foreign secretary of the British Academy. I am now responsible for our European liaison work, and I am supposed to know something about the European Union.

Three quick points. As we have said in our submission, the story for British applicants across scientific domains under European funding programmes is a very good-news story. As the British Academy, we are pleased that the social sciences and humanities do even better than the natural and life sciences.

Secondly, the British Academy has been very closely involved in discussions with the European Commission about the shaping of framework programmes, as we have as regards experience to date, and that has been very important. Obviously, part of our concern, as with David Walker, is to help ensure that social sciences and humanities have enough weight in the process.

Thirdly, given that you have just been taking evidence from the other national academies, the British Academy has been working very closely with them on the development of the new scientific advice mechanism, which we may come back to later.

The Chairman: We will indeed. Thank you. Sir Emyr Jones Parry.

Sir Emyr Jones Parry: I am the president of the Learned Society of Wales. We are the new kid on the block; we have been in existence for five years. I am also chancellor and chairman of the council at Aberystwyth University. Thank you for the opportunity.

My fellows, regardless of views on membership of the European Union, would regard what the Community dimension has done for education, science, technology, research, as, on the whole, very beneficial. It has widened horizons. It has encouraged collaboration. Seen at the purely mercenary level, it has produced a degree of funding that has been very much appreciated.

The Chairman: Thank you very much, that is very helpful. I am going to ask Lord Hunt if he would like to start.

Q42 Lord Hunt of Chesterton: In yesterday's *Guardian* there was an article by a Dutch journalist discussing the British Brexit business, and he said that the question was whether we should be thinking of our relationship to Europe purely in a transactional way, the numbers and the money, or in a transformational way. What influence has the EU membership had on UK science, research and innovation? Do you see this in a positive way going forward?

Mr David Walker: It is very hard to distinguish bilateral relationships between UK social scientists, UK departments, UK universities, and their colleagues in other European countries, which for these purposes have to include Norway and Switzerland, which certainly in social science terms are very active participants, and programmes that take place under the auspices of the European Union. Regardless of the broader question of Brexit, it is not at all clear from the evidence that those bilateral connections would necessarily—taking the question of funding separately—be affected by the United Kingdom's non-membership of

the European Union. There is a rich pattern of exchanges, but pinning responsibility for those to the European Union and its programmes is much more difficult.

Professor Dame Helen Wallace: I would move on from there to say that from where we look at it in the British Academy and working with various sister organisations, we believe that we have some influence on the shaping of European research programmes and research priorities. We have been able to have a substantive and substantial voice in the way those discussions work from the early stages through the iterations, evaluation, and so on. Nothing is perfect, and I would not say for a moment that the European research programmes are perfect, but there is a relatively good fit between what makes sense for UK-based social science and humanities and science more generally and the way in which the framework programmes, and in particular the European Research Council, have developed.

Perhaps I could flag the European Research Council here, because not only is it the organisation from which British-based scientists generally do disproportionately well, but it is one that is particularly favourable to high-quality applications from individual humanities and social science scholars, so it fits very well with what makes sense to us. That helps us to make a major investment in human capital as the UK on the back of funding to individuals and research groups who have the kitemark of having won their grants in a very tough international competition.

Sir Emyr Jones Parry: The academics naturally go to where there is a partnership and expertise. Having said that, the EU has incentivised academics to look externally and to look to the European Union. Back in the early 1980s, I sat on the Atomic Questions Group in the council for three years, and occasionally in the Research Group. Over those years I was conscious how the United Kingdom has shaped the priorities of what is done in research in the EU. We have done that to the benefit of the sector in the UK. We have taken on a genuinely leading role because of the expertise that we have in the United Kingdom. I look back and think that the successful role that we played, and the benefit that has ensued for the sector, for the universities in the kingdom, has been to a very large extent beneficial. I do think there is a link, which you can show has been transformative to a considerable extent for universities that are perhaps not in the golden triangle that have been encouraged and incentivised, and the financial aspect has been important.

Lord Hunt of Chesterton: I was involved in a project of many, many disciplines involving systems for policy. It was absolutely unheard of; no research council was doing this 10 years ago in the UK. The EU was doing this extremely effectively and it has brought extraordinary connections. I imagine that kind of thing is one of the pluses really.

Sir Emyr Jones Parry: I recall that in the Department of Industry, as it was in 1982, the concept of innovation in a paper on that subject produced by the Commission was a source of ridicule within the department: what on earth was this subject? That is now part of the title of that government department.

Q43 Lord Hennessy of Nympsfield: I have interests to declare as a fellow of the British Academy and of the Academy of Social Sciences, and David Walker and I wrote a book together 30 years ago. Can I move us briefly from the plumbing of the relationship to the poetry, the intellectual free trade? As David Walker was saying, it is a two-way thing. I am a "remain" person as an individual in the great debate, but it seems to me that our influence on the arts and humanities side is pretty independent of the EU relationship. For example, in

many countries in Europe, the people they read about their own country are Brits: Paul Preston on Spain, Richard Evans on Germany, Ian Kershaw on Germany, Chris Clark on Germany, and Julian Jackson on France. That kind of intellectual influence is part of the internal discussion of the EU, but also the country internal discussion is both palpable and to our great credit. I do not think that would be affected by anything that we are talking about today because it pre-dated it. Denis Mack Smith was the great expert on Italy for Italians long before we were in the EEC. Do you think that we need to think of that level of the poetic life of the mind as opposed to the plumbing, the collaborations and grants, and so on?

Mr David Walker: Could I extend that to say that many of the questions which UK social scientists are interested in also interest social scientists from other countries, including the United States. This came to my attention, and I will share it with you and you can weigh it as you think fit. Lord Hennessy has a connection with the London School of Economics. The London School of Economics has a European Parliament research group. It has published some 23-odd working papers in the last few years. I have just looked at its website. Of the 23 authors involved—there is one duplication, because Simon Hix did two—12 came from the United States of America against seven from the United Kingdom and four from European Union institutions. I think that indicates something about the Americans being interested in Europe, which is a good thing, but also about how intellectual life is dense and not really national. It is very much institution-based, domain-based, but in this instance I do not think it could be said to be European Union-based.

Professor Dame Helen Wallace: We have an advantage because we speak English, and that helps the resonance of people who are anglophone and who write in English. I went to German classes with Ian Kershaw in 1971, when he was moving from being a monastic historian to becoming the great biographer of Hitler, and he would not have been able to achieve what he did if he had not also spoken German and spent quite a lot of time in Germany consulting sources. The resonance of poetry, or whatever, written in English is hugely important, but in order for that to have traction it needs benefit from contact elsewhere.

Q44 Lord Fox: I think this is the non-poetic version of the question that we have just heard. I am not a poet, of course. We heard from the previous evidence-givers that the sort of biomedical research that required access to large populations and harmonised data and access to large lumps of data was particularly benefitted by membership of the European Union, whereas standalone style of research probably did not necessarily need so much of that benefit. I have probably understated that. Is there a similar dichotomy in the academia that you represent, or is it all much more of the standalone, which I think Lord Hennessy was alluding to just now?

Sir Emyr Jones Parry: I think generally it is both. Lord Hennessy was absolutely right in the way he described it, but I do not see why there is a problem in pursuing academic to academic, the reputation of a scholar in a particular country, and at the same time doing what we do in the European Union. Both of those things are totally consistent. I see no contradiction between them.

There are a couple of myths that I would like to expose. The first is that if we were to leave, we could carry on as we were and benefit in exactly the same way and show the same leadership we have shown, and we could continue to do that outside. The second is that

alternatives exist and that we can plug into these. I do not think it is as simple as that. The truth is that we could manage perfectly well outside, but we would be diminished. The question is whether we want to be diminished. Too often, Governments speak about "the leading role" of the United Kingdom. We have a leading role in many things, but one of the few that we have "the leading role" is in science, research and what we do. Why throw that away for an argument that is slightly spurious?

Q45 Baroness Manningham-Buller: Good morning. I am not quite certain whether my question remains because of what has been asked. It is probably the plumbing of the poetry, to overegg Lord Hennessy's image. Most of the evidence we have had has been on the value to science, not so much on social sciences and the humanities from ERC and other grants. If you are able to give a comment on that, I think the Committee would find it helpful, even though it is the Science and Technology Committee, to have a perspective on the broader benefits of EU funding, particularly in social sciences, but also in the humanities.

Professor Dame Helen Wallace: There are two different kinds of answer to that. One is that there are fields of inquiry: migration, urbanisation, demography—we can make a list of the ones that are hugely important, both at the national and international level—where some mixture of social sciences and humanities scholars have really important contributions to make to our understanding of those issues. To be able to do that on a comparative basis across European countries, and indeed more broadly comparative, is important.

The second point, which links to what Lord Hunt said, is that in many fields one needs a cross-disciplinary/pluri-disciplinary team of contributions, where often issues that are about scientifically based choices also involve making judgments about the behavioural or cultural, and therefore being able to include in the team an anthropologist, a cultural studies person or a sociologist might make an important difference to understanding what makes sense in science policy and what is capable of being implemented as European legislation.

Baroness Manningham-Buller: I think the Committee would absolutely understand and accept that point. My question was about funding and benefit from the EU in this area. Can you comment on that?

Mr David Walker: In a sense you asked a leading question. Obviously there are European Union funds. From a social science perspective, the question is: what do they add to the other sources of funding that are available, national and international? If I can give you an example of data, there is a thing called the European Social Survey, which Paul Boyle mentioned when he appeared before you, an important piece of work that looks at attitudes across various European countries, including—I emphasise again—Switzerland, Norway and non-members of the European Union. It is also a European Union project, a so-called European Research Infrastructure Consortium. That is very important, although one observation might be that work from the European Social Survey does not enter into the kind of policy conversations or public conversations that take place in the United Kingdom. There are lots of other data sets social scientists draw on, such as the OECD, United Nations, and national datasets. I happen to chair the governing board of Understanding Society, a massive multiyear project looking at how households have been adapting to socioeconomic change over recent years. That is funded by the Economic and Social Research Council. It does not have a huge amount of international orientation, because it is looking at the United Kingdom in real time. Trying to isolate a specific European Union contribution, provided one

can get clear the question of whether monies from the EU are now and in future additional to national funding, is very difficult.

Q46 Lord Peston: I remember when Keith Joseph changed the name of the SSRC to the ESRC, and it was one of those rare occasions when I entirely agreed with him, and still do. This question is partly about the balance of the natural sciences and the social sciences. If you look at theoretical physics, plus experimental physics, and ask yourself where in the social sciences you find any work to compare with what the physicists do, you would be hard put to find anything, in my view. What passes for research in the social sciences is often completely second rate, in my view. In my own subject, once you have understood opportunity costs and the fact that free exchange between two pressed people will benefit both of them, you have learnt almost the whole of economics. I am puzzled at this notion that somehow we are not doing enough for the social scientist. Is it not about time that the social scientists started to do some stuff for themselves rather than bellyaching? I have put that to you as cynically as I can.

Professor Dame Helen Wallace: I am not sure that we are bellyaching. I wonder if that is fair. I think the research communities in social sciences and humanities include more talented and less talented members, and that is probably true in physics as well. Emyr is a physicist; he can comment on that. We would argue that we want appropriate opportunities for high-quality social science and humanities work to make a contribution.

To come back to the previous question, one of the advantages of going through European Union funding is that it is seriously tough, oversubscribed international competition and on the whole is really only able to fund pretty much the best work. It is an advantage to the British communities to have that kitemark. I hope it is the case that the peer review system and the competitiveness help to safeguard European programmes from, as it were, the poor second cousins who you talk about.

Mr David Walker: For the sake of institutional amour propre, I must not let Lord Peston's remarks go unchallenged. One can cite umpteen examples from UK economics of excellent work.

Lord Peston: Can you give me a few examples?

Mr David Walker: From UK sociology, which is held in low regard by some people, the work of John Goldthorpe on social mobility is absolutely excellent. He is a fellow of the British Academy. His work over the years is sociological quantitative work of the highest international quality. The present chief executive of the Economic and Social Research Council, Jane Elliott's work on longitudinal studies of households and families across time, again is rigorous, quantitative and extremely good work. There are exceptions that might prove a rule that social science can offer rigorous high-quality work.

Let me make a point, if I may, which is germane to your deliberations in this Committee. The success of UK social scientists in European Union-organised competitions is palpable. The data is not very great, but in quantitative terms it is better often than their STEM colleagues. I do not think there is any question of whingeing on behalf of UK social science. If I may say before you, the real question is whether we should expect UK social scientists to do as well as they do, or whether their performance does not actually reflect the excellence of UK universities and research institutions. It is the question you have addressed before of the denominator in the equation. What do you measure the return to UK social science on? Is it

population, the number of institutions or, a much subtler measure, the existing research excellence of the UK? On that basis, some of the results are perhaps less impressive than the conversations we tend to have about UK participation in the EU might imply.

Sir Emyr Jones Parry: Whatever the research, the important thing is to have a degree of rigour and excellence in what is being done, and that should be adequately reviewed. Going back to the early 1980s again, the work that was done by the Joint Research Centre was very expensive, but actually of no benefit at all scientifically or in any other way. That was changed over a period of time. It does follow that if you are going to do quality research in physics, it costs more and you are going to have to invest more. That is not an argument about not having sufficient funding for other good-quality research.

The Chairman: Before I invite Lord Cameron, I must observe that, having served on this Committee for a very long time, I can recall a number of occasions where our conclusions have been that we have not involved the social sciences community often enough and early enough in the outcome and our national policies would have benefited by a greater input. I must put that on record to counterbalance.

Q47 Lord Cameron of Dillington: Good morning. I suppose I have a view of the Treasury that they always tend to take a short-term rather than a long-term view, based on this year's Budget, so you will have to excuse a degree of bias or perhaps suspicion in my question. Do you think the current funding that we put into the European Union R&D budget would remain as UK funding for R&D in the case of Brexit?

Professor Dame Helen Wallace: That is a really hard one, is it not? As you know, the UK pays an aggregate contribution to the EU budget; it does not pay a separate subscription, as it were, flagged for the research and development programmes. The British Government have repeatedly argued in favour of increasing European research funding and for decreasing agricultural funding, to take a slight caricature. After a presumed Brexit, who knows? There would be many budgetary dispositions to rethink, including what the UK national spend should in that case be on agriculture, and that would probably trump the discussion about research. The Treasury—George Osborne at least is very keen on science, as we know—might allow for some enhanced science spending, but it would not necessarily have the same criteria of mobility and international collaboration that characterise European funds. My guess is that it would be not as much, it would not be ring-fenced and it would have different characteristics.

Lord Cameron of Dillington: Perhaps I should have declared an interest as a UK farmer.

Professor Dame Helen Wallace: I know you are.

Lord Cameron of Dillington: But one who, I may say, believes very firmly that the agricultural spend is excessive and a waste of money.

Sir Emyr Jones Parry: From the viewpoint of the scientist, the university, there is a certainty, there is a programme, there is money available, and there is an opportunity to bid for it. For a university or a scientist, especially in one of the devolved nations, there is even greater uncertainty than that set out by Dame Helen, and that is that whatever the British Government determine their priorities would be with that aggregate contribution and what they are in future going to spend it on, the way Barnett works there is then the question of how much comes to the devolved Administrations and that is not hypothecated. It is a question of what individual Governments in Scotland, Northern Ireland and Wales would

then do with that money and how much would trickle down. There is no certainty. Given the priorities that some of those Governments put in place, I would judge that most academic researchers would say better the certainties they have than the uncertainty that they would enter into.

Q48 Baroness Neville-Jones: I am going to ask a question about the regional impact of EU funding when it comes to university research. In some of the submissions that we have had put to us there has been some analysis that suggests there are regions of the country that are more dependent on EU funding to maintain their research capacity than others. Is that a feature of life that is very salient, or do you not regard that as being particularly important, the variable regional impact and whether EU funding helps the regions more significantly than perhaps money coming out of, say, the UK research councils? Perhaps Sir Emyr has views on this.

Sir Emyr Jones Parry: As you will know, one of the disadvantages of the Barnett formula is that it does not take account of need; it is a formula based on population. The net result is that the way it is allocated, I think, disadvantages Wales. If you applied the British Government's criteria for allocating funds within England, Wales would do better if the same criteria were applied in Wales. Having the benefit of structural funds and a large slab of the deprived parts of Wales comes within category 1, it produces a net return that is seen as a benefit for investment for the economy, but there is a consequential spin-off for research for the university sector. Funds have been used to support universities, to support research. Put simply, if Wales and other areas in Scotland are advantaged by being part of the EU system, they would be correspondingly disadvantaged were Brexit to apply.

Baroness Neville-Jones: Do I understand you to be saying, therefore, that the structural funding element, as distinct from, say, the science funding that comes from the EU, is relatively more significant?

Sir Emyr Jones Parry: Ten streams of financing come into Wales from the European Union, and they all contribute to the economy in different ways, but the economy is so directly linked to research, to the success of universities, that there is a direct read across that comes in. The very substantive investment in Swansea University at the moment has to a considerable extent been funded from the European Union.

Mr David Walker: I think it is worth recording that we do not have a total for the amount of research money, broadly defined, that comes from the European Union, because of this division between the directorates and their research budgets and between structural cohesion funds that issue in research contracts. Horizon 2020 and the European Research Council produce an aggregate which I am not sure we have collected together as a figure. Regarding its national breakdown, I do not think the data exists.

Baroness Neville-Jones: The impression I get from what Sir Emyr said is that it is the totality of the support that comes from EU funding that in the end makes the really significant difference.

Sir Emyr Jones Parry: The totality certainly makes a difference to the economy of the nation. Although the figures are imprecise, and there are errors in them, the one that I have is that from 2007 to 2013 the United Kingdom secured €7 billion from Framework Programme 7. Obviously there are other bits that have not been taken account of, but it is at least at that level. I think it is generally assumed, both in Brussels and the UK, that we do

disproportionately well. How well is a matter of a question mark perhaps at the margin, but we do disproportionately well.

Baroness Neville-Jones: On the science side?

Sir Emyr Jones Parry: Yes.

Professor Dame Helen Wallace: The science allocations do not have geographic criteria, unlike the structural funds. In this sense it is a random regional/interregional outcome, except that we know that under the science research funding streams it is the most highly rated universities that are the most successful. Perversely, in a way, simply on the science budget, the golden triangle institutions—as well as Edinburgh and Manchester—would be most vulnerable to the immediate hit and void as opposed to other parts of England or the wider UK. Northern Ireland has very disappointing returns on its applications to European programmes and keeps trying to set targets to do better.

Mr David Walker: Again, could I very briefly and gently take issue with the argument that the UK share is disproportionate? Of the top 100 social science universities, according to world rankings, 31 are from the European Union, of which 12 are in the United Kingdom. That would produce a proportion of around 40%. On that arithmetic, the UK should be getting 40% of available EU social science funding, and it does not.

Baroness Neville-Jones: I would not use the word "disproportionate", I agree.

Q49 Lord Peston: Central to the EU is freedom of movement, of course. Can you point us to any evidence or analysis of how freedom of movement affects the social sciences and humanities as compared with the natural sciences? Is it more important to social scientists, or do we not know? Dame Helen, you mentioned the Americans, who are separated from us by a common language, or whatever the joke was.

Professor Dame Helen Wallace: I declare an interest, Lord Peston, because my son took up a Marie Skłodowska-Curie fellowship at the University of Edinburgh last week, returning from the University of Chicago, in mathematical biology, so you may disregard anything I say on mobility and programmes that fund mobility.

Lord Peston: No, quite the contrary.

Professor Dame Helen Wallace: I think mobility is very important in all branches for the social sciences and humanities as for the natural, life and engineering sciences. I would stress the early career fellowships, of which the Marie Skłodowska-Curie programme is a prime example, provide a talented young scholar with the opportunity to have contact with whatever the state of the art, whether it is a research group or individual expert in her field. Certainly when I ran the Schuman Centre at the European University Institute in Florence, where we had many people on Marie Skłodowska-Curie or equivalent fellowships, it was very impressive to see the outcomes for them in changing their environment, getting the extra contacts and their career progression. I do not have stats on it, but it would be a really good question to ascertain their progression from those fellowships, which are typically two or three years, to tenured posts. I think we would probably see rather robust figures showing that this sort of postdoctoral fellowship stage in particular, with the opportunity to travel and work in another country, really makes a difference.

Lord Peston: I can see that it is important, but you still have not felt able to tell us whether it is more important for the social sciences.

Professor Dame Helen Wallace: I do not think there is a difference between social science and other fields.

Lord Peston: You do not think it is?

Professor Dame Helen Wallace: I think mobility and the opportunity to connect to state-of-the-art research groups in other countries in your field is incredibly important if you want to make a mark in any scientific domain that is transnational.

Mr David Walker: There is a cost to this. Again, I apologise because this is anecdotal; there is no quantitative evidence. Given that one of the purposes of social science inquiry is to elucidate general problems of public policy—society, economy, the Chairman mentioned social policy—if you get largish numbers of people from non-national backgrounds, their interest in national problems, and we all live in a national environment, is necessarily more limited. One hears of departments—political science, sociology, economics—that are stocked with mobile people, which is a good thing in many ways, whose interest in contributing to better understanding of United Kingdom public policy is necessarily a lot less. We do register perhaps a possible cost.

Q50 Lord Fox: One of the scenarios in the event of a Brexit is that the UK could become an associated country. Earlier, Mr Walker, you alluded to Switzerland and Norway. Looking at those countries, in your experience how would British science be affected in the event that we did become an associated country? How likely do you think that scenario is?

Sir Emyr Jones Parry: This is one of those myths that I referred to. There is an assumption somehow that the United Kingdom could be a greater Norway or Switzerland. I negotiated the European Economic Area some years ago, and the truth is the Norwegians were screwed. They are screwed by the Spaniards and others by having to pay and grant access to fishing waters off Norway. I said earlier, and I will repeat, we have a leading role in this area. Of course, we have an excellence but, none the less, do we really think that having walked out we are going to have the same access, the same degree of influence on what is happening as we currently enjoy. I think that is an illusion. I do not think it will happen like that.

Switzerland chose not to enter the European Economic Area. When it came to having to have a series of bilateral agreements with the European Union, again Switzerland had a very hard time from Spain and had to pay heavily for access and give rights to Spanish workers in Switzerland, which it would not otherwise have done, but was forced to do. The Swiss felt a degree of second-class citizen, so they made concessions in order to respond to that. I think it is true to say that in Horizon 2020 they have been downgraded. Why do we think that people will necessarily be grateful to the United Kingdom if we walk out? I do not think it will happen like that.

If I could finish one other point, we have not said much about the degree of competition and of promoting of excellence that takes place, but I do think that message of the EU that you encourage people to look more widely, to be competitive, helps. The mobility we were talking about earlier enriches universities, both in staff and students. The British Government were most reluctant to support the Erasmus project when it first came out. There was worry about sovereignty and competence in education transferred to the Commission. Did it work like that? No, it did not. As I understand it, 125,000 students from the United Kingdom have benefited through the Erasmus scheme from exposure, horizon-

widening, and, more importantly, employability at the end of it. It has been a considerable benefit.

Mr David Walker: We have examples of projects that are European in which Norway and Switzerland now participate as full members. We have mentioned already today the European Social Survey, which happens to be physically based at Bergen in Norway. The British Academy has recently been doing some very useful work, if I may say, on how far social sciences should be quantitative, and undergraduates have to do some number work before they graduate. The examples that John MacInnes has collected for the academy again feature countries in the EU, but also Norway and Switzerland, as well of course as New Zealand, Australia and the United States. Regarding the intellectual plain of UK social sciences, I am not sure that Brexit as such would necessarily have an effect upon participation by UK academics in projects that were genuinely pan-European, leaving the money question aside for one moment.

Sir Emyr Jones Parry: Of course, Chairman, we could continue to participate. That is not in dispute. The question is whether we want to play in the premier league or whether we want to be in division two, and that is where we would be.

Q51 Lord Hunt of Chesterton: One question that has not emerged in the way that Lord Peston asked is: what has been the value to the UK of the social science research? Clearly there are parts of the UK that are very deprived; the education is not very good. There are others where things are better. There are huge variations across Europe. My question is: have we learnt how to do things better in the UK from our involvement with the EU, and will that move forward? Clearly, the way education is done across the European countries is hugely different. I had a cousin who experienced the German system very unsatisfactorily as a schoolboy. There are big differences. I wonder whether the research and knowledge has emerged from the European research projects or has it just been, as it were, at the very high, intellectual poetic level.

Professor Dame Helen Wallace: That is very difficult to pin down. We do not have any evaluation that will give you robust answers to that. David Walker has already made the point, which I agree with strongly, that British social science and humanities, as the British research community more generally, are the strongest in Europe as reflected by our top-ranked universities and all the rest.

Lord Hunt of Chesterton: A lot of our education is very inferior to what is happening in certain schools.

Professor Dame Helen Wallace: At the university level?

Lord Hunt of Chesterton: At the school level, but university people study what happens in the schools and say what should happen in the schools.

Professor Dame Helen Wallace: I think British university experience has been very valuable in helping to develop the wider European research communities. One of the by-products of that is that universities in other European countries are setting about trying to become more competitive with British universities. In this sense, although the British record is a very powerful one, there are no grounds for complacency on our side that British universities can continue to have such a leading edge when universities in other European countries are beginning to do better.

To return to the association question, it is none the less the case that the rest of the European Union would suffer a loss if it no longer had such active British participation because of the current quality of British research. The question then is what kind of deal could be negotiated. We do not know whether an EEA/EFTA status could be negotiated for Britain, as with Norway. That is part of a much wider question that is not about research. We might end up with something that is more ad hoc and bilateral. What the British would lose in that scenario is the opportunity to be full participants in shaping the direction of travel of programmes, because we would be takers, not makers, of the policy process and guidelines.

Mr David Walker: To address your specific question about schools education policy, again one of the prime purposes of the social science inquiry is to try and undergird policymaking with evidence. I make the observation in a non-partisan spirit that schools policy in England recently has not been much driven by evidence of how things work, but the ideas that have powered policy have largely come from the United States of America, where Secretaries of State have found inspiration. They have not come from comparative studies across the European Union. The policy for schools in respective EU countries does not seem to have been relevant in any palpable sense regarding the formation of English schooling policy, and I think that would continue regardless of the relationship of the UK and the EU.

The Chairman: I think we can all accept that shaping the agenda is going to be at risk, and possibly funding too, were Brexit to happen. I do not follow playing in the second division, as Sir Emyr said, because we have already agreed that America can play over here and we can play in Europe. Why should the quality of our research suffer as a result of Brexit?

Mr David Walker: If I may endorse your question by giving you an example, there is a very useful longitudinal survey called the English Longitudinal Study of Ageing. In an ageing society it produces very useful data and analysis about how we are coping with demographic change. That survey is partly funded by the American National Institute on Aging. It is not funded by a European entity. It is first-class social science and would inevitably continue.

Another counter example is there is a big European Union-funded project called the Survey of Health, Ageing and Retirement in Europe, an important piece of work based in the Netherlands led by one of the scientists who is on the new scientific advice mechanism in Europe. There is no UK participation in that. It doubtless does very useful, interesting work, but it does not feature, partly because we have extant national programmes to analyse ageing here. There is maybe evidence that the future could be quite bright for UK social science in a non-EU context.

Professor Dame Helen Wallace: Can I add a point? It is clear, and we are all agreed, that currently the UK has high-quality science communities. Those science communities are full of many talented people who are not British. A very significant proportion of faculty researchers in British universities are not British. A very significant proportion of postgraduate, doctoral and postdoctoral fellows in British universities, as indeed with undergraduates, are not British. That is because the British have had a very open and welcoming system, we happen to speak English, which helps enormously, and we are a magnet for talent from elsewhere in Europe and other parts of the world. If we were less welcoming of, and less attractive to, talented people from elsewhere, my guess would be that UK universities would not do so well in those rankings. There is obviously a set of issues here about how far Brexit would put that at risk. It would take away some of the schemes

that bring talented people from other European countries. That does not necessarily affect the rest of the world. Let me say, in parentheses, our migration rules do not help in this context for third countries.

Sir Emyr Jones Parry: If I could answer the question you addressed to me, Chairman, I was referring to premier league and second division regarding our involvement in the European Union research community. Of course we will continue. Outside the EU the United Kingdom will prosper. Research will prosper because of our excellence. The point is that we would be impoverished, diminished, by taking that course of action. That is not an argument against universities being international; of course they are international much beyond the European Union, but the EU dimension in what it has brought—the competitiveness, the incentive, the resources—has actually benefited very considerably the sector. That is not to argue, a point that Lord Hennessy raised at the very beginning, against the different strands. They should continue, but one strand would be materially the weaker.

Q52 Lord Hennessy of Nympsfield: Can I pursue a little further the evidence-based policymaking theme that we touched on a moment ago? Can we have your thoughts on the organisation of professional advice to the UK Government compared to the EU? It seems to me that arts, humanities and social scientists are not as well placed as scientists, because we do not have chief sociologists or chief historians attached to departments. We have chief economists and statisticians, but the humanities and social sciences have always been rather thinly represented regarding organised advice. Having said that, we have been very concerned about the scientific advice mechanism that is being developed in the European Union. Are you happy, for example, that the arts, humanities and social sciences will have a strong enough voice as part of the wider science input into the SAM? Do you think the British tradition of speaking truth unto power, which we prize greatly as the key to public service here in the Crown service sense, is not exactly replicated inside the European Commission, if I can put it tactfully?

Professor Dame Helen Wallace: It is a very complex landscape. The European Commission has always drawn on science advice and has some 1,200 expert advisory groups. We are not starting from nowhere. Much of that policy advice has come in policy silos, for which we pay prices, as with the Volkswagen diesel fume issue, because climate change trumped public health and they got off lightly on the public health side.

The EU experiment with a single chief scientific adviser, which is the British system, turned out not to work very well at first sight, and with the new scientific advice mechanism—and it is a pure experiment—it is much too soon to say what its chances of flying are. The High-Level Group has been designated. It has yet to elect its own chair and deputy chair, which will come shortly. How that will operate and how far they will get on with the truth unto power challenge is a really interesting question. It was part of the remit that one of the members of that High-Level Group should be a social scientist. There are only seven of them, so that is not unreasonable. A Dutch empirical sociologist has just been nominated. We have to see how this works out. Flanking that High-Level Group, we hope, will be a consortium of European academy federations. I can only assure you that those of us who speak for social sciences and humanities have been, and are being, extremely active in trying to develop the proposals for that in such a way that the social sciences, and so forth, will have a firm position, not least because it is the behavioural, the societal and the cultural issues that will often be very, very important in determining whether or not new scientific breakthroughs

turn out to be publicly acceptable in Europe. Genetic editing is an example—one of the new sciences. We all have to try to make the new science advice mechanism work.

Mr David Walker: Two months ago you had before you that eminent scientist Sir Mark Walport, Government Chief Scientific Adviser, and I have to say you were eating out of his hand. Sir Mark is a very charming, courteous and distinguished scientist.

The Chairman: You are saying we were a pushover?

Mr David Walker: It is not at all clear, and Lord Hennessy hinted at this, that the organisation of science advice in the United Kingdom is perfect. Lord Hennessy mentioned economics I would say the fact there are separate organisations within Whitehall for economists, social researchers, operational researchers and statisticians means that there is a large area of policy-relevant activity that does not get fed into the official channels of 'science' advice. Mark runs the Government Office for Science. There are few social scientists, as such, who are present in the running of the Government Office for Science. I am not sure that in Whitehall/Westminster we necessarily have a model that we should say without qualification should apply elsewhere. That said, and Helen has hinted at this, the arrangements in Brussels look rather temporary. It is true that there is one social scientist on the inner group of the new scientific advice mechanism, and she may well be a distinguished Dutch sociologist, but, from our point of view, it does not look like the critical mass that would speak truth to power, that would say, "Here is evidence that is contrary to the thrust of policymaking", that has been built into these arrangements.

Sir Emyr Jones Parry: It is not only in the European Union, but perhaps in some of our nations that the need for a more evidence-based approach to policy exists. I have a colleague who was vice-president of the Academia Europaea as well as the Learned Society of Wales, and, talking to him, his view is that at least under this new system—and the jury is still out, as Dame Helen said—science advice and evidence-based policy in the EU will be given much more emphasis under this new arrangement than it was in the past. The seven individuals are quite impressive in their own right, but for the first time there will be an officially recognised route for academic professionals to provide scientific evidence for policymaking to the Commission through the pan-European academic networks. If those work well, reflect their membership and co-operate together, there is a prospect of a transparent system that may well work, but the jury is still out.

The Chairman: Thank you. Looking around the Committee, there are no further members trying to catch my eye. I will say to Mr Walker that I entirely agree that the present arrangements are not necessarily the best of all possible arrangements for organising science policy advice and regulation. I repeat again that we have said many times that the social sciences could make a greater contribution were Government to effectively interact with that community. I think that is precisely the advice that Mr Walker has just given us, so we agree about that.

The purpose of this report, and thank you for all the input you have made to it today, is to discuss the relationship between EU membership and the effectiveness of science, research and innovation in the United Kingdom. When we come to write the report we will be looking very carefully at the evidence you have given us today, both written and oral, on the role that social sciences can play, and indeed should play. Thank you very much indeed for a most illuminating morning.

Marine Biological Association – Written evidence (EUM0035)

General comments

- The Marine Biological Association (MBA) is a Learned Society established in 1884 "to promote scientific research into all aspects of life in the sea and to disseminate to the public the knowledge gained". The Association was incorporated by Royal Charter in 2013 and currently has about 1400 members (including international members).

- The MBA has a long history of providing advice to the UK Government, the European Union and the Devolved Administrations. It continues to engage with policy and provide advice through a wide range of activities including responding to government consultations and giving evidence to Parliamentary committees.

- The MBA membership is made up mainly of professional marine biologists and as such regularly invites its members to provide input on a range of issues. The MBA therefore provides a 'clear independent voice to government' on behalf of the marine biological community.

- The MBA has been based at Citadel Hill Laboratory in Plymouth since the Marine Laboratory was built in 1887. MBA members and staff have been at the forefront of providing scientific information to support marine environment protection, management and education.

Questions

Funding

Question 1: What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

1.1 The UK is currently one of the leading countries in the world in terms of scientific output and impact. Consequently, research organisations, charities and universities are amongst the most successful in attracting EU funding as well as attracting the best talent from within the EU and abroad. In 2014, for example, the EU contributed €1.02 billion to the UK for research and development which is more than double the EU average of 7%[374]. In the Seventh Framework Programme (FP7) funding scheme from 2007-2013, the UK secured 16%[375] of the available funding (c. €4.4 billion), the equivalent of about 10% of the national science budget and second only to Germany[376].

[374] http://europa.eu/about-eu/basic-information/money/expenditure/index_en.htm
[375] Universities UK, Briefing – Horizon 2020 budget (http://www.universitiesuk.ac.uk/highereducation/Documents/2013/BriefingHorizon2020Budget.pdf)
[376] Creating the Future a 2020 Vision for Science & Research: A Department for Business Innovation and Skills Consultation on Proposals for Long-Term Capital Investment in Science & Research (2014)

1.2 Under the Seventh Framework Programme for research (2007-2013) the Commission contributed an average of around €350 million a year towards marine and maritime research. The majority of funding however is still provided at the national level. A JPI Oceans report revealed in 2011that "*most of the activities in the field of marine and maritime research are funded, programmed, implemented and assessed at national level*". National funding for marine research has not been increasing in real terms however and organisations such as the MBA are increasingly reliant on European funding.

1.3 As an example of a UK marine organisation, the Marine Biological Association (MBA) has been successfully applying for European funding since the beginning of FP7. The MBA currently participates in nine successful projects, bringing a total value of €3.7 million. Since then, EU funding through Horizon 2020 (the 8th Framework Project) has taken on higher importance, reflecting the reduction of available funding and higher competition in the UK for a decreasing amount of available funding. Since the start of H2020 in 2014, the MBA has participated in five successful projects of a total value of €3.7 million, including a European Research Council (ERC) Advanced Grant. For the year 2013-2014, EU funding constituted 20% of the MBA's budget (£760 000) and 16% (£653 000) for 2014-2015. For Smaller organisations, such as the MBA, which produce world class research of international significance, this funding stream is being used to make up for real-term declines in national funding.

1.4 EU funding is strongly project based which means that marine organisations can vary widely year to year on how much EU funding is received as projects start and finish or new framework programmes are implemented[377]. These 'drop-off points' in funding are also an issue at the national level however and more needs to be done to address this in order to retain capacity and develop expertise.

Question 3: What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

3.1 There has been an increasing drive to make access to European funding more straightforward and easier for grant-receiving bodies to manage so, for example, the ongoing project management and reporting (technical and financial) is much more streamlined with H2020 and decisions on proposals take about the same time for both H2020 and RCUK. H2020 therefore now compares very favourably with RCUK for administrative costs and reporting. This makes H2020 an attractive source of funding.

3.2 In addition, for H2020 100% of direct costs are funded and overheads are a simple flat rate of 25% of all eligible direct costs (staff costs, consumables, travel, equipment). RCUK in contrast only provides 80% of Full Economic Cost (FEC) and the overheads (Indirect and Estate costs) are allocated on an institutional basis (calculated annually based on 3 years accounts figures i.e. actual, budgeted and projected). Also, RCUK overheads are only based on staff time and due to the efficiency savings in RCUK, awarded indirect costs are generally top-sliced.

[377] http://www.sams.ac.uk/learned_society/sams-agm/SAMS%20Annual%20Report%202014.pdf

3.3 H2020 funding is therefore preferable to national funding in that is incurs less administration time (calculating annual overhead rates), is better in terms of cost recovery (100% vs 80%) and is more flexible in terms of indirect costs.

3.4 There are issues however over the type of organisation that benefits. For FP7 60% of UK participants were academics (only 11% were research organisations), the highest proportion in Europe**Error! Bookmark not defined.**. The top universities were best represented due to the dedicated support available for winning and managing awards. As a small research organisation (c. 60 staff) the MBA has found it difficult to take the lead in contributing to call development and leading on proposals. This is not due to issues around quality of science (the excellence of MBA Science can be seen in its high impact in terms of science output and winning of awards such as ERC grants) but the cost of engagement in European marine research and strategy development and subsequent project bids.

Collaboration

Question 4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

4.1 Marine scientific research requires collaboration over large geographical scales due to the interconnected nature of the marine environment; the large scale over which ocean processes operate; the wide distribution and large dispersal distances of many organisms; and the necessarily multidisciplinary nature of marine research. The EU's Strategy for Marine and Maritime Research states "*Maritime-related knowledge and innovation requires an integrated approach to cope with complexity*"[378]. The collaborative nature of EU funding programmes, such as Horizon 2020, help address the requirement for large-scale interdisciplinary research and facilitate the sharing of skills and transfer of ideas and knowledge over appropriate scales.

4.2 Working collaboratively at the European level also allows EU funding to sustain areas of research which are not currently considered as high strategic priority as they ought at the UK level, such as marine biology. An example would be the area of marine education (referred to as Ocean Literacy). This is seen as being of critical importance at the international level and the UK currently leads a major H2020 programme on Ocean Literacy (SeaChange[379]) involving 17 partners from nine countries across Europe. In these instances, EU funding enables the UK to remain competitive in lower priority sectors and to retain excellent capacity and capability on which it can build at a future time.

4.3 The collaborative nature of the EU funding streams is therefore a major benefit for the UK. It allows researchers to build projects with researchers from across the EU, as well as third countries, creating a critical mass of expertise and capability to address difficult and

[378] Communication from the commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: A European Strategy for Marine and Maritime Research. A coherent European Research Area framework in support of a sustainable use of oceans and seas. Brussels, 3.9.2008. COM(2008) 534 final

[379] http://www.seachangeproject.eu/

complex problems. It allows member states to pool resources to tackle global challenges, such as climate change, food shortage, and anti-bacterial resistance and discover joint solutions. The scale of these topics is beyond what could realistically and practically be done by a single country.

4.4 The fact that national funding is still the predominant means of supporting science (see 1.2) with most activities undertaken at the national level does have implications in terms of fragmentation in marine and maritime research across Europe**Error! Bookmark not defined.**. Even if national funding is proposed to replace any decrease in EU funding therefore, there still needs to be a method of ensuring that collaborative research can be undertaken and that appropriate support is provided for networking and sharing of ideas and expertise at a pan-national scale.

Question 5: What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

5.1 Bilateral collaboration is facilitated by various EU initiatives and participation in EU funding programmes is also of great use in attracting international talent. For example, the Marie-Curie programme under FP7 the UK attracted more than 3000 projects[380].

5.2 Some marine scientists however feel being a part of the EU adds unnecessary costs and restrictions on liaising with non-EU partners and that additional support should be provided to encourage liaison at a much wider international level.

Question 7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

7.1 A number of UK marine organisations are involved in major international research infrastructure projects such as the ESFRI European Marine Biological Resource Centre (EMBRC). Partner countries currently include Belgium, France, Greece, Israel, Italy, Norway, Portugal, Spain, United Kingdom. For the UK, partner institutes currently include the MBA, Scottish Association of Marine Science, British Antarctic Survey and Scottish Oceans Institute. The EMBRC is making resources, infrastructure and expertise available to increase the research and up-take of marine biological discoveries by enabling both public and private sector researchers from around the world to access this network of marine stations and their research facilities. A relatively modest investment from the UK as a national node opens up access to a huge amount of research infrastructure for scientists to utilise all over Europe.

Question 8: What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and

[380] Russel Group Response to the Government Review of the Balance of Competences between UK and EU: Research and Development (http://russellgroup.ac.uk/media/5082/35russell-group-response-to-balance-of-competences-research-and-development-consultation.pdf)

Singapore?

8.1 Membership of the EU currently allows the UK to attract top marine researchers. The main reasons for this are that Marie-Curie fellows can come to the UK and ERC grant holders can transfer their grants to UK institutions. Withdrawal from the EU would stop this happening as these grants must be spent in the EU. Marine organisations such as the MBA also undertake collaborations with and invite researchers from non-EU countries. This is more difficult due to non-EU researchers not having being able to utilise the EU agreements on movement and employment. Also arrangements tend to be bilateral agreements with organisations rather than large consortia agreements.

Regulation

Q10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

10.1 A major driver of current EU marine research has been the Marine Strategy Framework Directive (MSFD). This complements and feeds into other EU legislation such the Water Framework Directive and Habitats Directive and also supports national legislation of member states (such as the UK Marine and Coastal Access Act). Working to address major gaps in understanding for the implementation of EU environmental legislation has been a significant undertaking for the marine science community and led to an integrated approach to common problems e.g. the need to have indicators of marine ecosystem health that can be used across member states.

Question 12: How is the innovation landscape affected by EU membership?

12.1. The innovation landscape is affected positively by; the promotion of cross-border collaboration leading to enhanced capacity to address global issues through global scale research; the sharing of ideas and expertise through EU networks (e.g. COST actions) and transnational access programmes; the common policy issues (see 10.1) that can be addressed at the appropriate scales and which require new methodologies (e.g. marine monitoring technology); a strong drive for collaboration between the public and private sectors on innovation in order to support the blue economy[Error! Bookmark not defined.].

12.2. The drive for collaborative research from the EU has not just been about scientific necessity but also to promote broader European objectives such as cohesion and industrial growth[381], or since FP6, to help "*create a coordinated European 'internal market*"[382]. This can stimulate innovation (see 12.1) but can impact on the type of research that is funded. Horizon 2020 marine research calls for example have been developed in light of the Blue Growth Agenda with a focus on "*how new technologies can put marine resources to productive use and create sustainable growth and jobs, while at the same ensuring that these resources can be enjoyed by future generations*"[383]. It is important that fundamental science is not overlooked if

[381] Parliamentary Office of Science and Technology. POSTNOTE number 83, October 1996. Research and the European Union. http://www.parliament.uk/documents/post/pn083.pdf.

[382] Parliamentary Office of Science and Technology. POSTNOTE number 359, June 2010. EU Science & Technology Funding. http://researchbriefings.parliament.uk/ResearchBriefing/Summary/POST-PN-359.

[383] Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth. Brussels, COM(2014) 254 final/2 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=COM:2014:254:REV1&from=EN

it cannot be seen to support this agenda. This is also an issue however at the national level where there is an ongoing debate between the appropriate balance between fundamental (or 'blue-skies') and applied research.

Scientific advice

Question 13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

13.1 The marine biological community has a strong track record in working in working with the policy community. As a learned society with members who are experts across many areas, the MBA for example has been able to provide expert input to numerous enquiries and investigations[384]. This input has been facilitated by the fact that the UK government and Devolved Administrations have clear principles for consulting on policy matters[385]. Consultations have a clear process and timeline and are open and transparent. Also, the system of Chief Scientific Advisors and the proactive engagement of civil servants in marine science issues and committees helps the marine biological community to feed directly into policy (there are some issues with process but here is not the place to discuss these). For the EU it is more difficult to create links between marine experts and the appropriate policy officials and the whole system of science to support policy is less clear, particularly since the EU decided not to retain the post of Chief Scientific Advisor. This often restricts input to occasional consultation responses. The reporting system is also less clear at the EU level on how decisions are reached and legislation is developed. For example, it is relatively easy to look at the discussions that led to the creation of the UK Marine and Coastal Access Act by going back through meeting notes, the green and white papers, select committee minutes, Hansard etc. this clear process facilitated engagement. This can be compared with, for example, the Marine Strategy Framework Directive where it is more difficult to establish how the legislation was drafted and developed.

Question 14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

14.1 The UK marine biological community is both respected and influential at the EU level and as such is invited to contribute in areas of policy. For under-resourced communities such as the UK marine biological community however it is difficult to build up close working relationships with EU policy officials or to engage with some of the committees set up to facilitate science policy links such as the European Marine Board[386], or JPI Oceans[387]. Policy influence is therefore left in the hands of a few larger institutes or with government departments and agencies (although the same argument can be made for other international marine boards such as the International Council for the Exploration of the Sea, ICES[388]). It is important that links are made between experts in the field, wherever they are based and the EU policy community.

384 http://www.mba.ac.uk/policy/
385 https://www.gov.uk/government/publications/consultation-principles-guidance
386 http://www.marineboard.eu/
387 http://www.jpi-oceans.eu/csa-oceans/csa-oceans-partners
388 http://www.ices.dk/Pages/default.aspx

14.2 EU membership is unlikely therefore to inhibit the UK marine biological community from influencing policy but more could be done on the 'enabling' front to make sure UK marine expertise is better utilized.

20 November 2015

Met Office – Written evidence (EUM0060)

Introduction

1. The Met Office, the UK's National Meteorological Service, is a Public Sector Research Establishment (PSRE) and an Executive Agency for the Department for Business, Innovation and Skills. A comprehensive science programme underpins the weather and climate services that we deliver to protect the public, help businesses and advise government. This science base has enabled the UK to attain a world leading position in weather forecasting, climate prediction and climate change projection, and to sustain a reputation as a premier centre of excellence in weather and climate research.

2. International collaboration is integral to our work. Met Office models rely on observations from around the world which means that international cooperation is essential to deliver all of our weather and climate services. We collect and share weather observations and forecast information with counterpart National Meteorological Services and international organisations such as the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and the European Centre for Medium-Range Weather Forecasts (ECMWF).

3. International engagement also brings direct benefits - allowing us to work with the world's best weather and climate scientists, access additional computing resources and attract international research funding. The knowledge that we gain from our international activities, and the revenue that is generated, is fed back into our science to keep our weather and climate science among the best in the world. Our engagement also ensures that UK priorities are reflected in international forums and programmes, as well as ensuring European policies have the rigorous independent scientific underpinning, with our Chief Scientist one of the seven members of the newly appointed European Commission Scientific Advisory Mechanism High Level Group.

4. While there have been many benefits for Met Office science from the EU, there is room for improvement, particularly on the administration of funding streams, and improving the important links between infrastructures, basic science and applying science to services. These points are highlighted in our response below. In this regard the Met Office has been hampered by not being an integral part of the UK research landscape where decisions on joint research initiatives (e.g. JPI) lie within the Research Council domain. The Nurse Review may address the relationship between RCUK, Innovate UK and PSREs such as the Met Office.

Funding

Q. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

5. The Met Office has engaged in competing for European research funding since the early-mid 1990s, through the Framework Programme series and now Horizon 2020 (H2020). In the early 2000's EU funding to the Met Office was £0.75m pa and we were successful in around one third of our bids. In 2014, our revenue from Framework Programme 7 and H2020 has grown to £2.3m pa with a success rate of 50%. In H2020, the Met Office has expanded its engagement, and has strong involvement in projects on climate modelling, Disaster Risk Management, Space Weather, the use of satellite and non-space based observations, and ocean and marine forecasting. Separate to H2020, the Met Office has recently led two Single European Skies Aviation Research (SESAR) projects, funded by the EU, which will improve how weather observations and forecast data are used in support of future air traffic management across Europe under SES.

6. Although to a much smaller order of magnitude, the Met Office is also engaged in R&D projects funded through the EEA and ERC, and the R&D components under the Copernicus Themes (Climate Change Service, Marine and Atmosphere Monitoring).

7. Many other European National Meteorological Services engage in EU R&D funding projects. The Met Office compares favourably with most, with the Finnish and Swedish Met Services being probably the only two who have greater absolute funding than ourselves.

Q. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

8. The European Commission has made a number of improvements into how funds are managed. The implementation of a single flat rate funding approach for indirect costs within H2020 (compared to FP7) has been one. The introduction of a full electronic submission process under H2020 is another. The EC also now uses six Executive Agencies to manage the EU Programmes, rather than the DG unit management structure under FP7, and this has been beneficial. In addition, the reduction in time from proposal submission to completing grant negotiation now being seen in H2020 has been positive.

9. However, there still remains uncertainty over how to engage, and the benefit delivered, with some of the newer financial instruments. For ERANET Cofunds, far more weight is applied to Member State funding than for other instruments, and the MS funding contribution operates under national Research Council regulation. Within the UK this proves difficult for PSREs, such as the Met Office, who at present cannot be prime contractors. Through involvement in the JPI (Joint Programme Initiative) Climate, the Met Office remains uncertain as to the benefit that a JPI delivers for this thematic. JPIs are designed to integrate and coordinate the pooling of significant elements of national research funding to progress common European issues. The JPI Climate has not made as much progress as other JPIs where the common European

problems are clearer. We welcome the current EC review of the JPIs and look forward to its findings later this year/early 2016.

10. Under the last 2-3 years of FP7 and into H2020, the European Commission has been establishing an increasing range of Expert Advisory Groups to support the development of H2020 work programmes and strategic research areas. These are additional to the traditional Member States representation on the H2020 Programme Committees (PCs), and the Scientific Advisory Committees (SACs) which directly support the PCs. This diversification has led to the risk of potential dilution of Member State influence at the PCs. In addition, the time available ahead of PC meetings for Member States to review has not been ideal for the 2016-17 H2020 work programmes. The Met Office sits on the BIS H2020 Network Group, two of the SACs (past FP7 and present H2020) and has representation on some of the important newly created advisory groups of relevance (e.g. the European Climate Service Roadmap Implementation Group). This has been a conscious decision to try to coordinate effective UK influence into the EC.

11. The Met Office is playing a leadership role within H2020, coordinating a number of important projects and managing a range of institutions with different cultures, mindsets and internal administrative procedures. To successfully achieve this, such leadership must be based on strong national capabilities. Maintaining a national capability is also important for ensuring the UK can influence the direction of policy and programmes within Europe, as well as for separate national resilience considerations.

Collaboration

Q. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

12. Participation in EU collaborations and funding programmes currently provides the Met Office with a range of benefits including:
    - Access to 3rd party funding to support and accelerate Met Office “Science to Services” activities, benefitting the UK government, academics and the public.
    - Engagement allows the UK to play a full and active role in key European fora, the results of which benefit the UK (e.g. increasingly including future climate disaster risk management as a key environmental component to “resilience”).
    - Building UK export capabilities and expertise (i.e. Met Office and partners) in Europe allows the UK to show leadership on the European and wider international stage.
    - Knowledge sharing and exchange with leading science institutions in Europe to the benefit of the Met Office, its partners, and hence the UK. This particularly includes access to expertise not available directly in the UK.
    - Collaboration with other EU member states on common science issues provides a benefit to the UK through the sharing of resources and the ability to progress issues which are more difficult to do so in isolation.

- By its nature, meteorology is a subject which crosses borders and the ability to easily collaborate between countries inherently improves the way in which we work.

13. It should, however, be recognised that the majority of EU R&D actions (i.e. H2020) require an element of matching-funding, so gearing is required to national funding activities. This is certainly true for the Met Office, and we ensure that engagement in H2020 topics has strong strategic fit with nationally funded programmes and activities for gearing.

14. The Met Office suggests that further improvements could still be made in H2020, through better development of Strategic Research Agendas which have links across all the 3 key pillars of H2020 (Excellent Science, Industrial Leadership, and Societal Challenges). As an organisation engaged in end-to-end service development and delivery through partnerships, the Met Office can see that consolidating and improving links between fundamental science, infrastructure, and directed/applied science within H2020 and the ERC (as a key element of H2020 Pillar I) would be beneficial.

Q. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

15. For the Met Office, two important European/international facilities that have been developed as a consequence of EU membership have been:
    - The key topics under ESFRI (European Strategy Forum for Research Infrastructures).
    - The Copernicus satellite (Sentinel) series.

16. EU membership has allowed the UK and its institutions not only to consider its appropriate level of involvement (funding and resources), but also to have a seat at the table to advise and influence on the benefit of such European facilities.

17. The Met Office has benefitted directly from participation in:
    - The EuroARGO float network which give us important information on the status of the surface and sub-surface layers of the oceans.
    - EARLINET which provides ground based remote sensing observations of particulate matter for volcanic ash and gas concentrations, atmospheric chemistry and atmospheric pollution.
    - Access to major R&D time on the PRACE (Partnership for Advanced Computing in Europe) for cutting-edge climate simulations in partnership with UK academia.
    - The EUFAR initiative which provides access to research aircraft facilities across Europe to which the jointly operated UK NERC / Met Office research aircraft has been an integral part.

18. There have been issues around continued engagement in ESFRI projects due to member states being asked to take responsibilities for full funding of these facilities

(after initial support and investment from the Commission). The UK needs to continue to be a funder to allow UK institutions to be beneficiaries. There also needs to be clear recognition of the difference between, and hence distinction between, a "research infrastructure" and an "operational infrastructure" facility. The Met Office maintains and benefits from both. This distinction has proved important in discussions around supercomputing for weather and climate services.

19. The Copernicus Sentinels are different in that their primary function is as operational missions and not research missions. However, the Sentinels are built upon the principle of collaboration and cost sharing to invest in additional capability which all will benefit from, and single countries cannot invest in individually.

20. With regard to the question of restrictions in the creation and operation of international facilities outside the EU, for the Met Office most of our International partnerships revolve around operational systems within Europe (e.g. weather and climate satellite missions through EUMETSAT), together with international cooperation on a global telecommunications system for the exchange of weather, climate and environmental data coordinated by the World Meteorological Organisation. EU membership has been no inhibitor to these collaborations. In fact, EUMETSAT and ESA (to name two) have a majority of EU members involved, but also non-EU members as full partners.

Q. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

21. The free movement of people facilitates the Met Office's ability to undertake scientific exchange programmes and attract the very best scientists to work on UK research. Our visiting scientist programme allows the leading experts in a field to work collaboratively on internationally important research. This not only builds our own knowledge base in the UK but also builds the reputation of UK science and expertise when our scientists work abroad.

Scientific advice

Q. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

Q. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

22. The UK has a very well developed scientific advice mechanism and the UK is perceived to be a leading country in this regard, by both other Member States and beyond. UK leading capability which is increasingly recognised within the EC include:

- GO-Science and a specific CSA role to UK Government.
- CSAs within Government departments working together under the leadership of the Government Chief Scientific Advisor.
- The role of the Scientific Advisory Group for Emergencies (SAGE).
- The role of Science and Technical Advisory Cells (STACs).
- The scientific input to National Risk Assessments coordinated through the Natural Hazard Partnership (NHP).
- The Council for Science and Technology.

23. UK experts currently use EU membership to engage with EU senior personnel and inform and influence the development of policy and programmes. The Met Office has for a number of years developed a good working relationship with a range of EC Directorate Generals, focussing on DG RTD, ECHO, JRC and GROW. Some of the key messages we have been conveying to the EC have been around the scientific expertise in modelling and advice that have been developed within the UK, and the partnership approach which is increasingly at the heart of science innovation and growth.

24. Some examples of how the Met Office has helped shape policy on behalf of the UK are:
    - Through its developing relationship with DGs JRC and ECHO, the Met Office is co-organising the first scientific seminar of the newly created EC Disaster Risk Management Knowledge Centre (DRMKC) in London in late November 2015. This will provide information to be held on the DRMKC, available to the EC and all EU member States (and wider) on good practice on how science informs DRM and the science goals of the “post-Sendai Framework” (March 2015).
    - Through a pro-active approach of relationship management, the Met Office was invited to be a member of the “European Roadmap for Climate Services” Implementation Group. This is an important group which will advice the Commission on where to invest future H2020 funding and how to pull through science developments into services which compliment and add value to national activities (e.g. through Copernicus).

25. The increasingly respected and valued role of Met Office “Civil Contingency Advisors” working with regional emergency responders is also an expert science consultancy activity which DG ECHO Emergency Response Coordination Centre has become aware. The ERCC wishes to harness this added value capability, with the intention of allowing more efficient and effective deployment of multiple resources (national and non-national) during disaster management due to a major high impact event.

26. In terms of areas in which the process can be improved; a recognised aspect of EU membership which can constrain influence is the need for the EU to develop a majority view amongst its members. The UK does not always have the same/similar views to its fellow EU members. Freedom from this restriction may be of benefit, but may also come with corresponding less weight to the view (a single country rather than a union of 28).

Background to the Met Office

27. The Met Office is a Public Sector Research Establishment and Executive Agency within BIS. We are the UK's National Meteorological Service and provide a critical national weather and climate capability, acting as a key component of the UK's defence, security and civil contingencies infrastructure. We are ranked as the most accurate met service in the world, according to standards set by the World Meteorological Organization, and are recognised globally as a leading weather and climate service. This standing is underpinned by the development and fast pull-through of cutting edge science[389], a 24/7 operational forecast capability, resilient delivery infrastructure - including High Performance Computing (HPC), and sophisticated observations networks.

28. As a Trading Fund the Met Office is not vote-funded so must cover costs from revenue earned from government, commercial customers and other funding streams. We provide the following core underpinning services to government:
    - The Public Weather Service (PWS), funded by BIS on behalf of the UK, and the Civil Aviation Authority (CAA).
    - Defence Service, funded by MOD.
    - Met Office Hadley Centre Climate Programme (HCCP) funded by DECC and Defra.

    EU funding allows us to do some valuable science research and development that might otherwise not be done as our funding structure is to deliver specific contracted services to customers, without significant flexibility for reprioritisation.

17 November 2015

[389] The Met Office 'h-index' – a measure of how productive and influential our research is – increased from 155 to 177 in 2014 (i.e. 177 papers now have in excess of 177 citations), with a total of more than 20,000 citations recorded in 2014. The Met Office h-index far exceeds that calculated for any equivalent public UK environmental research organisation, and is only beaten by NCAR on an international standing (from those assessed).

Met Office, Science and Technology Facilities Council (STFC) and Wellcome Trust – Oral evidence (QQ 107-116)

Evidence Session No. 10 *Heard in Public* *Questions 107 - 116*

TUESDAY 9 FEBRUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Baroness Manningham-Buller
Lord Maxton
Duke of Montrose
Baroness Morgan of Huyton
Baroness Neville-Jones
Lord Peston
Viscount Ridley
Lord Vallance of Tummel

Examination of Witnesses

Professor Dame Julia Slingo, Chief Scientist, Met Office and member of the European Commission's Scientific Advice Mechanism (SAM) High Level Group; **Professor John Womersley**, Chief Scientific Officer, Science and Technology Facilities Council (STFC) and Chair, European Strategy Forum on Research Infrastructures (ESFR); and **Stuart Pritchard**, EU Affairs Manager, Wellcome Trust

Q107 The Chairman: Could I thank Dame Julia, Professor Womersley and Mr Pritchard for joining us for the second session today? We are most grateful. We are being broadcast, so would you like formally to introduce yourselves for the record? If any of you would like to make an introductory statement, please feel free to do so. We shall start on the right with Professor Womersley.

Professor John Womersley: Good morning and thank you, everybody. I am Professor John Womersley. I am the Chief Executive of the Science and Technology Facilities Council, which is one of the seven UK research councils within the Department for Business, Innovation and Skills. We support big science—a lot of international science projects. I am also the Chairman of the European Strategy Forum for Research Infrastructures, which I think you will be asking

about later. That promotes a coherent strategy-led approach to the planning of big international research facilities across Europe.

Professor Dame Julia Slingo: I am Julia Slingo. I am the Chief Scientist at the Met Office and also a member of the High Level Group for the new European Commission Scientific Advice Mechanism. The Met Office, as I am sure you know, is one of the world's leading weather and climate services, but also embodies a very significant research activity in weather and climate science, numbering some 550 scientists under my direction. We benefit enormously from our international collaborations, both in services and science, and particularly important European networks which sustain our services and contribute quite significantly to our research base. We have a long history of international co-operation and I would say that EU funding, particularly over the last decade, has been incredibly beneficial to the advancement of our science so we can provide improved services not just in the UK but across the world.

Stuart Pritchard: Good morning. My name is Stuart Pritchard. I am the EU Affairs Manager at the Wellcome Trust, having joined six months ago. Prior to the Trust, I have a background in European policy, having worked for a pharmaceutical company in Brussels and—I mention with some trepidation—in the European Parliament as a researcher for a UK MEP on health and environmental legislation. As you may know, the Wellcome Trust is an independent charitable foundation which funds science and research. We want to improve health for everyone by helping great ideas thrive. Like many EU-based foundations, the majority of our expenditure is in the country in which we are based, the UK, but the Trust is particularly interested in EU science and health policy as it has a major impact on the organisations that we support.

Q108 The Chairman: Thank you. The first question is directed to Dame Julia and particularly her role on the High Level Group of the Scientific Advice Mechanism. I believe you held a meeting, did you not, on 29 January?

Professor Dame Julia Slingo: That is correct.

The Chairman: Is there anything you can tell us about the outcomes of that meeting?

Professor Dame Julia Slingo: Yes. The group met for the first time just over two weeks ago and we looked particularly at our terms of reference and our roles and responsibilities. We were led in that discussion by Commissioner Moedas, and it is fair to say that I found the discussions very positive. We are a body which is about providing scientific advice through the interpretation of the relevant evidence in the context of the policy that the EU is interested in. We are not about facts and figures; they have many bodies that help them with facts and figures, such as the Joint Research Centre. We also agreed that everything we do should be open and transparent; we were very keen on that. We stressed very much our need for independence. Indeed, the Chair of the HLG will represent our views to the Commission; they will be the views of the HLG, they will be published and then it is up to the Commission to use them in the best way they can.

We looked at the sorts of work we could do, and basically it fell into three tranches. I would say the first was what one would call urgent topical advice on key issues that have suddenly come up—things like Ebola or Zika, those sorts of problems. Most of our work will be based on the EC Work Programme and, therefore, will be tasked by them for areas where they would like scientific advice. We also have a role in promoting new pieces of work that are

longer-term, horizon-scanning topics where we feel the EU would benefit from more in-depth science and more structured advice.

What is clearly important to the Commission is the way in which we draw on the wider scientific community, so the relationship between the HLG and the learned societies is obviously critical, and you will be aware that they have set a budget to engage the learned societies. Also, they are very keen that we look beyond public sector research to private sector research whenever it is appropriate, and that is for us to decide. We were given two pieces of work in the first instance, one led by one of the vice-presidents to look at particular aspects of cyber security, and the second led by DG-CLIMA to look at how we can monitor CO_2 emissions from light vehicles.

The Chairman: That is very helpful. You were given two separate projects. Does this mean that the initiative for these projects comes from the vice-presidents, or does it come from you within the membership of the group?

Professor Dame Julia Slingo: For the bulk of our work we will be tasked by the Commission to provide scientific advice based on the work programme of the Commission. We also have the opportunity to put forward topics ourselves, and we will do so where we believe there is a need for some horizon-scanning or maybe a Foresight-type of report on what we believe to be the emerging big issues around science for the European Union.

The Chairman: Given that your proceedings will be transparent and open, will the scientific community have the opportunity to offer suggestions to you? Is that how you expect it to work?

Professor Dame Julia Slingo: Yes.

The Chairman: Therefore, are you encouraging the scientific community to feed ideas into the group?

Professor Dame Julia Slingo: Absolutely, yes.

The Chairman: You also referred to immediate issues, and I think you mentioned Ebola and the Zika virus. How easy is it going to be to react quickly to such issues?

Professor Dame Julia Slingo: I am not sure, and, actually, I was not entirely sure they knew that either. When they talk about urgent topical advice, I do not think they are thinking in terms of hours or days; they are thinking of a slightly longer period like three months. To be honest, there was no further detail on that.

I should say that on the pieces of work we have been tasked with, we reviewed draft-scoping papers which have been now finalised, and they will go public, so, again, everyone will be able to see the scope of the work that we have been tasked with and the sorts of things we will do. My role for the UK is to make sure that I bring to the table the best expertise we have in this country through my connections with the learned societies and engaging with them. I have done that already. I have met with a large number of our learned societies. The British Academy in particular has been very helpful in setting that up. To some extent we need to engage with GO-Science, although I think our independence is really important. We are there as individual scientists to give independent advice, so although I see it as important for me to work with the CSA network in this country, because there will be topics—and these are two—where I do not personally have deep expertise, I will need to have that help to find the best people to engage in providing evidence, workshops, those sorts of things.

Lord Hennessy of Nympsfield: Dame Julia, I think the EEC came into being on 1 January 1958. Are you not amazed, as I am, that it has taken them this long to set up an apparatus of this sort? I have a supplementary question. It is very hard, wherever you stand on the European debate, to sing a positive song. The Eurovision Song Contest has rather put us off that sort of thing. Do you not think that as a country we punch heavier than our weight—all the metrics suggest we do—and through you in this new apparatus we can bring something positive to the European Union; a good story to tell rather than a perpetual drizzle of complaint and pessimism?

Professor Dame Julia Slingo: Yes, I do, actually. I can see why the EU has struggled with this question of scientific advice. Anne Glover has already given you quite a lot of background on that. I should say that this new mechanism is supported by some really, really good staff in Brussels. I was very impressed with the quality of the staff who sat around the table with us and were assisting us. I think there is an opportunity to make a real difference.

You have to be aware that although I am on this group, I do not represent the UK and I do not represent my area of science, although of course I know my area of science and I can work that. I am there as an independent scientist who, presumably, can exercise the right sort of judgment on the way in which we gather the evidence and how we communicate it. There is no doubt in the discussions that we had around the table that the way the UK gathers its scientific evidence to underpin policy is greatly admired. While there is no way they can ever replicate that, they can recognise the strength of the way we gather evidence and have inquiries and ask for written submissions, and really involve as many people as possible in gathering the scientific evidence for policy.

I hope that I can bring a positive contribution to the HLG by knowing a bit about how we do it in this country, which I think is as good as you will find anywhere.

Lord Hunt of Chesterton: I do not know which world Lord Hennessy lives in, but in the world I know about Europe is seen, scientifically and technically, as an astonishingly successful operation with CERN, et cetera. In the United States, they now say, “Tomorrow’s weather: here is the American forecast and here is the European forecast”, and invariably one is better than the other. There are extraordinary things about Europe. My question is whether your committee—and I put this question to Professor Womersley also—is going to help define or suggest, longer term, these enormous, mega-successful projects. Where do we go from here?

Professor Dame Julia Slingo: I think that is a really good point. At the moment it is not explicitly in the terms of what we do, but when I was interviewed and subsequently when I talked to the Commissioner and other people there, it was quite clear to me that if we work on a topic, or even if we commission some serious pieces of work—and I am proposing to commission something around the changing landscape of climate risk for Europe, because there are some really difficult problems there—surely out of that must come a recommendation for further research. If it does not, I do not think we are doing our jobs as scientists. One of the key things we discussed a couple of weeks ago is yes, we are a high-level group to advise the EU on science for policy but we also have to be advocates for science and honest brokers. For me, that was a really nice description of what our role should be. You are absolutely right that if we do a really good job, out of that will come, I think, some major initiatives where the EU—Europe—stands up and says, “We do not have

the evidence base or the science in place yet for this, and this is what we need to have done by the research community”. I am hoping that is where I will get to with this.

The Chairman: Would Professor Womersley or Mr Pritchard like to offer their thoughts about the Scientific Advice Mechanism in the light of what they have heard?

Professor John Womersley: Maybe I should follow up on the question of big science projects, which I do not think are currently within the domain of SAM, but there is clearly a lot of overlap. As you were saying, the way to address these big science questions requires international collaboration and the pooling of resources. The mechanisms to do that are facilitated by the European Commission, but not funded by it, so when you talk about things such as CERN as a European success, indeed it is, but it is a voluntary collaboration of European governments and, in fact, it predates the establishment of the European Union.

When we think about scientific and technological innovation to address big challenges or to ensure our future prosperity, it absolutely requires international collaboration and the pooling of resources across Europe. These facilities, networks, data-gathering exercises and high-performance computing resources all require investments that are greater than any single country can make if they are to address these very high-level questions. I chair ESFRI which is a mechanism for that. ESFRI is hosted by the European Commission: that means it provides meeting rooms and a secretariat, but it has no budget from the EC; in fact, it has no budget from anywhere. It is a set of delegates from national governments who come together to construct a mutually agreed roadmap of next-generation scientific facilities that they will then voluntarily decide to join or not, on the basis of individual national contributions.

Funding from the EU is something like 1% of the total budget for these kinds of things, and where big projects have emerged, such as the European Spallation Source or the Square Kilometre Array, those are intergovernmental agreements between national governments. Where the UK has engaged with those, such as the Square Kilometre Array—the headquarters is now in the UK—it has done very well. Where we have not engaged particularly strongly, such as with high-performance computing in Europe, we have not had much influence. It is our choice. We are never mandated by the Commission to be part of something we do not wish to be part of. In most of these areas there are parallel structures that are established through intergovernmental agreements or treaties, often also involving countries such as Switzerland and Norway, which are associated states rather than members.

The Chairman: Mr Pritchard, do you want to add something on this subject?

Stuart Pritchard: The Trust was concerned when the CSA post disappeared from the Commission, but the indications with the new SAM mechanism are very positive, and I think we would welcome the structures and resources that appear to be being put in place to support the evidence that is being provided to the Commission. It would be interesting to see how that information is provided to the Parliament, where there tends to be a bit of an argument of, “My science is better than yours”. Having a sensible middle ground where parliamentarians could receive advice they could rely upon as being neutral would be very helpful in some of the regulatory discussions in which the Parliament engages.

Viscount Ridley: I want to follow up on exactly that point, if I may, and, to echo Lord Hunt’s words back to him, I do not know what world he is living in. If we look at recent history, the

European Union has become synonymous with the rejection of the rational scientific case for genetically modified crops, for example; the ban on neonicotinoid pesticides was essentially taken on unscientific grounds; some of the attitudes to electronic cigarettes have been deeply unscientific; and as you said, Dame Anne Glover lost her job partly because of pressure because she was being too scientific about this. What confidence do we have that this new mechanism will not repeat those sorts of anti-scientific approaches to rational questions?

Stuart Pritchard: I am not sure the Trust has a position on that.

Viscount Ridley: Maybe it is for Dame Julia to tackle that one.

Professor Dame Julia Slingo: Let us be clear: I have been at one meeting. I think the issues that Dame Anne had are very well understood. The fact is she was a lone voice, and there are seven of us, and she had an office consisting of about three people, whereas we now have 20. The other thing that gives me some confidence is that we are independent of the Commission and therefore what we publish is what we publish, and it will be open and transparent. It will be there for national governments to see that this is our position on something. The chair is completely independent of the Commission, so when something is published by the Commission it is what we have produced; it is not what they would like to publish based on what we have put together We made that absolutely clear right from the word go when we met. That has to be a position of strength.

Of course, there is a long road between what we might publish and what policy might be taken up. I think there is more work that the HLG needs to do with members of the European Parliament, and I am meeting with some of ours to talk to them about our role and how I can interface with them.

We do not have a formal route into the Council as yet. I asked specifically about that this last week. We are there for the Commission and not yet for the individual nations and the MEPs, but maybe that is something we should be there for. That is after one day together. I should also say that there are seven us and of course we do not cover all the sciences, but they are an incredibly impressive bunch and they will not be a pushover.

Lord Peston: When SAM was set up, I asked myself whether its purpose was to strengthen the role of science and engineering in EU decision-making or weaken it. I came to the conclusion that it was intended to weaken it, without a shadow of a doubt. Listening to what you have just told us, Dame Julia, confirms that. You did not choose the two questions that it is asking. You may decide the answers but who chooses the questions and commissions the research? That is what matters. Who goes and looks at what the European decision-makers are doing and says, “That is scientific nonsense”, which is what Lord Ridley implied. There is no one now who does that any more. That has gone. That seems to me to be a very serious backwards step in the role of science and engineering in the whole EU set-up. I put it bluntly like that to give you a chance to answer bluntly.

Professor Dame Julia Slingo: Let us be clear: yes, we were given two topics, and I think it is good that we have something to cut our teeth on. However, let us be careful here. We were not given them; they were proposed to us.

Lord Peston: If I could just interrupt, could you have said no?

Professor Dame Julia Slingo: And we could have said no. We did not have to accept the commission.

Lord Peston: What would have happened if you had said no?

Baroness Morgan of Huyton: There would be no scientific advice.

Professor Dame Julia Slingo: Hang on. Can I just answer that? On these two particular topics, and I am not going to go into the detail—the scoping papers will be out before very long—we challenged quite significantly exactly what it was that it wanted to introduce, what the policy was and where the science question was. For something such as cyber-security, how long is a piece of string? It is a massive topic. We challenged—and the same with the other topic: we challenged very, very strongly—and the Commission had to go away and rewrite the scoping papers on the basis of that. We have seen them again and said, "Yes, we are comfortable with them and we will accept the commission that this group will work on those topics".

To be fair, the people who were trying to persuade us to work on these topics were DGs, commissioners and vice-presidents, not people lower down. These were top people and we challenged them quite robustly. You are right that we do not yet know whether the sorts of things that will come before us are, in a sense, those where the scientific evidence advice is not going to be very challenging. These are very early days, so let us wait and see. I was very pleased with the way the meeting was conducted, which was very informal but very challenging; you felt you could push back and ask quite tricky questions.

Q109 Lord Cameron of Dillington: My question has already been touched on by several people. Bearing in mind the European Union is run by a triumvirate of the Commission, the Council of Ministers and the Parliament, and SAM is only advising the Commission at the moment, should the other two have their own scientific advisory mechanism or should SAM be expanded to cover and give advice to these other two? It is important that science advice is in all three really, is it not?

Professor Dame Julia Slingo: I do not think I can answer that question because I do not yet know enough about all the workings in Brussels. We touched on it at our first meeting, and I have had some further correspondence about exactly that issue. Let us see where we get to. I do not know that it is my push on this, but, actually, if the member states would like that to happen, I think it probably is the right thing in many respects.

Lord Cameron of Dillington: Do the other two witnesses have any views on that?

Professor John Womersley: I would assume and hope that when our Ministers attend the Council they have received science advice through their national mechanisms.

Lord Cameron of Dillington: Which might be contradictory in the 28 member states.

Professor John Womersley: I shall say no more. That is the nature of the Council.

Stuart Pritchard: Certainly in my experience, the UK Government have a very good permanent representation in Brussels, which is a valuable conduit for gathering evidence and advice for the Government in their negotiations. The Parliament has a number of structures already in place to provide advice to members. Whether that advice always cuts through, I am not sure, because it is a very noisy environment in the Parliament, with a lot of lobbying activity going on and a lot of conflicting advice. For me, one of the challenges for parliamentarians is how they find evidence that is sufficiently robust to inform discussions when they are being bombarded by huge amounts of information. Having some further

strengthening and rigour in the advice provided to members to counteract that would be a helpful addition to the discussions, if it is organised in the right way.

Q110 Baroness Manningham-Buller: Good morning and thank you for being here. We have covered in evidence in a number of ways the extent of the influence of British scientists such as yourselves, Professor Womersley, and Dame Julia, in the fora in the EU in which you engage. Obviously, it is early days for SAM, Dame Julia, and for you to be able to claim vast influence, but we hope you will have it. Could you both give us a perspective more broadly on the influence and effect that British science has on European decision-making? It is a pretty broad question and we have had a couple of answers on that already.

Professor John Womersley: I think we have successfully defended a view that each country needs to make its own decisions on its science investment, especially on the kinds of big projects that I am responsible for. We should not have a single European fund and we should not have a very large research budget in the Commission to which we all contribute and which then gets disbursed, because we would lack confidence that was being used to promote excellence, and it might well be used to meet other objectives. We have defended the principle of variable geometry—we decide what makes sense for us to be part of and where our particular science strengths and interests lie in our community.

Baroness Manningham-Buller: Can I interrupt you? In the event of a Brexit, would any of that be affected or could we still decide whether to invest in a big infrastructure project?

Professor John Womersley: At the risk of treading on unclear ground, that kind of collaboration requires mutual trust between Governments. Our government is spending hundreds of millions of pounds of our money, and expecting others to contribute similarly. Could you assure me that such mutual trust would not be threatened? It also requires the ability to hire the best scientists from all over the world. That is not a trivial issue right now because of the immigration rules. For example, at the Square Kilometre Array, half the staff at the headquarters at Jodrell Bank near Manchester are from outside the UK. That makes sense in an international project. The other participants wish their scientists to be employed there. The things I would worry about in such a world would be the ability to recruit scientists from elsewhere in the world and whether there was a negative impact on mutual trust between Governments.

As you say, most of these projects are outside the EU frameworks because that is the way they wish to work. Within the EU, the way that Horizon 2020 has been operated, the way FP7 was set up before that and the way the European Research Council operates are attempts to follow the best practice of the UK research system, with the Haldane principle—although not called that—with proposals peer-reviewed purely on the basis of excellence, without using criteria to skew the outcomes to favour certain geographic regions and so forth. Without perhaps realising it, we have had great influence as exemplars of best practice, and the clear separation between the role of the European Research Council and those of the more innovation-oriented agencies is a good thing to hold on to. I think we have had good influence there and we are seen across the whole EU as having best practice in the way science operates.

Lord Hunt of Chesterton: You have already answered the second question. To put it another way, when we joined the EU, I asked some scientific civil servants what the benefit of this was, and they said, “At last we have a peer group which can ask us questions”, because they

regarded Parliament as a non-serious peer group in the UK. That is sort of what you are saying, is it not: that these meetings of people who are government officials, discussing scientific policy—the EU club, as it were—have been quite effective and, if we were not part of the EU, we would not have that?

Professor John Womersley: We have peers in these kinds of forums who are the holders of research budgets in other major European countries and, as I said, that includes countries such as Switzerland, which are not actually members of the EU but with which we collaborate. We have successfully built collaborations such as the Square Kilometre Array with other countries such as China and India, but I think the mutual trust we have with other European partners has certainly helped that process, even if it is not a legal underpinning of it.

The Chairman: Lord Hunt, would you like to continue?

Q111 Lord Hunt of Chesterton: One of the issues is how our science measures up and how it would be changed by the possibility of a Brexit. The statistics suggest that UK basic research is arguably the strongest in the EU, but perhaps not in applied science. There is a question about that. Does the number and scale of EU research facilities in the UK reflect our strength? If not, why not? That is obviously for you all to answer.

Professor John Womersley: If I may start, I am going to quibble with your question because when you say EU research facilities, I am not sure you mean that.

Lord Hunt of Chesterton: European research facilities.

Professor John Womersley: Back when the European Community was established, Euratom was set up as a pooled research programme. ITER/JET at Culham is one of the few areas where there really is an EU flag on the outside of a big research project. Of course, we benefit from having JET at Culham, and if Steve Cowley were here he would make that case very, very strongly.

We host a number of European intergovernmental research facilities such as the European Centre for Medium-Range Weather Forecasts, which Julia can talk about, but we have not been successful in securing any of the more recent round of big facilities such as those for the European Spallation Source or the X-Ray Free-Electron Laser, which is in Hamburg. Historically, the UK has often seen big science facilities as places to go and do science, which seems a little obvious. However, if you see science output as the key thing, having somebody else build and operate it looks like a cost-effective way of getting access to the facilities for your scientists. You do not have to build the headquarters, you do not have the liability of decommissioning and you do not have to hire a large number of staff.

Historically, we have been quite content to use the Synchrotron Radiation Facility at Grenoble and the facilities in Hamburg and so forth. I think that has shifted because we have rediscovered the knowledge that there are long-term benefits to having such things on our soil. Those come from the economic impacts, the spin-outs; from the fact that these facilities serve as an ecosystem for small businesses, or even for large companies to locate around them, and that they have a pool of staff who can go on to stimulate economic activity. That is what STFC is trying to do at the Harwell site. That is what we have been working on at Daresbury as well. We have attracted organisations such as the European Space Agency to put their science and technology centre at Harwell very much with that in mind. That is why we have bid very strongly to host the Square Kilometre Array at Jodrell Bank—because of

the impact on big data and computing that will come from that next-generation astronomy project.

The realisation of these other benefits alongside the pure science outputs has shifted the balance a bit. We are doing better. We have been working quite hard in STFC, and I know the other research bodies in the UK have similarly, but there is still some way to go. The benefits are around the innovation ecosystem and the science and technology campuses that these things can anchor and stimulate.

The Chairman: The Joint Research Centre, which is, effectively, an in-house research facility for the Commission, has a number of sites in member states but none in this country. Have we missed out?

Professor John Womersley: I am not intimately familiar with the JRC, but what I hear about it does not inspire huge confidence. These are former nuclear research facilities that have been repurposed. I am not aware of a new one having been established recently. You may know more through SAM.

Professor Dame Julia Slingo: No, I do not.

Lord Hunt of Chesterton: There are various views on that. One of the roles of the JRC, which was extremely important, was as a tool to enable, for example, the European Commission to see what was and was not being grown all across Europe. The environmental monitoring is quite considerable. The Met Office had some interactions with them on that.

Professor Dame Julia Slingo: I think it comes back to the comment I made around the HLG that something such as the JRC is great for what the Commission calls facts and figures and technical advice, and that sort of thing, but if you want deep science, that is not where you go.

Lord Hunt of Chesterton: It is an applied European lab.

Professor Dame Julia Slingo: That is not where you go. That is not what it does. It is not what it is recognised for. I think that is a very clear distinction.

The Chairman: Certainly, it is a facility that is available to the Commission. Let us move on. Lord Peston.

Q112 Lord Peston: My question is initially to Dame Julia. Incidentally, Dame Julia, may I say to you that many years ago I chaired a conference on forecasting, devoted entirely to why meteorologists were very much better at forecasting than economists. Since then it seems to me the meteorologists have become a lot better and economists, if anything, a lot worse. I give you that as background. My specific question is whether what is happening with all these expert groups is risking a dilution of the influence of individual states in the EU, and, I might add, does it matter? Can you throw any light on that?

Professor Dame Julia Slingo: I am not sure I can, to be honest. You are right that there are lots and lots of advisory groups, and the HLG is trying to understand the landscape of those different groups and what their remits are. I do not think I can answer your question. Thank you for the comment on weather forecasting. We do start from some fundamental laws of physics that are a great help.

The Chairman: In the written evidence from the Met Office you refer to the JPI that you are particularly concerned with, and you expressed some reservations about whether it was adequately fulfilling its role. Would you like to comment on that?

Professor Dame Julia Slingo: We have a JPI on climate. Perhaps it has not had the—what is the right word?—impact that some of the other JPIs have had. From our specific perspective in the Met Office, it has been quite difficult for us to engage, and that is because the JPIs typically involve research funders. We are not a research funder. We are a public sector research establishment. We do not have access to research council funding in this country. There are parts of the JPI and the ERA-NET instruments that require you to put in in-kind resource, which is fine if you are a research funder such as a research council, but of course the Met Office does not have any capability for engaging, so we have had to work quite hard to get round the JPI table. We are there now, I am pleased to say, but I think some of the difficulty from the UK side, and particularly from the Met Office side, is what Sir Paul Nurse highlighted in his review of the research councils, which is the relationship between public sector research establishments such as ourselves and the National Physical Laboratory and the research councils. That is one of the key issues from my perspective as Chief Scientist at the Met Office.

Q113 The Chairman: In the earlier session this morning, we were being advised by Siemens that there was perhaps a need to synchronise national programmes with the programmes coming out of Europe, and in that way it was thought perhaps we might do better, certainly within industry, in attracting the funding. Do you think the problems you are having with the JPI Climate is another manifestation of our failure to synchronise?

Professor Dame Julia Slingo: I think we have to be cautious here. The UK science base is very strong nationally, and of course we have very, very good international collaborations and partnerships. I think we have to be very cautious that our own science agenda and our own strategy for science is not taken over too much by what Brussels would like to see done. That was one concern that some of us had around some of the new instruments where a lot of national funding is required. Because our science base is so strong nationally and we are excellent in a number of science areas, we want to be careful not to risk weakening our core areas of excellence because we are trying to fit to somebody else's agenda. For me, it is always about getting the right balance between national interests and the quality of our science base versus what we gain by working more collaboratively in Europe. There is always that tension, and I think John can comment on that too.

The Chairman: Did you want to comment, Professor Womersley?

Professor John Womersley: We want these scientific collaborations to promote excellence and to promote science that is of itself worth doing and is not of value simply because it brings Europe together.

Professor Dame Julia Slingo: That is right.

Q114 Lord Fox: Turning to you, Mr Pritchard, charities, particularly those in the medical sector, are key funders of research in this country. Would the potential change in EU membership make any difference to charity research funding in the future?

Stuart Pritchard: Potentially. The Trust does not apply for EU funding itself, but we work with a lot of charities for which EU funding is an important part of the diversity of funding

they receive. Having worked for a smaller charity myself in the past, I would say that having a broad range of funders is very important for stability and sustainability. From some of the evidence that you have seen from the AMRC, for example, EU funding is not a huge number in the grand scheme of things, certainly for some of the larger charities, but it is important as part of the mix of funding that charities receive. A lot of the medical research charities work with other research organisation partners in the UK which are themselves recipients of EU funding, particularly in the university sector, so you could argue that, should EU funding to the UK research community decrease, it would have a potentially negative impact on the work of medical research charities.

Lord Fox: Are UK charities essentially operating only as UK charities? How much co-operation is there with charitable organisations within the rest of the European Union?

Stuart Pritchard: Quite a lot, I think. It depends on the area in which the particular medical charity is working. For example, in rare diseases there is a great deal of collaboration because the scale required to deal with rare diseases requires that collaboration. There are a few organisations working closely together. In fact, there is a much greater chance of success if charities that fund medical research themselves collaborate with other EU member states, and the charities that work within them. Thinking back to the evidence that the AMRC submitted, the AKU Society, for example, has received significant funding which, in the grand scheme of things, probably does not look a huge amount, but is enormously helpful in facilitating them to work closely with other partners and deliver progress against their charitable objectives.

Q115 Baroness Morgan of Huyton: Can we move on to regulation and particularly the harmonisation of regulation within the EU? We have had a fair amount of evidence around this. Broadly speaking, I would say the summary has been, “Harmonisation is a good thing but …” There are a few exceptions who have not agreed, but, broadly speaking, that is the shape of what we have had. Do you all agree with the, “Broadly it is helpful but …” position? If you do, can you explain for us in a bit more detail what the “buts” are? If you could reform it, what would you do? What are the key areas of concern?

Stuart Pritchard: As you know, the Trust takes a great deal of interest in policy and regulation that is appropriate to our charitable objectives. The life sciences are a very important part of our work. I think the Committee has received quite a lot of evidence already on some of the areas which the Trust has traditionally followed, so those will be familiar to you. They include the protection of animals in scientific experiments, the data protection regulation and clinical trials. The physical agents directive is an interesting example as well. They all have their own little peccadillos in the challenges they have presented. Ultimately, all of them have resolved themselves fairly reasonably. The challenge is the process. The outcomes can be unpredictable. The timescales can be unpredictable. For example, the data protection regulation has only recently been adopted—at the end of last year—and that was after four years’ hard slog, with right-down-to-the-wire unpredictability about how the Parliament particularly would respond to that.

Each piece of legislation has its own challenges. I would say that it is not always negative. For example, some of the positions taken within the EU discussions on the use of animals in scientific procedures were occasionally quite hair-raising, but, ultimately, this was legislation that replaced a 21 year-old directive that was no longer fit for purpose given advances in medical technology.

For me, part of the challenge in this is the actual process that the legislation goes through and the uncertainty that comes with that. We are quite fortunate in the Trust that we have the resources to follow legislation over an extended period. Not every organisation has that, and I think one of the challenges is how you enable appropriate input into that legislative procedure so that, for example, smaller charities which may not have the resource have their voice heard properly in some of the discussion. That is very difficult for some, and the Trust tries to work in coalition with other charities to enable the appropriate input to be made to those legislative discussions.

Baroness Morgan of Huyton: There seems to be something of a move towards regulation and away from directives. Is that more problematic?

Stuart Pritchard: There are pros and cons for both. Directives provide member states with flexibility to respond to their different national requirements, which is important for some of the research ethics considerations. The in vitro diagnostic directive is currently going through the EU institutions, and one of the sticking points is the Parliament's position on mandating genetic counselling for people using genetic tests. Genetic counselling is not a responsibility of the EU. It is very specific to the capacity of each member state how they deliver it, and it is a challenge whether the Parliament will stick to its guns or the member states and the Commission will convince it to take a different position. For example, if it was a regulation rather than a directive, and that were to emerge negatively in the position on genetic counselling, that would be much more difficult for a member state to adapt to; but regulations have their place in giving that opportunity for a single piece of legislation across all member states. For example, for clinical trials it makes sense to have that simplification across 28 different regimes.

Viscount Ridley: Following on from that, what is the opportunity cost of what you call down-to-the-wire uncertainty? In other words, in the case of clinical trials or animal testing, or whatever, how much good research has not happened because it has taken a long time to work out the uncertainty in this area? I know you cannot put a number on it. I can give you a very specific example here of a directive that is heading our way in May: the tobacco products directive, the aim of which, presumably, is to dissuade people from smoking. However, it contains within it an article that many people think is going to hugely discourage the take-up of vaping, which we now know—which we did not when they were first talking about this—is a very, very good exit route from smoking and much safer. The juggernaut is coming and there is nothing we can do. We are not allowed to amend directives.

Stuart Pritchard: I think it is difficult to think about opportunity costs, but if you were to think about the clinical trials directive, which initially came through in 2004, the Academy of Medical Sciences conducted a review into that in 2011, and that had some fairly worrying figures about the reduction in the number of clinical trials that were being applied for and conducted within the EU. According to the European Commission, the number of applications to carry out clinical trials in the EU fell by 25 per cent between 2007 and 2011.. That has now been replaced by a regulation that will come into force in about 2018, so that is a considerable period during which clinical trial legislation has been less fit for purpose than it could have been. You cannot necessarily put a figure on the cost, but I think the impact on the ability of the EU to conduct those clinical trials is clear.

From a commercial point of view, I know that when the Innovative Medicines Initiative was established, the amount of time that it took from the announcement of the intention that

the legislation pass through the institutions to its actual adoption was a concern, because the Innovative Medicines Initiative was intended as a measure to improve the competitiveness of the pharmaceutical industry in the EU. It was a very interesting and quite forward-looking piece of public/private partnership activity by the Commission and the pharmaceutical industry, but the delay and potential delay that was built into the legislative discussion was quite disconcerting for the pharmaceutical sector. You can imagine that uncertainty imbues people with a little bit of sensitivity about what the EU is of capable of delivering in the legislation.

Viscount Ridley: Chairman, I should declare an interest. The Academy of Medical Sciences was mentioned and I am a fellow of it.

Q116 Lord Hunt of Chesterton: The next question concerns structural funds and how they are used for research and innovation. Professor Womersley and Dame Julia, what is your experience of structural funds and how they are awarded for research and innovation? How do you think this relates to Horizon 2020 funding?

Professor John Womersley: Within the UK we have not received very large amounts of structural funds because of our relative economic development, but it is not as if we have not benefited from them. Sci-Tech Daresbury, which is in the Merseyside area, has received European regional development funding for an innovation building, for example, and there have been useful and significant contributions that way. Ironically, we have benefited quite a bit from spending in eastern European countries. The Czech Republic, Romania and Hungary are using structural funds to develop new high-power laser facilities, and some of the contracts they have placed have come to STFC in this country to build the lasers that they are not able to deliver themselves. Thus, in an indirect way we are building European collaboration with those countries and benefiting from structural funds.

Their experience of using structural funds for science facilities has not been smooth, not only because of Brussels but because of their own governments. It is much easier to make the business case for that kind of funding for a road, bridge or airport than it is for a science facility. I applaud them for choosing to invest in that way, because if you see skills and STEM capabilities as essential to their future prosperity, having those big science capabilities in-country is a way to stop a brain drain and to promote the kind of economic development that I am talking about.

Lord Hunt of Chesterton: In the Czech Republic they are working on small fusion devices in collaboration with the UK, which makes your point very well.

Professor Dame Julia Slingo: I do not think I have any more to add from the perspective of the Met Office.

The Chairman: Of course, we recognise that structural funds have a particular role for the developing economies within the member states, so to that extent we are less likely to participate. Do you think, nevertheless, that our research infrastructure could have benefited from these structural funds had we been a bit more alert to the opportunities?

Professor John Womersley: I am not sure how straightforward it would have been to make the case because, as I said, even in countries that clearly have a will to do this, the bureaucracy—their own and the bureaucracy in Brussels—was not set up to imagine that investments in big science facilities were the kinds of things those funds were created to support. I think they have benefited from it. A couple of years ago the Chancellor announced

a major capital investment fund for science, and that reflects the realisation that we had underinvested in our scientific infrastructure in the UK and we are taking steps to redress that through national budgets. I suppose one could put those two points together and say that, had we been able to take advantage of European funding, it might have been a smart thing to do.

The Chairman: We have wrestled with this issue at earlier stages of the inquiry and I have the impression still that some of our comparator countries such as Germany have done rather well out of structural funds. It is an issue we may need to look at a bit more carefully to decide to what extent there might be opportunities, and to try and come to a view about whether this could be of greater help to research in this country.

Lord Hunt of Chesterton: Is it because we are too centralised for the criteria these funds are judged on, rather than our funding being more regionalised?

Professor John Womersley: The UK itself is not a huge recipient of it and the areas that have benefited from it have not always been the most obvious places where one would put big science facilities. For example, Thames Valley, where Harwell is located, has one of the lowest returns on structural funds anywhere in Europe because it scores high on the development indicators. As I said, there are places such as Merseyside and the north-east where we would be able to make use of such funds, and have done for roads and bridges and so forth. Perhaps science facilities could and should be added to that list, perhaps through the perspective of the northern powerhouse.

The Chairman: I am sure Newcastle University could benefit from it. Looking around at the Committee, I think we have probably drawn to a conclusion. We are most grateful to the three of you for some very helpful evidence today. Thank you very much, therefore, to Dame Julia, Professor Womersley and Mr Pritchard. Dame Julia, we will be offering you every encouragement at the High Level Group. It is clearly early days and we recognise that it is not possible at the moment to determine how things are going to shape up, but we wish you well and are delighted that you are there. Thank you very much.

Mr Emran Mian, Social Market Foundation Society, Scientists for EU and Scientists for Britain – Oral evidence (QQ 128-135)

Transcript to be found under Scientists for EU

Clare Moody, MEP – Written evidence (EUM0062)

Scientific advice

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

I was elected in May 2014 and appointed as a member of the European Parliament's Science and Technology Assessment Panel earlier this year. In my experience so far I have seen first-hand the direct and substantial contribution made by UK scientists to EU scientific advice in policy making.

As I will outline below, my experiences in Brussels leave me in no doubt that the UK's membership of the EU greatly amplifies the influence and effectiveness of scientific advice from UK scientists, having a direct impact on urgent policy issues such as climate change and the Circular Economy amongst many other issues.

The Scientific Advice Mechanism in the European Commission; engagement of the Commission; and regard for British science in Brussels

The Scientific Advice Mechanism was established as the replacement to the Chief Scientific Adviser position. While there were considerable concerns about the announcement of the abolition of the post of CSA the SAM is better placed to be embedded more deeply into the work of the Commission. Firstly SAM is fully staffed with a Commission department; it will provide a broader scope of scientific input and it is properly integrated into the institutional framework of the Commission's policy development process.

It is worth noting at this juncture that the previous mechanism, the Chief Scientific Adviser, was instituted by Commission President Barroso in 2012 during his second mandate. The position was filled by Professor Anne Glover of the University of Aberdeen.

Commissioner Moedas has provided regular updates to MEPs, particularly British MEPs as we were vocal on the need for scientific advice to be part of the policy making process at an EU level, on the development of SAM over the past year.

Through these updates and information provided to STOA we know of the value the Commission places on British science. This was also demonstrated through the appointment of Sir David King to the Identification Committee, the Committee used to select the seven members of the SAM group.

The value the EU places in British science is further demonstrated by this Committee's decision to appoint Professor Dame Julia Slingo, Chief Scientist of the Met Office, as one of those seven members of SAM.

Dame Julia Slingo's experience and reputation make it certain that her appointment to SAM will provide a unique and rare opportunity to dramatically reinforce the influence and effectiveness of UK science.

The EU policy making machine, informed by UK science, provides a globally powerful, geographically far reaching, and thematically wide ranging legislative framework through which to filter UK science. The influence of SAM, with an activist Commissioner Moedas fighting its corner, should not be underestimated.

The STOA panel - UK MEPs & engagement with UK science; the European Parliament's MEP-Scientist pairing scheme
The Science and Technology Options Assessment Panel of the European Parliament provides an opportunity for Members of the European Parliament to advocate for the virtue of impartial and fundamental scientific research. The 23 member panel has five British Members, more than any other Member State.

The MEP-Scientist pairing scheme provides an excellent example of the work STOA does to mainstream scientific advice into policy making. Since 2007, STOA has been pairing interested scientists with MEPs in relevant policy areas, to help inform legislative work through impartial, technical, scientific advice.

The UK is a major player in this scheme, with British Universities representing 33 of the 108 successful applications to the scheme in 2015.

Informal contributions to the policy process
Outside of the formal channels for advice, UK scientists have a more informal route to contribute to the EU law making process, through one off, bilateral meetings.

UK membership of the EU means the door is always open for UK scientists who wish to engage with the Commission and Parliament, and the Commission in particular actively welcomes these engagements. The best example I can provide of this is a recent meeting I facilitated between Royal Society climate scientists and the Commissioner for Climate Change, Miguel Arias Canete, with his chief negotiator in advance of the COP21 Paris conference.

During this meeting the two participating groups were able to provide a valuable exchange of information, resulting in a request for scientific advice and expertise on definitions of climate neutrality, in the context of climate change targets to be negotiated at the Paris Conference in December. There was also a recognition that Paris is not a full stop on this work and the Commissioner was keen to follow up on the meeting, including beyond Paris, with the Royal Society's scientists.

Conclusion
At every avenue or opportunity to feed scientific advice into the EU law-making process, be that formal or informal, British science and scientists play a central role; and EU officials repeatedly look to fill gaps in scientific advice with British science. In return, the EU provides

a powerful, far reaching and wide ranging platform for British science to change the policy landscape and ultimately to inform changes to our laws and the world we live in.

25 November 2015

Professor Philippe Moreillon, University of Lausanne, Switzerland – Oral evidence (QQ 136-143)

Evidence Session No. 13 *Heard in Public* *Questions 136 - 143*

TUESDAY 1 MARCH 2016

Members present

Earl of Selborne (Chairman)
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Kakkar
Baroness Manningham-Buller
Lord Maxton
Duke of Montrose
Baroness Morgan of Huyton
Baroness Neville-Jones
Viscount Ridley
Lord Vallance of Tummel

Examination of Witness

Professor Philippe Moreillon, Vice Rector, Research and International Relations, University of Lausanne, Switzerland

Q136 The Chairman: We welcome Professor Philippe Moreillon. We are being broadcast, so I would ask you formally to announce who you are and, if you would like to make an opening statement, please feel free to do so and after that we will go into our questions.

Professor Philippe Moreillon: Thank you very much to the Committee for the invitation. My name is Philippe Moreillon. I am professor of medicine and microbiology at the University of Lausanne in Switzerland. For a number of years I have been vice rector of the University of Lausanne, in charge of research and international relations, and, in that sense, I have been exposed to the questions that were posed to Switzerland regarding the EU frameworks.

As an opening remark I would say from the Swiss point of view, of course, there is some history. Twenty five years ago we voted against being part of Europe. It was very tight. There were a number of negotiations and agreements signed by our diplomats to be part of the European adventure, if I could call it that. Before 2004, from a scientific point of view, we were considered as a third country. Between 2004 and 2014 we were considered as an

associated country, and it was of tremendous benefit, and since the terrible vote of 9 February 2014, we have reverted to a third country.

Q137 The Chairman: I am not sure whether you were in the room when I said earlier that we would welcome an opportunity in this session to discuss associated country status with the European Union. We will come to that in a moment. Recognising that Switzerland is a highly productive nation in published output per researcher, what do you attribute this to? Which aspects of the environment for science and research in Switzerland most contribute to this?

Professor Philippe Moreillon: I would say it is a biotope and it has historical grounds. In Switzerland, we do not have any raw materials to valorise. We only have excellence in science, innovation and services. The people and politicians of Switzerland are very aware of that. There is collective knowledge of the fact that we need to be excellent in these types of areas because we have nothing else, no massive production industries et cetera.

I would put six points here. The first is the awareness and willingness of the authorities and people to nurture this excellence. The second is investment. We put money in. The Swiss Government puts about 3% of GDP into research and education. This is not the largest among European countries, but it comes third, I think. There is free public education. There are almost no tuition fees for education from kindergarten to university. There are very low taxes, and that helps, of course, because taxes for foreign students and researchers are not high either. There is free-thinking science. As other European countries, we have our own national funding body, the Swiss National Science Foundation—you have the Wellcome Trust et cetera—which provides money for large, mostly free-thinking programmes. That would be the ideas part, or ERC part, of the current Horizon 2020 and the FP7. Of course, that is important because in basic research—asking how matter functions, how nature functions, how society functions—you are deemed to have discovered new, unexpected things that were not foreseen or predicted, and you are building the future; the future not in five years, but in 20 or 30 years. That feeds into what comes later on, which is applied research. Applied research is the application of what we know and trying to get it into the field, but it is not novel. It is important to have fundamental research and I think Switzerland does this pretty well.

There is internationality. Fifty per cent of Swiss researchers have non-Swiss passports. This is important. I guess it is not very different from the UK. Thirty per cent of Swiss researchers come from Europe, from neighbouring countries, so the networking and mobility that was alluded to in the previous session is quite important, at least for Switzerland.

Last but not least, just as we put a lot of money into research and science, we have good infrastructures, and, if you come from another country to work in Switzerland, you will be well treated regarding infrastructures and support.

The Chairman: In this country, sometimes we congratulate ourselves on our luck in having English as our native language, which is becoming very much the language of science around the world. You referred to the excellent educational system in Switzerland and, indeed, you have three national languages, effectively, and you all, including yourself, Professor, speak absolutely excellent English as well. Is this linguistic ability part of the strength that Switzerland has to offer the science community?

Professor Philippe Moreillon: Yes, but we are not alone in that. Many other countries do, except maybe France where it is traditional not to speak English. It is changing though. In many other places, there is teaching partially in English. I would make a point on the English language for science. I think it is a code. At least, that is how I sell it to my elderly colleagues and doctors who hate having programmes in English in their field. For a long time before that, it was Latin. It has changed over the two world wars with the evolution of Europe. Now it is English and that is the code we have to use in order to share our science, and we just do it.

Q138 Lord Hunt of Chesterton: In your opinion, what are the main advantages and disadvantages conferred on the Swiss science community as a result of associated country status within the EU? We have discussed variously the different opinions as to whether you have lost your strategic position in influencing the big European programmes. Could you comment on that?

Professor Philippe Moreillon: Yes, sure. We have experienced both. When you are not associated and you are a third country, there is no place at the decision table. Many programmes are not available to you and you are out of the game, unless you have colleagues in Europe, for instance, in collaborative projects. It is complicated because you need at least three European members for a collaborative project, so if you are a third party country you come as a fourth. Of course, it is more complicated to work like that and you have fewer opportunities to work with these guys.

The other problem with being a third party is if you have a collaborative project with European partners, Europe will not pay for your share of the programme, but Europe will decide what you and your country have to pay. The system is quite complicated because your local funding support will tell you, "I want", or, "I don't want to put that much money in". You lose your freedom and the system is complicated.

When we became an associate, it was much, much easier, of course, but we are still not sitting at the decision table or on the consultative committees where the decisions are made. We have a number of ways to interact, such as through university associations. We are still in the corridor, but at least we are part of the whole programme. The country puts in a share of money according to an equation of people, scientists and the GDP, and you apply for this money and the money comes back. Switzerland increased tremendously its proportion of scientists applying for European funds. If I give you the numbers, they show that we did very well. In ERC, this free ideas programme, Swiss scientists get back something like 2.5 their share, and on average for the whole of science about 1.45. That is not exactly the benefit in francs because you have fluctuations. That was amazing. However, two years ago, when we were out again, new applications for the European programmes dropped by 50% immediately. The number of co-ordinations dropped by 95%. That is because it is much more difficult to deal with. You come with your own project and you try to get a few other groups, and they say no because it is too complicated, or maybe for psychological reasons.

Lord Hunt of Chesterton: I have done projects with Switzerland under the former regime and it worked very, very well, but clearly there is a big change now.

Q139 Baroness Manningham-Buller: I think you have mainly answered my question, Professor, but are there examples you can give us of where your being in the corridor as

opposed to in the room, contributing to the decisions, has put you at a disadvantage? It is obviously a speculative question, but do you know of anywhere where you could say that?

Professor Philippe Moreillon: No, I cannot give you one or two clear examples on that. It is obvious that scientists adapt. You have the funding bodies in Switzerland, which are quite open, and if you want to go to Europe, you adapt to the European rules and programmes. You may or may not be happy, but that is the way to progress in science.

Q140 Lord Fox: Turning to regulatory harmonisation, obviously you can give us two views, one as a third country and one as an associated country. Do Switzerland's national regulations influence international collaboration? For example, do Swiss scientists end up having to adhere to two sets of regulations, the European and their own? Is there some advantage to having their own in the sense it frees them from some of the things we have heard in previous evidence?

Professor Philippe Moreillon: If you work with European colleagues, or if you are applying for ERC funding, or if you are funded by Europe, you abide by the European rules. Administratively, it is a bit complicated sometimes, but you make it work, and it is a tremendous opportunity for science and networking. If you want to go to the Swiss funding agency, and the Swiss have a big one—the Swiss National Science Foundation—then it has its own rules, which are a little simpler. I would say that it is advantageous to have both systems because they are complementary, if that is the question. There is no disadvantage in having two systems with two sets of rules. There is an advantage in having two complementary systems.

Lord Fox: Is there any advantage to having a national system to free you up from perhaps some of the worst aspects that we have heard in other evidence?

Professor Philippe Moreillon: Yes, I would say so, especially if you are not at the decision table. I think most of the countries in Europe have their own funding agencies. There is an advantage in having both, provided they are complementary. That is my opinion.

Q141 Viscount Ridley: I want to drill a bit further into the question of the February 2014 referendum and the impact that had on participation in European science. As I understand it, what the EU and Horizon 2020 particularly objected to was not merely the controls on immigration that came in but the specific rules that favoured Swiss nationals within scientific laboratories, among other places, as opposed to people from outside. Is that right? Was there something very specific there? This is relevant to our question because we have a tier 1 and tier 2 visa arrangement for getting scientists into the country from abroad, which would presumably continue because it works outside the EU at the moment. Can you shed light on exactly what it was that triggered the demotion of Switzerland to third country status? Could you come on to the question of how long term that effect is and what will happen at the end of 2016 when the current deal with the EU programmes expires?

Professor Philippe Moreillon: I am not sure I can tell you the exact details and whether there were small details that really bothered or frustrated the EU. I can tell you the vote was against massive immigration, which is a terrible term. Of course, that was launched by the conservative parties in our country, which are pretty strong and do a good job, at least in advertising and campaigning. First, I think it is important to note that they won this vote by 50.07%. It was called "a great victory", but that is only relative. The advertisement that was put out was that we would use more Swiss guys. It was somewhat of a lie that in the overall

workforce foreigners were taking jobs from Swiss people. The unemployment rate was something like 3%. This is a safe and sane unemployment rate. There was the impact on another treaty that was under way on free mobility for Croatia. I think that was the particular treaty that came down automatically with this vote, and Europe was very frustrated at that and they took these measures.

My opinion is that it was legitimate for the EU to do that, because if you have common values among all these countries to have free mobility, and little Switzerland says, “Oh no, not me, but I will take advantage of all the other things”, it could not cope with that. We voted two days ago on another referendum by the same party on the expulsion of foreign criminals—foreign being those with two passports or one non-Swiss passport—and the Swiss people, luckily, voted massively against that one, and I think that is a good sign.

Viscount Ridley: Against the criminals?

Professor Philippe Moreillon: Against the expulsion of criminals.

Viscount Ridley: Good.

Professor Philippe Moreillon: It is l’état de droit, the rule of law.

Viscount Ridley: Can you reflect on this question? As I understand it, Switzerland renegotiated its way back into associated status with the science programmes, but that deal is only until the end of 2016. What happens after that?

Professor Philippe Moreillon: We do not know. We have been out and then we have been partially in for one of the package of systems, which, basically, is called excellence. Now we do not know. I guess we will have to make a decision on whether we re-open the votes against massive immigration and especially mobility for Croatia. I think that is the deal. The Swiss Federal Council will have to make a move before the end of the year to either re-vote or make a statement or an amendment on its own.

The Chairman: What are the implications from this lack of certainty? You say you have no idea what is going to happen after 2016, which is this year, I suppose. Does this have implications for the long-term planning of your research institutes or universities?

Professor Philippe Moreillon: Yes. You have to take this as a bundle or a package. Our raw material is science and, talking egoistically from the point of view of small Switzerland, with the networking and the fact we have attracted many scientists from all over the world to work, we have a scientific jewel, if you will. Now, we are out of the big networking from Europe, so you may say we can have networking with the United States, India, China et cetera, but our direct scientific neighbours are the European countries, and they have built this European area of knowledge, education and research, and we would be foolish not to use it.

I will give you an example. If you have a good researcher coming from a European country with an ERC, which we favour very much because it is basic research, and the ERC cannot be hosted in our institutions, he or she will not come, or he or she will come and use their ERC in another institution. This makes no sense. It will take some time, but the level and attractiveness will decrease, and this is all we can predict. If you decrease science, you decrease the applied science that sits around it; you decrease SMEs coming in and maybe the big pharma—because there are a lot in Switzerland—in my domain, and big industry. It

has a tremendous effect over time. That is what we could predict. You could react to that and have other things.

Q142 Lord Hennessy of Nympsfield: Professor, can I ask you a qualitative question? How do collaborations between Swiss and EU scientists differ, if they do at all, from collaborations between Swiss scientists and scientists from non-EU countries? Do you think that the non-EU collaborations are stronger because of your gallant independent stand and recognition that your little grey cells collectively, as a nation, are your greatest single raw material?

Professor Philippe Moreillon: I am afraid I cannot give you numbers for non-EU connections for scientists. Scientists go where they need to for their science and they network in that way. There are many connections with the United States, for instance, but the funding or putting money together for a common project with the United States, Brazil or China is much more complicated than with Europe, because in Europe you have this wonderful system where you have a centralised pot and projects, and everybody comes in and evaluates the projects with the best experts, and you can do that with a lot of money. Big, big projects with the United States with one-by-one scientists are no problem, but a huge project, such as CERN, with the United States I would think is very difficult.

Not being in the EU any more, our direct neighbours are still Europe and scientists will go first to European colleagues and further later on. I do not think it will affect much. We will not increase much collaboration with scientists outside of Europe because of the difficulty of cross-funding.

Lord Hennessy of Nympsfield: Could I ask a quick supplementary? As a sympathetic friend of the UK, as I assume you are, I do not know how much you have been watching the nature of our national conversation about the European question. Are there elements of it that baffle you?

Professor Philippe Moreillon: Sorry, can you repeat your question?

Lord Hennessy of Nympsfield: When you listen to our national debate in the UK about the European question—remain or leave—are there elements of it that baffle you? Do you think by the way we conduct our debate we are very peculiar people?

Professor Philippe Moreillon: No. I think the arguments are the same as we have had in Switzerland for 25 years. Maybe I will make a joke here. This is a cartoon which comes up again and again. When Swiss people have to vote or make decisions on Europe, it is a cartoon where, basically, the heart says “yes”, the gut says “no”, and the brain says “I don’t know”, and then you have 50% voting.

Lord Hunt of Chesterton: Are they all related to each other?

Q143 Lord Vallance of Tummel: Can we turn to collaboration between business and universities in research? We took some evidence earlier which suggested that if you were a business headquartered in the European Union, you would find it perhaps significantly more difficult to collaborate with a Swiss university than you would with a university within the EU. You might want to comment on that. Looking at it the other way round, do you think that a Swiss business would find it significantly more difficult to collaborate with a European Union university versus collaboration with a Swiss university? If so, why?

Professor Philippe Moreillon: Scientists and businesses have their own logic for collaboration. They go where it is more profitable and easier. If you have different standards in different countries, and you have big Europe with a common standard for whatever production or R&D—you were talking about clinical trials—you would go to the big market, not the small market where rules are different and more constrained, because your product will not fit. Being outside Europe makes life tougher. Maybe not for very complicated or high grade or very specific domains, but those would be close to fundamental research because it is new. Basically, I think businesses would just go out to where it is easier. It is logic.

Lord Vallance of Tummel: So it is a straight commercial decision?

Professor Philippe Moreillon: Yes.

The Chairman: Professor, I think we have asked all the questions that we had in mind to put to you, unless any of my colleagues want to come back on anything. I think not. I pass on the thanks of all members of the Committee for your great courtesy in coming to help us today. It has been enormously valuable to us to have your perspective from Switzerland. There is a lot of relevant information we will have to take away and contemplate as we write our final report, which we will be doing very soon. Thank you very much, Professor, for joining us today.

National Institutes of Bioscience (NIB) – Written evidence (EUM0050)

The National Institutes of Bioscience is a partnership that brings together the eight bioscience research institutes that are strategically funded by the BBSRC: The Babraham Institute, The Institute of Biological, Environmental and Rural Sciences (IBERS), The Genome Analysis Centre (TGAC), The Institute of Food Research (IFR), The John Innes Centre, The Pirbright Institute, The Roslin Institute and Rothamsted Research.

The mission of the National Institutes of Bioscience is to deliver a national strategy in bioscience and respond effectively to global challenges such as food security, climate change and healthy ageing.

The views expressed here are independent of the Research Councils.

Funding

1. The eight Institutes that form the UK National Institutes of Bioscience (NIB) receive EU funding towards their research programmes. This makes up between 1 and 9% of individual Institute's annual grant income and in 2014/2015 totalled over £14M. Most EU income comes from the European Research Council (ERC) with smaller awards from the European Cooperation in Science and Technology (COST) actions and the Marie Skłodowska-Curie actions (MSCA). In the current climate, to replace this funding from UK sources would be very challenging.

2. A further £20M investment was awarded this year through the European Regional Development Fund to develop the Aberystwyth Innovation and Enterprise Campus (AIEC) which will sit next to IBERS. Like the other research campuses that are emerging around the NIB Institutes, this will contribute to drive innovation and maximise the impact of the world-class science research and infrastructures that are already in place at the Institute. The campuses are creating a low-risk environment for high-risk innovation and are key to the growth of the UK's bioeconomy (see http://www.bbsrc.ac.uk/documents/babraham-research-campus-timeline-pdf/ for evidence of how the Babraham Research Campus is supporting the UK bioscience industry and NIB overview brochure pages 16-17 for summary of the UK's Research and Innovation Campuses: http://www.nib.ac.uk/wp-content/uploads/2015/04/nib-overview.pdf).

3. It is difficult to draw direct comparisons between the management of science funding in the UK and the EU, mainly due to the size of the operations they carry out. The management of EU funding is a complicated compared to UK public funding sources and researchers have had to be encouraged to engage with H2020 due to the perception of "a politicised review process". All the Institutes are subscribed to UKRO which provides advice on EU funding opportunities and policy. As researchers become more familiar with the process and the Commission's simplification agenda is implemented, the number of applications to EU sources of funding is expected to increase.

4. The EU's science programmes are complementary to many of the UK's research missions. European funding has contributed to the Institutes' long-term research programmes and helped raise their profile internationally. Examples include: FISHBOOST in which The Roslin Institute is the only UK partner, and ELIXIR-ACCELARATE through which TGAC will facilitate the integration of Europe's bioinformatics resources, supporting all sectors of life-science R&D. Importantly, EU funding has supported the development of new techniques, infrastructures and intellectual property that have been used to leverage further funds. Examples include the EU-FP7 Bacchus, coordinated by IFR, which is providing evidence to support the development of foods containing bioactive compounds with health claims. This project has led to commercial innovations such as Beneforté Broccoli (http://www.beneforte.com/). Both The Pirbright Institute and The Roslin Institute were partners in NADIR, a network that helps maximise the use of the Institutes' infrastructures and services relating to animal disease diagnostics, control and treatment by both public and private sector companies. They are currently in the process of bidding for a second phase of this project.

5. EU funding has also had significant, positive, impact on the careers of early-mid career scientists via studentships and fellowships that promote the movement of researchers within the EU and knowledge transfer. The opportunities afforded through the MSCA programme significantly improve opportunities for fellowship and training support.

Collaborations

6. Collaborations with the best scientists accelerate the rate of discoveries and the impact of research. The recently published Nature Index 2015 Collaborations report provides further evidence that high-impact research is conducted through international collaboration (http://www.natureindex.com/).

7. The EU has been a major funder of networks to facilitate sharing of expertise and facilities across Europe. The Institutes participate in activities such as the COST actions, which promote interactions with EU scientists and enable new research collaborations. UK science would suffer if it ceased to have access to the cross-EU consortia and facilities that have been established by EU science programmes. EU funding helps fuel larger and more ambitious projects which could not be supported by any member state individually.

8. The National Institutes of Bioscience recruit the best researchers from all over the world and have benefited from the free movement of people between EU countries. In some Institutes nearly a third of scientists are non-UK EU citizens. If they had to go through the visa process that applies to non-EU citizens the scientific efficiency of the Institutes would suffer and undoubtedly they would become a much less attractive place to work. Indeed, in some Institutes there has been a slight decrease in the number of staff recruited from non-EU countries, possibly due to the more stringent visa requirements. It is worth noting that immigration policies that result in an effective bias towards EU scientists over others will weaken UK science.

9. Despite the large number of collaborations between NIB Institutes and EU member states, the Institutes have established many long-term collaborative projects with partners in Africa, Australia, Brazil, China, India and USA, that are addressing research areas of strategic importance such as human health and wellbeing, animal health and welfare, agricultural sustainability, pest and disease management, disease surveillance and land management. The fact that the UK has access to EU funding and infrastructures, along with the potential to develop successful research outcomes into wider business opportunities both within the UK and across the EU, makes it an even more attractive country for international collaborators.

Regulation

10. Regulatory frameworks relating to the food industry, animal research, data protection and novel genetic technologies such as genome editing have a direct impact on the Institutes science programmes and on the realisation of their socio-economic impact.

11. The EU's current position on GM has been detrimental to the exploitation of high quality UK science and as GM acreage continues to expand in other countries, there is a real danger of stifling Europe's competitiveness. If the UK were not a member of the EU, this regulatory framework could be reformed to the benefit of research (or not, as in Scotland: http://www.nib.ac.uk/ban-of-gm-crops-will-affect-the-future-competitiveness-and-productivity-of-scotland/). By being part of the EU, the UK has the chance to influence and harmonise regulatory frameworks at European and national levels and thus facilitate collaborative research.

Scientific advice

12. The NIB Institutes contribute to inform EU science policy and investment through links with EU Directorates, Technology Platforms and UKRO's National Contact Points. Furthermore, the senior scientists at the Institutes actively engage with MEPs on science and technology committees. The influence exerted is relatively limited but by working in partnership as NIB the member Institutes are aiming to have a more significant role in shaping the EU science agenda.

13. The Institutes are well aware of the importance of balancing public consent with scientific evidence when attempting to influence policy. They have conducted public dialogues and developed numerous public engagement activities to ensure awareness of public attitudes to bioscience research and address public concerns. Thus, they are perfectly positioned to highlight the benefits of bioscience research to politicians, policy makers and funders in the UK and in Europe.

NB: Several of the National Institutes (Babraham, JIC, IFR, TGAC, Pirbright) have made their own separate submissions which emphasise specific issues within their own research areas that are not replicated herein.

20 November 2015

National Nuclear Laboratory (NNL) – Written evidence (EUM0019)

1. Statement of interest

NNL is government owned and operated. Its mission is central to an integrated nuclear R&D programme in the area of nuclear fission: operations & maintenance of nuclear plant, new nuclear build & future reactor systems, waste management & decommissioning, fuel and fuel cycles, and safeguards & security. This includes involvement in integrating the capabilities within universities, national laboratories, and end-users of nuclear technology, providing access for R&D purposes to subject matter experts across the nuclear fuel cycle and state of the art nuclear R&D facilities, including facilities for handling highly radioactive materials. NNL collaborates with UK and International partners and provides expert advice to UK Government Departments.

As the UK's National Nuclear Laboratory, the experience and evidence base upon which our responses are made is specific to the nuclear fission sector, and to funding of research in nuclear energy and the nuclear fuel cycle. Accordingly our comments do not address the totality of the question in this inquiry, by any means. However we feel that the insights from our sector may be useful to the Committee as they illustrate some of the specific benefits and impacts of EU membership and the relationship with science, research and innovation in the nuclear fission sector.

2. Responses to issues raised in the terms of reference

Funding

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

Over the period covering the EU Framework 7 (FP7) and Horizon 2020 (H2020) programmes (2008 – 2015) the NNL has received in excess of £5 million for work carried out on collaborative projects in Europe, predominantly in the area of nuclear fission research. The UK government reported in 2013 that the UK participated in more projects in FP7 than any other member state and were second only to Germany in terms of cash receipts. Data for H2020 is not available to us yet but we believe this information is collected by the EU Commission. Hopefully this will include a breakdown sector by sector.

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

The Department for Business Innovation and Science are best placed to answer this on behalf of the UK for overall EU contribution and the proportion of that spent by the EU on science and research.
For the fission sector previous financial rules of FP7 required participants to match the funding received from the EU, and therefore make an additional contribution to the research

budget. Under the rules of H2020 this is no longer a requirement and participants receive 100% of allowable costs. This change has had the unintended consequence of reducing the amount of money spent on EU collaborative fission research as little 'in-kind' effort is now contributed by the participants.

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

In our experience of FP7 projects, the overhead and bureaucracy associated with EU project funding are significantly more onerous than those for UK science funding, however this has been reduced in the current H2020 programme.
In the nuclear fission sector the NNL participate at all levels in development of the research and innovation agenda and the programme detail is agreed by the Member States in the fission configuration committee. Significant and successful effort is made to align the programme calls with UK fission research priorities.

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?
In the nuclear fission sector the NNL participate at all levels in development of the research and innovation agenda and the programme detail is agreed by the Member States in the fission configuration committee. Significant and successful effort is made to align the programme calls with UK fission research priorities.
Participation also gives the NNL the ability to influence the priorities of the fission research and innovation programmes.
It also provides:

- Involvement in large programmes that the UK could not undertake in isolation
- Development of skills and capabilities
- Technical reputation
- Opportunities for innovation
- Opportunities for business development
- Visibility and utilisation of the UK nuclear fission research facilities

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

Involvement in EU programmes and strategy groups improves the level of mutual understanding and awareness of capabilities between EU partner organisations and allows for a better focus on bilateral opportunities. It also provides the opportunity to share UK and NNL research and innovation priorities and capabilities in nuclear fission research. This in turn improves the possibilities of bilateral collaboration with our EU counterpart

organisations. There is no requirement on the NNL to operate any bilateral research programmes through EU mechanisms. The exposure of NNL scientists and engineers to this international community and capability enhances our ability to develop strong international and bilateral links both within the EU community and with non-EU countries.

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

The fission research programme covered in FP7 in which NNL participated was valued at approximately £70 million giving a greater than 10 fold gearing of UK investment in the research. This is clearly of significant benefit and value to UK science and the NNL. Involvement in EU collaboration is attractive in recruiting and retaining the best STEM graduates into the NNL. It also enhances the reputation of the UK participants which in turn attracts inward international interest and investment

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

In the nuclear fission research and innovation area the European Joint Research Centre (JRC) operate a number of fission research facilities which NNL have access to as part of EU membership but have to pay as used. UK involvement in other international facility projects include Jules Horowitz reactor, the Halden project and Myrrha are generally conducted as bilateral arrangements outside of EU influence or in the case of Halden through UK membership of the OECD.NEA. There are no restrictions on UK participation in non-EU facility projects, although there are few examples at this time.

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

UK scientific output per euro spent is probably as good as (or better than) any of our European partners. Free movement of high quality scientists is critical to this – EU membership enables this and some financial support is provided, but isn't a pre-requisite. NNL continue to look for people exchanges where relevant and appropriate and where funding is available to cover the high cost of access to nuclear facilities. Security considerations clearly impact this for nuclear fission research and collaboration with certain countries

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

Not to our knowledge

Regulation

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

NNL have no comment to make on this question

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

NNL have no comment to make on this question?

12. How is the innovation landscape affected by EU membership?

NNL have no comment to make on this question?

Scientific advice

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

The provision of scientific advice to UK public policymakers in the nuclear fission area is relatively straightforward compared to the EU processes which need much wider consultation across all member states

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

Involvement of UK subject matter experts in the governing bodies and steering committees of the nuclear fission technology platforms such as SNETP(sustainable nuclear energy), IGDTP (implementing geological disposal) and MELODI(radiation dose initiative), allows the UK to be at the heart of the policy formation process and ensure alignment of UK policy and priorities in the EU agenda. NNL does not feel inhibited in influencing public policy in any international arena and takes guidance and advice from UK government and other UK stakeholders in formulating strategy

Author – Stephen Napier, National Nuclear Laboratory, Science and Technology Directorate

19 November 2015

National Physical Laboratory (NPL) – Written evidence (EUM0025)

Summary

1. NPL is one of the world's top three National Measurement Institutes; a leading enabler of science, research and innovation; delivering £634 million p.a. in benefits to organisations through measurement innovation.
2. Over the last few years NPL has seen a rapid increase in revenue from the EU such that in 2014 it equated to 17% of its turnover.
3. The benefits of shared results and faster progress through collaborative research on common challenges, e.g. climate change, energy and healthcare amplify the direct financial contribution.
4. NPL won 22% of the €400m European Metrology Research Programme (EMRP). It is now engaged in the €600m European Metrology Programme for Research and Innovation (EMPIR). Both are Article 185 programmes of co-ordinated research under FP7/ H2020 respectively.

1. For over a century the National Physical Laboratory has been a highly regarded laboratory whose core role is as the UK's National Measurement Institute. We sit at the intersection between scientific discovery and real world application, working as a bridge between academia, business and government. Our expertise and original research underpin quality of life, innovation and competitiveness for UK citizens and business. www.npl.co.uk

- NPL develops and maintains the nation's primary measurement standards, supporting an infrastructure of traceable measurement throughout the UK and the world to ensure accuracy and consistency – an essential foundation for a technologically advanced economy.

- NPL works in partnership with over 75 universities and 2500 businesses both in the UK and overseas, and publishes over 300 papers a year in peer-reviewed scientific journals.

- NPL provides companies with access to world leading support and technical expertise, inspiring the absolute measurement confidence required to innovate and realise competitive advantage from new materials, techniques and technologies.

- NPL has a track record in demonstrating the economic and societal impact of its work. Independent studies have shown that NPL's government-funded work returns ~£2bn pa to UK GDP, and a survey of over 500 industry customers showed benefits to these customers of £634m in 2012. An independent study found that NPL's portfolio of low carbon and climate science work is calculated to be responsible for 8 million tonnes of emissions reductions - equivalent to approximately 2% of the UK's total annual carbon dioxide emissions. It has also been estimated that NPL's contribution to improving the accuracy of the radiation dose NHS patients receive saves at least an additional 145 lives each year.

2. In this response NPL is commenting only on its research and innovation activities related to Framework Programme 7 and its successor Horizon 2020. In particular NPL participates in the €400m FP7 European Metrology Research Programme (EMRP) and the €600m H2020 European Metrology Programme for Innovation and Research (EMPIR) which are both co-funded by the European Commission, under the provisions of Article 185 of the Treaty on the Functioning of the European Union, which enables the EU to participate in research programmes undertaken jointly by several Member States.

Funding

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

3. In 2014 NPL earned £13.6m from the EU which represents 17% of its turnover. This is primarily through the EMRP and the EMPIR. The European Commission provides 50% of the funding for the EMRP and EMPIR programmes the remaining 50% being provided by States participating in the programmes. The State contributions are determined by the relative sizes of their metrology research programmes such that, for the 4 largest states in the EMRP Germany, UK, France and Italy the share of EC funds was 36%, 22%, 10% and 7% compared to their share of European GDP of 9%, 7%, 7% and 6%.

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

4. The UK's core commitment to EMPIR is €83m over the period 2014-2024, with a further €41.5m available as a reserve.

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

5. The EMRP and EMPIR are operated by a delegation from the EU to the Association of European National Metrology Institutes, EURAMET eV. EURAMET competitively contracts the administration of the Programmes. NPL was successful in winning the contracts to administer both programmes. Project selection results from a robust process involving open consultation for topics and independent reviewers.

6. The administrative costs in the EMRP were 4%, which included everything from call announcement through to final reporting to the Commission. This figure is comparable to the administrative costs of the UK Research Councils (Triennial Review of the Research Councils, BIS, 2014).

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

7. Many of the issues which are of concern to the UK and which require research and scientific solutions to address them are common to many countries, e.g. climate change, energy and healthcare. Where there are common challenges, collaborative research enables more to be achieved, and in a shorter timescale, as workload and costs can be shared and wasteful duplication reduced. Collaboration with others can also provide access to specialist equipment or expertise which would not otherwise be available.

8. International collaboration inevitably involves additional costs so should only be engaged in where there are scientific or economic advantages from doing so. In the case of the EU Metrology Programmes, which are aligned with UK priorities, there is the additional benefit of leverage from the matching funds provided by the European Commission which significantly increases what could be achieved using domestic funding alone.

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

9. Bilateral collaborations are not inhibited by any requirement to work through EU mechanisms but there are incentives to work through the mechanism of the European Programmes. As a result most of NPL's research collaborations with European laboratories are associated with the European Metrology Programmes.

10. EMRP and EMPIR involve both EU members and non-members from within Europe, e.g. Switzerland, and beyond. Institutes which are not from EU members or whose Governments do not have an Association agreement can participate as unfunded partners or collaborators. In some cases, e.g. Korea, the National Metrology Institute is funded by their own government to take part in the projects.

11. NPL also has strong bi-lateral collaborations outside of the EU Programmes, particularly with the US and China.

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

No comment

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

No comment

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

12. Scientific research, at the highest levels, is internationally competitive. As they have the right to work here, NPL vacancies attract more candidates from the EU than other parts of the world, and it is an easier process to employ those individuals. We are eligible however to employ individuals that don't have the right to work in the EU but have to go through the application process for a certificate of sponsorship with them, which is lengthy and time consuming. Where the quality of the candidate justified it we have applied for approx. 6 certificates of sponsorship in the last 2 years, all of which have been accepted.

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

No comment

Regulation

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

13. EMPIR is governed by the Rules for Horizon 2020 so all projects receiving funding from the Programme must comply with those rules. EMRP was similarly influenced by the rules of Framework Programme 7, although there was more flexibility to customise administrative arrangements.

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

No comment

12. How is the innovation landscape affected by EU membership?

No comment

Scientific advice

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

No comment

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

No comment

20 November 2015

Parkinson's UK – Written evidence (EUM0003)

About Parkinson's

1. Parkinson's affects one person in every 500, about 127,000 people in the UK. It is a progressive neurological disorder for which there is currently no cure. Around a third of people with Parkinson's develop symptoms before the age of 65, and one in 100 before the age of 40. The number of people with Parkinson's is estimated to increase by 28% by 2020.

2. Parkinson's is associated with the death of nerve cells in the mid-brain which results in the loss of the chemical messenger dopamine. This affects learned voluntary movements such as walking, talking, writing and swallowing.

3. The condition affects everyone differently and while it impacts on movement (rigidity, tremor and slowness of movement) there are over 40 "non-motor" symptoms that people report including anxiety, depression, fatigue, pain, continence issues, memory problems and sleep disturbance. Also, as the condition progresses it impacts on all aspects of a person's life and the lives of those around them.

About Parkinson's UK

4. As the UK's Parkinson's support and research charity we're leading the work to find a cure, and we're closer than ever. So far we have invested over £70 million in ground breaking Parkinson's research. Currently we are supporting around 70 research projects totalling over £20 million across England, Scotland, Wales and Northern Ireland.

5. We also campaign to change attitudes and for better services. We bring people with Parkinson's, their carers and families together via our network of local groups, our website and free confidential helpline. Specialist nurses, our supporters and staff provide information and training on every aspect of Parkinson's.

Executive summary

6. Parkinson's UK welcomes the committee's inquiry into the influence of the EU membership on UK science and would be delighted to provide further written or oral evidence.

7. This submission addresses the following issues:
    - Influencing regulation
    - The importance of collaboration across the EU
    - Research workforce
    - Drug licencing

Influencing regulation

8. Being a member of the EU brings many benefits to science and research in the UK. It is extremely important that the UK has the ability to shape EU research programmes, something that could not happen if were not members of the EU.

9. This is particularly relevant for negotiations on regulation. It is important that the UK has the ability to influence the development of regulations for research through channels such as UK Members of European Parliament (MEPs), in order to ensure that they are appropriate and beneficial for UK research.

10. Parkinson's UK has been involved in work to influence regulations and directives that will impact research in the UK such as:
    - the EU Data Protection Regulation
    - the European Clinical Trials Regulation
    - the European Directive on the protection of animals used for scientific purposes

11. The medical research sector in the UK is working together to influence the development of the EU Data Protection Regulation. The proposal for a new Regulation currently being debated in Europe could impact researchers who use personal data in their work.

12. Personal health records are a valuable resource, revealing the most effective ways of caring for patients and allowing us to better understand the causes and frequency of conditions. If amendments put forward by the European Parliament's Civil Liberties, Justice and Home Affairs (LIBE) committee are taken forward, health and scientific research will be severely threatened.

13. For example, the requirement to gain specific consent could stop the largest ever in-depth study of people with Parkinson's study *'Tracking Parkinson's'.* It is a 5-year project which aims to speed up the search for a cure by finding 'biomarkers', many of which circulate in the blood. Participants complete questionnaires, donate blood samples and have their Parkinson's symptoms carefully monitored at regular hospital appointments. They give broad consent for the data to be shared with researchers. The information and samples collected in the study are made available to researchers studying Parkinson's all over the world free of charge. This study would become unworkable under the LIBE committee's amendments since the form of consent is very narrow.

14. We have been working with MEPs, Council of Ministers and the European Commission to influence trilogue discussions and ensure the regulation maintains important exemptions for health and scientific research. We believe the regulation must include an alternative means to allow processing of personal data for research where consent is not practicable; and ensure it includes proportionate safeguards to protect data subjects' interests and ensure exemptions are used appropriately.

15. The European Clinical Trials Regulation has been heavily influenced by the UK. This new regulation will replace the 2004 EU Clinical Trials Directive and aims to speed up the process for launching new clinical trials; establish a more proportionate regulatory regime; streamline reporting requirements and simplify rules for multi-

country trials[390]. Many UK stakeholders such as medical research organisations, have been working with MEPs to help shape the development of this regulation and ensure that it will overcome the barriers that the previous Directive brought[391] and benefit UK medical research.

16. The Regulation's introduction of a portal with a single application dossier is particularly attractive to streamlining and harmonising the application process for clinical trials.

17. An EU database will also be developed which will contain all data and information submitted via the EU portal. The portal and database will ease the applications for clinical trials authorisation. Particularly in case of multinational clinical trials they will assist the sponsor; the assessment carried out by the Member states authorities' and also allowing access to clinical trials information by the general public[392]. It is vital that UK researchers and public are able to benefit from the portal and be able to access this database. This will enable findings from clinical trials to be shared across the EU.

18. A European Citizen's Initiative sought to repeal the European Directive on the protection of animals used for scientific purposes and ban the use of animals in medical research. We worked with the medical research sector to ensure that the EU Commission opposed this initiative. This Directive has enhanced animal welfare standards and introduced the concepts of refinement, replacement and reduction ('3Rs') across the EU, while ensuring Europe remains a world leader in biomedical research.

19. The use of animals in research has contributed to many breakthroughs in our understanding of Parkinson's and the discovery of current treatments. This includes a key treatment, Deep Brain Stimulation (DBS), which has been one of the biggest breakthroughs for people with Parkinson's in the last four decades. It is crucial that this type of research can continue to help discover more and better treatments for people with conditions such as Parkinson's.

20. It is vital the UK can influence these discussions to ensure EU regulations are workable and appropriate for UK medical research. There is a process in place for the European Parliament and EU commission to work with MEPs and it is vital that the UK has representatives in place to influence these negotiations.

The importance of collaboration across the EU

[390] http://www.nhsconfed.org/~/media/Confederation/Files/Publications/Documents/EU%20Clinical%20Trials%20Reg%202014%20infographic.pdf

[391] The Directive contributed to a 98% increase in admin costs; applications for clinical trials fell by 25%; delays for launching a clinical trial rose by 90%. European Commission and National Institute for Health Research Clinical Research Network.

[392] http://ec.europa.eu/health/human-use/clinical-trials/regulation/index_en.htm

21. It is crucial that the UK is able to collaborate with researchers from oversees and can access EU research funding. Projects that we collaborate on tend to have a greater impact.

22. Parkinson's research greatly benefits from EU grants and collaboration with EU research teams. Parkinson's UK is a partner in the EU-funded 'No Tremor' project which involves partners from Greece, Italy and the UK. This three year project received €2.9million from EU's Seventh Framework Programme for Research (FP7)[393].

23. In this project the researchers aim to use the huge amounts of data being collected by Parkinson's UK funded projects to create sophisticated computer models that can accurately predict how the condition develops over time in different people. It will ultimately be useful for understanding the condition and developing new treatments.

24. It is also important for UK researchers to collaborate with industry at EU level to ensure that research findings make it from the laboratory to market.

25. The Oxford Parkinson's Disease Centre has recently received EU funding as part of the stemBANCC[394] project. The main aim of the stemBANCC project is to generate and characterise high quality human induced pluripotent stem (iPS) cell lines from 500 subjects that can be used by researchers to study a range of diseases, including Parkinson's, and test for drug efficacy and safety. The cell lines will help to improve and speed up the drug development process, and ensure that patients benefit from more effective and safer drugs.

26. StemBANCC is supported by the Innovative Medicines Initiative (IMI)[395] and includes a number of partners including pharmaceutical companies, research institutions and small and medium enterprises.

27. It is extremely important that the UK can take part in projects such as these and access EU funding for essential research studies. Even if UK researchers are not successful in being awarded EU grants, having the opportunity to apply for them can bring many benefits such as providing opportunities to meet other researchers from the EU to start collaborating to find a cure and better treatments.

Research workforce

28. Parkinson's UK believes that membership of the EU is essential to maintain and grow the UK's research workforce.

29. Many UK higher education and research institutions recruit students and researchers from Europe and we know that Parkinson's research benefits from this recruitment.

[393] https://ec.europa.eu/research/fp7/index_en.cfm
[394] http://stembancc.org/
[395] The Innovative Medicines Initiative (IMI) is Europe's largest public-private initiative aiming to speed up the development of better and safer medicines for patients. IMI supports collaborative research projects and builds networks of industrial and academic experts in order to boost pharmaceutical innovation in Europe. IMI is a joint undertaking between the European Union and the pharmaceutical industry association EFPIA.

Professor Richard Wade-Martins, Principle Investigator at The Oxford Parkinson's Disease Centre comments:

> *"half of my team are from EU countries. Employing students and researchers from the UK and EU ensures that there is a greater pool of talent recruit from".*

Professor Wade-Martins has many rotation, PhD and MSc students and fellows from the EU working on Parkinson's research in his team.

30. The UK's withdrawal from the EU would present many barriers to this recruitment. Current employment regulations allow the UK to recruit researchers from the EU without any visa restrictions.

31. Having a wider pool to recruit from is particularly important to recruit researchers for neurological conditions. There is a need to recruit and train neuropathology experts. Neuropathology is a key area for conditions such as Parkinson's as analysis of post mortem tissue underpins a lot of research in to the condition. Limiting where the UK can recruit these researchers from would be detrimental to research.

32. It is essential there is the ability to recruit researchers across the EU; it also benefits the researchers as they gain relevant experience and also can disseminate findings from past studies too.

Drug licencing

33. As a member of the EU, the UK benefits from the advice and procedures of the European Medicines Agency (EMA). The Agency is responsible for the scientific evaluation of applications for EU marketing authorisations for human and veterinary medicines.

34. Under the centralised procedure, pharmaceutical companies submit a single marketing-authorisation application to the EMA. Once granted by the European Commission, a centralised marketing authorisation is valid in all European Union (EU) Member States[396].

35. Once the EMA provide a company with a license to market a product in Europe no further action is necessarily required from the UK regulatory system. If the UK were not a member of the EU, in order for a drug to be licenced for use in the UK, pharmaceutical companies would have to submit separate marketing authorisation applications to the UK's licencing agency – the Medicines and Healthcare products Regulatory Agency.

36. Although this might be dealt with by negotiation of a bilateral agreement, the result could still discourage pharmaceutical companies from applying for a licence for drugs to be marketed in the UK, in turn preventing or delaying UK patients from receiving

[396] http://www.ema.europa.eu/ema/index.jsp?curl=pages/about_us/general/general_content_000091.jsp&mid=WC0b01ac0580028a42

new treatments. In general by removing the UK from the core EU process, our voice in all discussions regarding new drugs for patients in the UK will be weakened.

Conclusion

37. Parkinson's UK believes it is vital that the UK remains a member of the EU to ensure that we continue to reap the benefits and opportunities for medical research it affords us.

38. The UK benefits from being able to influence regulation on data, clinical trials and using animals in research at an EU level that has a direct impact on UK research.

39. Delays in getting patients access to treatments may be delayed if the UK is not a member of the EU due to possible increased complications to licencing procedures.

40. There is a thriving EU network for Parkinson's research that benefits research into better treatments and a cure for people living with the condition in the UK. This research relies on the recruitment of talent from across the EU and also research grants.

4 November 2015

The Pirbright Institute – Written evidence (EUM0057)

Background information
The Pirbright Institute, formerly known as the Institute for Animal Health, is a world leading centre of excellence in research and surveillance of virus diseases of farm animals and viruses that spread from animals to humans. Working to enhance capability to contain, control and eliminate these economically and medically important diseases, the Institute's highly innovative fundamental and applied bioscience contributes to global food security and health, improving quality of life for animals and people.

1. Response to question 3, Funding:

> *What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?*

1.1 The management of EU funding is a complicated and time consuming activity that requires significantly more time compared to other funding sources, especially UK public funding sources. The demands of the EU in terms of record keeping are onerous and require full original records of every aspect of the costs associated with the grant. This level of record keeping seems to be proportionately more important than the actual science achieved when reporting back to the EU progress and especially in agreeing the final provision of funds to support the science.

1.2 In addition to this, the indirect costs the EU will provide is relatively low when the amount to be funded is compared to the full economic cost of the activity. The EU will not fund all support costs nor the management and maintenance of infrastructure as they argue this is the responsibility of the individual participant to provide. This means that unless match funding is obtained all EU grants are loss making for the institute. If, over the long term, this additional funding is not then EU grants effectively reduce the ability of the institute to be sustainable and the higher the percentage of EU grants won the greater the danger to overall sustainability.

2. Response to question 6, collaboration:

> *How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?*

2.1 The Pirbright Institute operates in the area of animal health, and has direct links with human health via the so-called "OneHealth" approach. The expertise and facilities we possess are of high interest to a range of commercial sector organisatons, for example in the areas of pharmaceuticals, biotechnology (including vaccine), diagnostics, medical devices, etc. These companies are typically a mix between large corporations with a global reach, and SMEs in various stages of their lifecycle with attendant variable reach. In combination, our expertise and facilities are unique, and we are world-leading in many of our areas of research and development. This makes us highly attractive as collaborators for certain

companies. As many of these companies have either headquarters or large research centres outside the UK, but within the EU, collaboration is facilitated immensely by our EU membership. EU membership allows for easy flow of goods, technologies, know-how, access to harmonised markets, access to harmonised regulatory practices, and access to funding from the EC which can, will and does leverage the investments made by companies into our research and development, and which greatly contributes to keeping our world-leading position. As there are similar facilities in the EU that also offer a high level of expertise and good facilities, membership of the EU, and eligibility for research funding, is important to maintain our competitive position. Investment from the commercial sector is required to warrant continuous, leveraged investments into our facilities, to maintain our expertise, grow into new areas of research and development, and to maintain our leading global position in animal health research.

3. Response to question 13, scientific advice:

How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

3.1 It is clear that the Institute makes very significant contributions in terms of the advice given on Public policy to the UK, to Europe, and further afield to recognised authorities in countries on other continents (Australia, China, Brazil, USA, India etc). The information and advice given by the Institute has always been more highly trusted in terms of quality, accuracy, impartiality and reliability than advice from most other non-UK sources however inadequate funding can place the work that is done and the ability to give the best, most detailed and most accurate advice, at risk.

3.2 The work/advice provided includes:

- The Reference Laboratories, which provide diagnostic information, test results and advice for a broad range of important diseases, These services and resources are world class and make a massive contribution to disease surveillance and control. We do receive funding from the EU to maintain some of these capabilities but not all as other stakeholders are involved.
- As part of the Reference lab structures, there are OIE recognised experts for each of the major diseases. This is a significant responsibility and puts us in a good position to contribute advice and inform policy decision.
- It has been said that the '<u>quality and effectiveness of scientific advice on matters of public policy</u>' related to animal disease, from Pirbright, is still some of the best in the world.
- Many international reference collections are maintained for several virus groups that provide a basis for testing and validation of diagnostic systems, vaccine development and challenge studies, as well as other research activities and collaborations. See http://www.reoviridae.org/dsRNA_virus_proteins/ReoID/virus-nos-by-country.htm for an example.
- Virus isolation methods, diagnostic systems and sequence databases have been developed and shared with partners in many other countries, including colleagues in north and South America, Africa, India, Australia and many countries in Europe.

These now represent standard systems and have massively improved surveillance and epidemiological knowledge in multiple regions (for example for bluetongue and related orbiviruses).

- Annually many scientific papers are published by institute researchers that contribute directly to fundamental knowledge concerning the viruses that are worked on at the institute.
- Vaccine development, diagnostics, antiviral therapies, modelling of outbreaks, etc. also form part the work carried out at the institute; all of which help to support policy decisions.

3.3 To summarise, the institute provides vital information and advice to both UK authorities (e.g. DEFRA), and to overseas organisations (both public and commercial) and authorities, enhancing knowledge, data gathering and control that help to reduce the impact and spread of disease in the UK and in other countries. This reduces the risks of disease transmission from these other countries to the UK and the rest of Europe.

4. Response to question 14, scientific advice

To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

4.1 Since the institute works primarily on exotic economically important and transboundary viral disease, the research tends to be very outward looking involving links with international collaborators and disease events in other countries that might threaten livestock industries, or even human health in the UK. These collaborations are very good for our national reputation and the perceived value of links with the UK. The UK membership of the EU has allowed us to initiate and coordinate several research networks and projects that have significantly influenced research direction and provided information to inform policy decisions that would not otherwise have been available.

4.2 Membership of the EU significantly helps to provide research funding and enhanced opportunities for us to provide advice to DG Sanco and other executive agencies in Brussels. It also promotes inclusion in discussion groups and international agencies (e.g. H4A – previously called IFAH, Epizone, H4A, IFAH etc) and massively increases opportunities to collaborate with colleagues/ research organisations in the EU. This allows institute researchers to be part of discussions and to influence the opinion and direction of the wider European scientific community.

4.3 Recent changes in global and EU climate may have helped important insect disease-vector species to colonise or increase their distribution in southern Europe, notably including the Adsian tiger mosquito *Aedes albopictus* (transits Dengue, Chikungunya, Eastern equine encephalitis viruses) and *Culicoides imicola* (transmits Bluetongue, African horse sickness, Equine encephalosis, Equine haemorrhagic disease viruses). Since work is carried out on many of these viruses, and diseases and represent part of Europe, our advice and collaboration on research projects is of real value to the European community as a whole.

There is not a significant aspect of our EU membership that inhibits UK scientists from influencing public policy at EU or international levels.

20 November 2015

Political Studies Association (PSA) – Written evidence (EUM0012)

Introduction

1. The Political Studies Association (PSA) is the leading organisation in the UK linking academics in political science and current affairs, theorists and practitioners, policy-makers, journalists, researchers and students in higher education.

2. Membership of the PSA is open to anyone interested in the study of politics. It spans academics in political science and current affairs, theorists and practitioners, policy-makers, journalists, researchers, politics teachers and students in Higher Education. Membership has grown steadily and now stands at over 1,900, making it the second largest such national association in the world.

3. As a charitable organisation that exists to promote the development of political studies and to encourage education and the advancement of learning in the art and science of government and in other branches of the political sciences we fully support any initiative that serves to improve standards of teaching.

4. This submission addresses questions 1, 3, and 4 of the inquiry.

What is the scale of the financial contribution from the EU to UK science and research, and vice versa?

5. UK universities receive significant and critically important funding streams from a number of EU sources. The main source of funding is Horizon 2020, which will disburse almost 80 billion euros over seven years (2014-2020). The UK did disproportionately well out of Horizon 2020's predecessor, Framework Programme 7, receiving 15.2% of all funding, amounting to 5.2 billion euros.

6. This represents a sizeable proportion of research funding in the UK. In 2013/14 the UK received £687m of research income from the UK. In the same year RCUK invested just under £3bn in research. Cambridge University alone received £68m in a year from Horizon 2020 – some 17% of its entire research income. This is particularly important at a time when national investment in science and research is static and our leading competitors are overtaking the UK by a significant margin in the proportion of GDP they spend on science and research.

7. EU funding for research continues to grow, despite an overall cut to the Commission's budget. Horizon 2020 is almost 30% bugger than previous programmes of a similar nature.

8. It is also important to note that Horizon 2020 pays for 25% of the cost of administration, which is significantly higher than from some other research funders.

What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

9. The EU plays a vital role in supporting universities to collaborate across borders. By bringing together 28 states under a single framework for collaboration it substantially reduces the bureaucracy generally associated with collaborating with institutions across borders, thus saving British institutions time and money.

11. The EU also encourages the establishment of networks of excellence and by pooling resources, expertise, data and infrastructure across borders it is able to generate a higher return on investment in research. It also enables British institutions to achieve a level of scale in their research, particularly with regard to research infrastructure, that allows them to compete with institutions in the United States.

12. Over half the UK's academic outputs are now in collaboration with other countries. This compares to just 33% for the US and this can in no small part be attributed to the spur to international collaboration coming from the EU.

13. Furthermore Horizon 2020 encourages research that takes up the "great challenges" of Europe's future, such as ageing populations and climate change, ensuring that the research is of strategic value.

14. Some universities are particularly successful at securing EU funding. This now accounts for a very high proportion of their research funding and plays a major role in keeping these institutions at top of international league tables and thus competing effectively against top US institutions – creating virtuous circle of funding and people.

What contribution does EU membership make to the quality of UK science and research through the free movement of people?

14. Membership of the EU makes it easier for universities in the UK to attract the best academics and avoid the cost in time and money of applying for work permits to bring over talented individuals. It also makes it easier to attract students, who make a significant financial contribution to both their institutions, in terms of fees, but also to the local communities in which they reside. The highly international nature of the UK's universities helps attract further talent from overseas creating a virtuous circle that further increases the UK's soft power.

15. Not only does EU membership help attract talent but through the Erasmus exchange programme it allows students and staff to spend time overseas, broadening their horizons and enhancing their language skills, thus improving their employability.

17th November, 2015

Research Councils UK (RCUK) – Written evidence (EUM0016)

1. Research Councils UK (RCUK) is the strategic partnership of the UK's seven Research Councils. Our collective ambition is to ensure the UK remains the best place in the world to do research, innovate and grow business. The Research Councils are central to delivering research and innovation for economic growth and societal impact. Together, we invest £3 billion in research each year, covering all disciplines and sectors, to meet tomorrow's challenges today. Our investments create new knowledge through: funding research excellence; responding to society's challenges; developing skills, leadership and infrastructure; and leading the UK's research direction. We drive innovation through: creating environments and brokering partnerships; co-delivering research and innovation with over 2,500 businesses, 1,000 of which are SMEs; and providing intelligence for policy making. Find out more about our work 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)
   - Biotechnology and Biological Sciences Research Council (BBSRC)
   - Engineering and Physical Sciences Research Council (EPSRC)
   - Economic and Social Research Council (ESRC)
   - Medical Research Council (MRC)
   - Natural Environment Research Council (NERC)
   - Science and Technology Facilities Council (STFC)

3. RCUK's key messages are summarised below:
   a) Being part of the EU allows us to shape the agenda from the inside, influencing the direction of travel and facilitating alignment with UK priorities.
   b) The opportunities offered by our membership of the EU are complementary: they support and strengthen the UK research base and facilitate access to new ideas, money and relationships.
   c) The EU enables research to be conducted at scales too large for individual Member States and support global projects such as the Square Kilometre Array (SKA) and the Human Frontier Science Programme (HFSP).
   d) Collaborative research is helped by harmonised legislation across borders and we need to be in the EU to influence and shape that legislation.
   e) Our membership of the EU enables the movement of people and a flow of talented researchers and skilled professionals, both through legislation and unique programmes such as the Marie Sklodowska Curie Actions.
   f) The EU gives greater access for UK industry to develop partnerships both inside and outside the UK, strengthening innovation and trade.
   g) Participation at a Member State (MS) level opens up new avenues for collaboration on global challenges (including the UK network of commonwealth countries).

What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

4. Our expectation is that government will respond to this question. We would however like to highlight that the UK is an exceptionally strong participant in EU funding programmes for research and innovation. Over the course of FP7 the EU financial contribution to the UK was just under €6bn.[397] In terms of participations the top four HEIs were UK based, as were 14 of the top 50 HEIs overall.[398]

What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

5. An accurate response to this question will be challenging to produce, given the complexities of the EU budget. RCUK would find this information of interest and look forward to reading the responses received by the Committee.

What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

6. Our response to this question focuses on EU management of EU programmes; as one of the main public funders of research and innovation in the UK we do not think it is appropriate in this context to compare our own efficiency and effectiveness with that of other funding bodies.

7. Overall, management of EU funds is effective and the Commission has an ongoing simplification agenda which we welcome. The new funding model for Horizon 2020 (100% direct, 25% flat rate for indirect costs) has been overall perceived as a simplification. Another major simplification is the new Commission Participant Portal, the online portal for electronic administration of all Horizon 2020 applications and grants.[399] RCUK has responded to the Commission simplification survey and will feed into the Horizon 2020 mid-term review.

8. In terms of decision-making, the UK via the Research Councils is represented on and participates actively in the work of the majority of Horizon 2020 Programme Committees including the Strategic Configuration. The Strategic Programming approach has made good progress in aligning the work programmes, with more work to follow in making the overall process of drafting work programmes more transparent. Strategic programming and planning over two year periods allows for longer term planning for funding applications, and stakeholders can feed into the development of the work programmes. Although the opportunities to feed in varies

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[397] https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf#view=fit&pagemode=none p.100

[398] *Ibid,* p.96

[399] http://ec.europa.eu/research/participants/portal/desktop/en/home.html

from area to area, initial feedback on this has been positive overall. Our participation also supports UK policy in realising the ERA (as a policy objective under the Lisbon Treaty), which is the driver for JPIs and ERA-NETs: reducing fragmentation and duplication of public effort, sharing/leveraging finances and other resources, and sharing the risk.

9. On a more practical level there are certain EU funded actions which are not replicated nationally and which support RCUK engagement in multi-country activities. For example, under FP7, Co-ordination and Support Actions (CSAs)[400] provided funding for the (often labour intensive) scoping, process design and groundwork needed to run international activities. In Horizon 2020 the flexibility offered through the ERA-NET Cofund[401] mechanism allows more research to be funded, as well as giving opportunities for a more inclusive approach with support for wider networking that would otherwise be hard to resource for ERA-NETs/Joint Programming Initiatives (JPIs) in the longer term. ERA-NETs aim to strengthen the co-ordination of national and regional research programmes by providing a framework to develop joint activities and support joint calls for transnational proposals. With an overarching objective of using national resource to realise the ERA, MS and Associated Countries participating in a JPI develop Strategic Research Agendas which aim to align priorities and coordinate national research activities.

What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

10. The European Framework Programmes for research and innovation play a vital role in supporting research and collaboration across Europe, benefitting the UK both as a direct recipient of funding and more broadly as part of the ERA.

11. EU research and innovation funding is important for the UK: this funding source widens the opportunities for UK researchers to engage in globally competitive collaborative research, strengthens links and builds partnerships. The UK's excellent research base is well recognised for its quality and, as a result, is highly competitive at the EU level and is particularly successful in receiving funding from the Framework Programmes. In Horizon 2020 UK institutions are still leading the result tables alongside Germany. Opportunities for UK-based researchers from the Framework Programmes complement UK research funding and ensure that the UK continues to be globally competitive as a world-class partner of choice.

12. We choose to engage in European initiatives when it represents a good opportunity for the UK and direct alignment to RCUK strategic priorities. Engagement to date has generally been positive and successful, and for the most part we consider the opportunities offered through EU engagement as complementary to those available at a national level.

13. When considering the positive impact of EU action on research and innovation, it is worth noting that Associated Countries with active research bases, for example

[400] https://ec.europa.eu/research/fp7/understanding/fp7inbrief/funding-schemes_en.html
[401] http://netwatch.jrc.ec.europa.eu/web/lp/learning-platform/p2p-in-h2020/background-information

Norway, Israel and Switzerland, pay to participate in EU framework programmes for research and innovation, demonstrating the real value that they see arising from EU collaboration in research. However, Associated Countries have less ability to shape Framework Programmes as MS, despite their financial contributions. It is also important to note that a significant proportion of UK engagement and collaboration with international partners takes place outside EU programmes. While there are many collaborations across the EU which take place outside the Framework Programme, the provision of a common framework for research collaboration which the EU offers can be immensely beneficial, especially in new areas so that every collaboration does not have to be a new legal arrangement.

14. The Research Councils are also members of Science Europe,[402] which promotes the collective interests of the Research Funding and Research Performing Organisations of Europe and supports its Member Organisations (MOs) in their efforts to foster European research. MO Working Groups on key policy areas such as peer review, text and data mining, open data, gender and diversity, and research integrity have enabled RCUK to engage pro-actively with key policy developments as they emerge and share best practice with partner organisations across Europe. Science Europe works to strengthen the ERA through its direct engagement with key partners, such as the European Commission, informed by direct representation of all scientific communities in its reflections on policies, priorities and strategies. RCUK welcomes the ability to engage at a collective European level with the European institutions, for example via Science Europe's participation in the ERA Stakeholder Platform.[403]

15. Having access to additional funding streams that sit alongside national support is especially welcome for facilitating collaborative research activities with teams drawn from across Europe. We also believe that it is vital for activities at EU level to focus on areas of high 'European added value': building upon and enhancing actions taken by individual MS. This is often the case for research in areas which require a large population base, for example research into rare diseases and large epidemiological studies, research requiring international validation, or when infrastructure is required of a scale or cost which could not be supported by any MS individually.

16. The Commission-developed concept of JPIs has had a significant impact on UK strategy and planning, as we are involved in all ten current JPIs. Many aspects of JPIs require a larger degree of implementation and funding than Member States can achieve collectively, therefore there is a valid role for the European Commission to incorporate some JPI areas within its plans, and assist MS in their delivery including with additional funding as appropriate. There are many other benefits of working together flexibly that enhance impact and efficiency, through co-planning and alignment, and that do not require identification or earmarking of funds outside of normal funding streams. The significance of such strategic co-design and alignment across MS should be recognised as a major contribution to joint programming.

[402] http://www.scienceeurope.org/
[403] http://www.scienceeurope.org/uploads/PublicDocumentsAndSpeeches/150623_ERA_Joint_Statement.pdf

17. The European Research Council (ERC) schemes, first introduced under FP7, encourage the brightest minds across the EU and beyond to compete with one another to carry out their research projects in the EU, with substantial funding. Funding competitive frontier research is a vital component in the knowledge cycle and contribution to the knowledge economy and competiveness of the EU. RCUK believes that supporting excellence is imperative to supporting innovation in the EU. The ERC is well managed, with a clear set of grants that appeal to outstanding researchers all over the EU and beyond. RCUK strongly supports its continuation in its current form. It should be noted that ERC funding comes under the Horizon 2020 ‘Excellence’ pillar and is not a separate funding stream; the ERC Executive Agency is the body which administers the funding.

18. The UK does spectacularly well from ERC funding. During FP7 ERC grant holders based at UK host institutions received around €1.7bn in funding, the highest amount of funding going to any one country across the whole programme (Germany was second with around €1.15bn). To put this in context, total funding for the ERC in FP7 was around €7.7bn, meaning that the UK has received around 22% of the total funding available. ERC funding also plays a part in supporting the UK’s ongoing ambition to attract outstanding researchers from outside the EU: out of 969 ERC grants currently in the UK, 114 of those are held by researchers from outside the ERA. UK participation in ERC funded grants, since its establishment in 2007, as at October 2015 is given in the table in Annex A.

19. The UK also does well out of the Marie Sklodowska Curie Actions (MSCA), which are implemented through the 'Excellence' Pillar of the Horizon 2020 Programme, and provide funding opportunities for mobility and training at all stages of a researcher's career. The UK is seen as an attractive host country for the scheme. The opportunities for mobility and training offered by the MSCA are a major strength of the EU Framework Programmes with far reaching positive impact in terms of not only training the next generation of researchers but global links between researchers. The MSCA have boosted mobility in researchers across the EU and world-wide, provided training and career support and have helped to improve employment conditions. In this respect, Framework Programmes to date have played a key role in supporting excellence and in building a skilled workforce required for innovation and growth in Europe. RCUK particularly welcomes the emphasis of the MSCA on funding individual fellowships and the Initial Training Networks (ITNs). Many of the policy initiatives surrounding MSCA (particularly those relating to researcher recruitment) have built on UK practices, demonstrating the UK’s positive impact on EU research policy through our position as a MS.

20. During FP7 the UK received over €1088m in Marie Curie funding, by far the highest amount of all countries benefiting from this funding stream (Germany is second with around €564m) The UK has hosted 3425 projects (Germany is second with 1541), attracting 8120 incoming fellows from outside the UK (Germany is second with 4605). This bottom-up funding, where researchers can apply for fellowships to go anywhere in the world, or come to the UK from anywhere, is highly successful in supporting valuable knowledge exchange and building international collaboration.

21. Horizon 2020 aims to fully integrate social sciences and humanities research into each of its priorities. A recent European Commission report assessed the extent to which the 2014 calls for proposals under the Societal Challenges and the Industrial Leadership priorities have delivered on the integration of SSH as a cross-cutting issue. This report identified the UK as the most successful country in providing SSH partners in projects funded across the 2014 work programme – with a 16% share, the UK also provides 13% of SSH coordinators (see also Annex C).[404]

What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

22. Firstly it should be noted that there are a significant number of 'non-EU' countries that have Associated Country status to Horizon 2020, with the same participation opportunities as EU MS. Where collaborations between RCUK and overseas partner organisations are established, this is largely due to mutual research priorities, maturity of the bi- or multi-lateral relationship, compatibility of funding systems, and to a certain extent resource (administrative) availability. The maturity of the UK's relationship with EU MS countries means that it is likely that we would have collaboration routes with or without the EU. However, the existence of the EU and its specifically multinational collaborative funding streams both provide opportunities to UK researchers that differ from the Research Councils' offer and also remove a potentially huge administrative burden in setting up a multitude of bi- and multilateral mechanisms to enable international partnerships.

23. Multilateral collaborations are as important as bilateral collaborations, as both offer the opportunity to build on strengths as well as develop new areas. In general the Research Councils concentrate less on bilateral activities with European partners because of the multilateral opportunities available through the EU. Our international activities aim to complement other funding routes available, where these align with RCUK strategic priorities. We see good levels of European collaboration in our academic community without needing to intervene directly ourselves in many cases. However where collaborative activities between the UK and European partner organisations do exist we do not consider that EU mechanisms act as an inhibitor outside EU programmes.

How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

24. The EU gives greater access for UK industry to develop partnerships both inside and outside the UK, strengthening innovation and trade. Extended and consolidated pan-European scientific networks underpin economic and other collaborations, to the advantage of UK research institutions and their business partners, thereby underpinning export growth within the Single Market. Inter-connectivity of UK scientific institutions and their European counterparts brings benefits to businesses

[404] http://ec.europa.eu/research/social-sciences/pdf/other_pubs/integration_ssh_h2020.pdf

operating across several member states or exporting to EU28 markets. Industrial partners with a significant UK base have retained this through the easy access to European partners via the collaborative networks built and maintained via EU research projects and programmes. Broader access to larger international networks where there are global fora which set policy and agreements, particularly where the EU is the negotiator, can be extremely beneficial in terms of addressing issues that require global collaboration and have the potential to leverage greater funding and focus. From engagement with many of the priority UK industry sectors identified by the last government RCUK is aware that companies engage with and benefit from EU opportunities, for example Jaguar Land Rover and Ricardo in the automotive sector.

25. There have been clear strategies for engaging the private sector in EU research funding programmes through favourable reimbursement regimes and the establishment of specific calls focusing on SMEs. The Joint Technology Initiatives and the Public Private Partnerships established under the Commission's recovery package in 2008 were specifically designed for this purpose, giving the private sector the main voice in directing the focus of the calls.

How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

26. EU membership, and the programmes supported through Horizon 2020 and previous Frameworks, is an enormous benefit to collaboration on research infrastructures (RIs) in Europe. The provision of networking funding has ensured that the benefits from national investments in research infrastructure are maximised through stimulating joint working with their counterparts across Europe. Integrating Activities with transnational access to facilities also ensure that UK researchers have access to the best facilities elsewhere in Europe and that European researchers have access to UK facilities which would not be possible under any existing national arrangements.

27. The planning of new multinational facilities has been stimulated by the formation of ESFRI (European Strategy Forum on Research Infrastructures). While ESFRI projects are supported directly by MS the EU has provided funding to enable and facilitate collaborations to form for the selected projects and create strong single proposals for consideration by national governments. This includes Research Infrastructures from across research areas including health and food, computer, physical and engineering, energy, social and cultural, and environment. Projects like the Square Kilometre Array (SKA), the world's largest radio telescope, have benefited from EU support which has enabled the UK and its European partners to play a strong role in this global project. UK engagement in projects such as the European Spallation neutron source (ESS) and the X-ray Free Electron Laser (XFEL) has also benefitted from their inclusion in the ESFRI roadmap and the EU funding provided to help initiate these projects. However, EU cooperation in no way prevents other RI global cooperation where the research calls for different partnerships with, for example, Japan or the USA, in addition to the links with Australia and South Africa developed by the European consortium for the SKA.

28. Many environmental RIs are highly distributed taking advantage of distinct national expertise, facilities and environments: the sum is greater than the value of the individual components. For example the European Plate Observing System (EPOS) integrates the European solid Earth science community from over 20 countries, both geographically and across Earth science disciplines to create a genuine pan-European RI.

29. An example of cooperation outside the EU is the core particle physics programme at CERN, funded directly by national governments, with a global reputation for excellence. CERN then engages in a broad portfolio of EU-funded programmes for research and e-infrastructures, for example through providing key inputs into coordinating the EU-funded computing grid initiative alongside its USA and other regional counterparts, to build a global computing infrastructure. EU funding has contributed to the development of the high luminosity upgrades for the Large Hadron Collider (LHC) and the development of advanced detector technologies.

30. The UK received €273 million from the Research Infrastructure programme (part of the Capacities programme) in FP7, 18% of the total awarded. UK institutions were members of 78% of the 341 projects funded during FP7 and coordinator of 41 of these projects. The UK was behind Germany, France and Italy in numbers coordinated, but the amounts awarded were on average larger (€6.5M) than the other countries. In the Horizon 2020 RI Programme UK institutions are in 69 of the 79 projects funded so far, 11 as coordinator.

31. Examples of UK participation in RIs include:
    a) MRC Harwell in Oxfordshire hosts an EU-funded resource that reduces the number of animals bred for research purposes. The European Mouse Mutant Archive (EMMA) is supported by EU funding through the FP7 Capacities Specific Programme. The unit stores frozen mouse eggs, sperm and embryos and sends them to other laboratories when needed, removing the need for other laboratories to breed animals unnecessarily to maintain a colony.
    b) The UK has benefited from the creation of the ERIC (European Research Infrastructure Consortium) regulation through which the European Social Survey (ESS) has been established at City University, making it the first UK hosted ERIC. The ESS is an academically-driven cross-nationally comparative survey that has been conducted every two years across Europe since 2001. The survey measures attitudes, beliefs and behaviour patterns of diverse populations in over 30 nations, with the data made available free of charge through the ESS website, an important resource for researchers.[405] A further ten projects in which the UK is engaging are using or applying for ERIC status. These include the European Spallation Source in Sweden, the INSTRUCT Structural Biology consortium managed by the University of Oxford, and the European Multidisciplinary Seafloor and Water Column Observatory (EMSO). The UK Government has recently announced measures, including the creation of independent expert advice hubs, to help support the

[405] www.europeansocialsurvey.org/data/

creation of Smart Specialisation Strategies; this is aimed at helping boost UK access to EU Structural and Investment Funds.

c) The UK has also benefited substantially from the e-Infrastructure initiatives of the EU. The grant for GEANT, the computer networking backbone for Europe, is held by a managing centre based in the UK and works closely with our national network JANET operated by Jisc. UK has been a key partner in initiatives such as EGI and EUDAT which have ensured the development of universal computing services and data management coordination for all research disciplines across Europe, driving standards in line with UK requirements. EU support for the Research Data Alliance (RDA) and major projects such as SKA and ELIXIR for biological data, funded from the RI programme, has strengthened the UK lead in data management in Europe and beyond. Open Science is being supported at a European-level by the OpenAIRE initiative, to promote the discoverability and reusability of research publications and data.

d) The UK's international engagement for fusion energy, for example the International Thermonuclear Experimental Reactor (ITER), is also managed through Europe. UK industry has benefited from the advancement of ITER construction since 2010 with nearly €400m of ITER contracts won so far, an above-average share when compared to other EU countries. Culham Centre for Fusion Energy (CCFE) hosts the Joint European Torus (JET), which is the focal point of the European fusion research programme. The UK leverages ~£50m p.a. from the EU for the operation of JET.

e) The UK is able to make strong use of the Earth Observation (EO) satellite technology developed and operated through the European Space Agency (ESA). While European Union (EU) and ESA are separate organisations, they are increasingly working together towards common objectives and linkages have been reinforced by the increasing role that space plays in supporting Europe's social, political and economic policies. In EO the main EU/ESA collaboration is the Copernicus programme providing long term data for environmental policy and development of commercial services. The data sets derived from the Copernicus programme are also of high relevance to the UK environmental research community, particularly those concerned with understanding environmental change. Some ESA programmes are primarily geared towards the research community for example the Earth Explorer missions including Cryosat 2, and the BIOMASS mission due for launch in 2020. In these programmes, the relationship between Research Councils (e.g. STFC and NERC) and the UKSA is via a 'Dual Key' mechanism. The UKSA is responsible for space-based infrastructure and the strategic development of EO instruments. NERC is responsible for environmental research using EO data, and the services and facilities underpinning this work, such as data portals and processing facilities for example the NERC Earth Observation Data Acquisition and Analysis Service (NEODAAS) and the Centre for Environmental Data Analysis (CEDA), hosted by STFC. Within the EO sector there is no perception that EU membership restricts the operation of facilities.

What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

32. Our membership of the EU enables the movement of people and a flow of talented researchers, enhancing skills and experience to improve UK research. The free movement of researchers aligns well with UK ambitions for research, as set out in the government's long term strategy to make the UK the best place in the world for science and business.[406] It also assists in addressing key skill shortage areas such as IT. UK success in a European context allows for benchmarking and strengthens the research base and overall attractiveness of the UK to students, researchers and businesses; there are a number of schemes and funding strands provided from EU membership that enable the UK to engage with international researchers. Annex B figure 2 gives an example of MSCA funded fellows, grouped by nationality, who undertake their research in the UK.

33. The free movement of persons competence enables the Research Councils to engage with EEA nationals in line with UK immigration rules. When recruiting for roles across the Research Councils there is a competitive recruitment process based on suitability for the role and the individual's ability to evidence their right to work in the UK; with regards to PhD level roles there is a deliberate attempt to recruit the brightest and the best, irrespective of nationality, in line with current UK immigration rules. As a result, the Research Councils adhere to the UK immigration rules and undertake advertisements and recruitment in line with current UK immigration requirements.

34. Across the Research Councils, nationals from other MS make up over 11% of the current work force; approximately 90% of these individuals are involved in or support research. At present, the Research Councils employ approximately 5.28% of their work force from outside of the EEA. Of these individuals, 139 are currently sponsored via Tier 2, as either researchers or in research support roles, with the vast majority of the remaining individuals continuing in employment after receiving indefinite leave to remain in the UK. Based on the number of individuals (3165) either employed or engaged with over the past year, the Research Councils have engaged more with individuals from within the EU (15.04%) than with individuals from non-EEA countries (9.07%).

35. In general, the ability for the UK to be able to attract the best international talent from across the MS is enhanced through the free movement of people, and in comparison to the administrative processes involved in sponsoring or engaging with individuals from non-EEA countries, provides a coherent and simple method for engaging with researchers from the MS. While there are a wide variety of immigration routes available to the research sector that enable engagement with non-EEA nationals, these options are more administratively demanding, costly to both the employer and employee and there is an increased uncertainty of when, or if, these individuals will successfully receive their visa. Based on the questions raised in a number of recent Migration Advisory Committee (MAC) consultations, as well as the increased competition for the limited numbers of Restricted Certificates of Sponsorship (CoS)

[406] https://www.gov.uk/government/publications/our-plan-for-growth-science-and-innovation

available on a monthly basis, there is a risk that recent and future immigration rule changes will negatively impact on the ability to attract and retain these talented individuals from outside of the EU. Recent changes to the attributes taken into consideration for the issue of these CoS have benefitted PhD level roles. However they have also made it more difficult to recruit research support personnel with skills which the resident labour force cannot always supply.

36. The free movement of researchers also enables the Research Councils to continue to support a number of talented researchers and scientists involved in international collaboration across other EU MS. The ability granted by the free movement of persons to work on and influence these collaborations is of great benefit to the UK, the researchers and future collaborations; some brief examples of these collaborations are:
    a) The European Molecular Biology Laboratory is at the forefront of innovation in the life sciences. It is established in four European countries (including in Cambridge, UK) and free movement allows researchers to access their state of the art facilities;
    b) With the Isaac Newton Group of Telescopes within the Canary Islands undertaking world-class astronomical research;
    c) The European Synchrotron Radiation Facility (ESRF) where UK scientists currently receive approximately 11% of the available beamtime.

Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

37. On the contrary: to receive certain EU funding, research infrastructures must apply an 'Open Access' policy, part of which is to be open to all interested researchers based on open competition; any restriction of the free movement of persons would put this funding at risk. The ability to engage with the most talented researchers has enhanced research projects and collaborations throughout the UK, and has led to the development of various research infrastructures within the UK and across Europe.

38. The EU immigration rules for third country nationals do not apply to the UK; the only impact on immigration from an EU perspective is in the free movement of EU nationals, and the adapted immigration rules for EU dependants; in all respects the UK is responsible for its own immigration rules for migrants from countries outside of the EU. The fact that the UK has access to EU funding and infrastructure, along with the potential to develop successful research outcomes into wider business opportunities both within the UK and across the EU, helps to enhance the attractiveness for international collaboration. If anything, as seen in the recent BIS report on the international comparative performance of the UK Research Base[407], it is the uncertainty and increased administrative requirements involved in the UK visa application and decision process, further exacerbated by the widely viewed perception

[407] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf

among the international research community that the UK is closed for business, that acts as an inhibitor to collaborative work with the wider international research sector.

39. Beyond immigration policy, EU membership offers opportunities for the UK to bring other countries into EU networks, e.g. USA and New Zealand into ERA-NETs, and global approaches in JPIs, further enhancing UK as a partner of choice through being a gateway to Europe.

What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

40. EU legislation and policy can have far-reaching consequences and participating fully in its development affords the UK the opportunity to influence relevant legislation for the better, helping to harmonise regulation and improve the research environment across the EU. Where legislation is developed which does not principally concern research, it is vital that potential implications and unintended impacts for research and innovation are fully considered to ensure that European research and innovation, and in turn European competitiveness, is supported effectively and is not stifled.

41. The Research Councils are active in working to ensure that such potential implications are identified and addressed during the development of legislation and policy. We often work with partners in the UK and across Europe throughout the different stages of the legislative process as policies are designed, developed and amended and also once legislation has been adopted to ensure appropriate guidance is in place to enable successful consistent implementation across MS.[408]

42. One area which demonstrates where this approach has been particularly effective is the development and implementation of the 2010/63/EU Animals Directive where the UK was able to help shape the legislation to raise standards in animal welfare across Europe. Over the development of the Directive the application of the 3Rs (reduction, refinement and replacement of animals in research) was prioritised whilst ensuring that essential animal research was not unnecessarily hindered by excessive broadening of the scope or by bureaucracy that did not directly promote animal welfare.

43. A current area of activity, and serious concern, is the development of the EU Data Protection Regulation which has reached trilogue. The Regulation has significant implications for research and the Research Councils have been working closely with a growing alliance of academic, non-commercial research organisations and patient groups in the UK and across Europe to ensure that Regulation provides an effective framework for the use of personal data in scientific research. Our concerns around the position taken by the European Parliament ahead of trilogue, and which have the potential to be highly damaging and severely restrict the use of personal data for scientific research, are outlined in a position statement endorsed by over 100 organisations across Europe, coordinated in the UK by the Wellcome Trust. With formal agreement expected in 2016, followed by a further two years to implement the

[408] http://www.datasaveslives.eu/media/1169/joint-statement-on-the-european-data-protection-regulation-june-2015.pdf

Regulation, this provides a good illustration of the need for sustained involvement over the whole of the legislative process.:

44. Another area of interest is researcher careers and how legislation can affect these. The rights and responsibilities of researchers are addressed in the 2005 European Charter for Researchers and Code of Conduct for the Recruitment of Researchers - a soft law mechanism under the Open Method of Co-ordination. A UK-level gap analysis in 2006 demonstrated that this posed no problems for the UK and the 2008 Concordat to Support the Career Development of Researchers[409] effectively transposes the Charter and Code principles into the UK context. Since 2010 UK HE Institutions have participated in the European Commission's HR Excellence in Research Award which acknowledges alignment with the principles of the European Charter and Code. This award is used in the UK to also demonstrate alignment with the UK Concordat and at September 2015 over 90 of the 240 award holders were UK institutions.

If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

45. Collaborative research is helped by harmonised legislation across borders; lack of harmonisation would create barriers which would hinder research and innovation.

How is the innovation landscape affected by EU membership?

46. As stated previously we see EU programmes as complementary to the UK research and innovation landscape. The current debate around the proposed European Innovation Council (EIC) will be interesting and RCUK is engaging with the Commission as the concept is developed. We would welcome an EIC that supports all actors involved in innovation which truly: promotes the collaboration between researchers, businesses and innovators; supports all forms of innovation, including social innovation; and helps to stimulate and facilitate the collaboration between universities, research institutions and businesses.

How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

47. RCUK welcomed the appointment of the Chief Scientific Advisor, Professor Anne Glover, under the previous Commission administration. We also welcome the new Science Advice Mechanism (SAM) and put forward nominations to the Commission for potential members. However, we consider it important that the SAM has a clear remit which distinguishes between ‘science advice for policy’ and ‘advice for science policy’, as there are already mechanisms in place to consult with the academic community on the development of research policy.

To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

[409] www.vitae.ac.uk/concordat

48. There are a range of opportunities available to UK researchers which allow them to inform and influence public policy at EU or international levels, which may not exist if the UK did not have EU membership. The UK Research Office (UKRO)[410] publicises and promotes opportunities for UK researchers to apply to serve on committees, advisory boards, and similar structures which provide advice on policy development. Seconded National Experts from government departments and their agencies can provide a UK perspective in the European policy making process, as well as gaining an understanding of other member states approaches to policy making. We are not aware of any evidence suggesting that EU membership inhibits UK researchers from influencing public policy.

49. Less tangibly, but of equal relevance, funding for transnational research as provided by the EU does allow a comparative approach. The fact that UK researchers are so successful in gaining EU funds and are part of these transnational projects should mean they have better visibility and potential to influence policy. In the area of Social Sciences and Humanities this funding enables a Europe-wide perspective and a greater understanding of why things are different across Europe locally, regionally and/or nationally giving greater European policy potential.

19 November 2015

Annex A: European Research Council participations as at October 2015

- These participation figures are the number of Principal Investigators (PIs) based in each country.
- The information stretches across both FP7 and Horizon 2020 and is taken from the ERC website (http://erc.europa.eu/projects-and-results/statistics).
- The UK consistently outperforms other Member States, with the most awards in each grant scheme, demonstrating the vibrancy and excellence of our research base.

Year	UK PIs	Germany PIs	France PIs
Starting Grant	571	393	365
Consolidator Grant	148	110	93
Advanced Grant	447	274	236
Proof of Concept[411]	53	25	25
Synergy[412]	6	6	1
TOTAL	**1225**	**808**	**720**

[410] https://www.ukro.ac.uk/aboutukro/
[411] Note that Germany and France are joint fifth for Proof of Concept grants; Netherlands based PIs have received 46, Ireland 31 and Spain 27.
[412] Note that France is joint fourth for Synergy grants, the Netherlands holds 5, and Spain 3. Only 8 countries host PIs who have been awarded Synergy grants.

Annex B: Marie Sklodowska Curie Actions

The UK received the most funding from MCA in FP7 2007-13.

Figure 1. Funding by country (top 10)

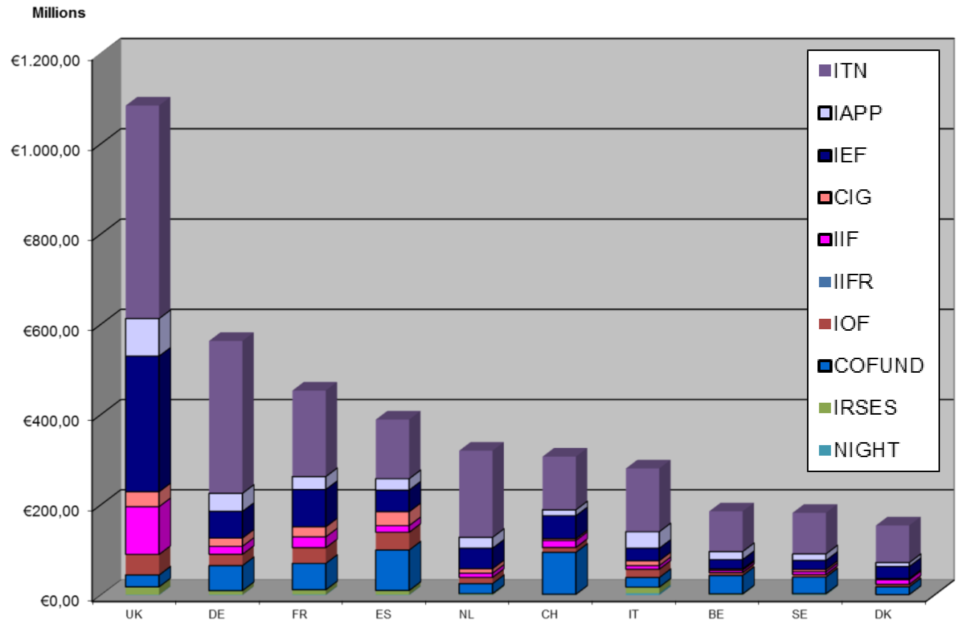


Figure 2: MCA Fellows (under FP7) coming to the UK grouped by nationality

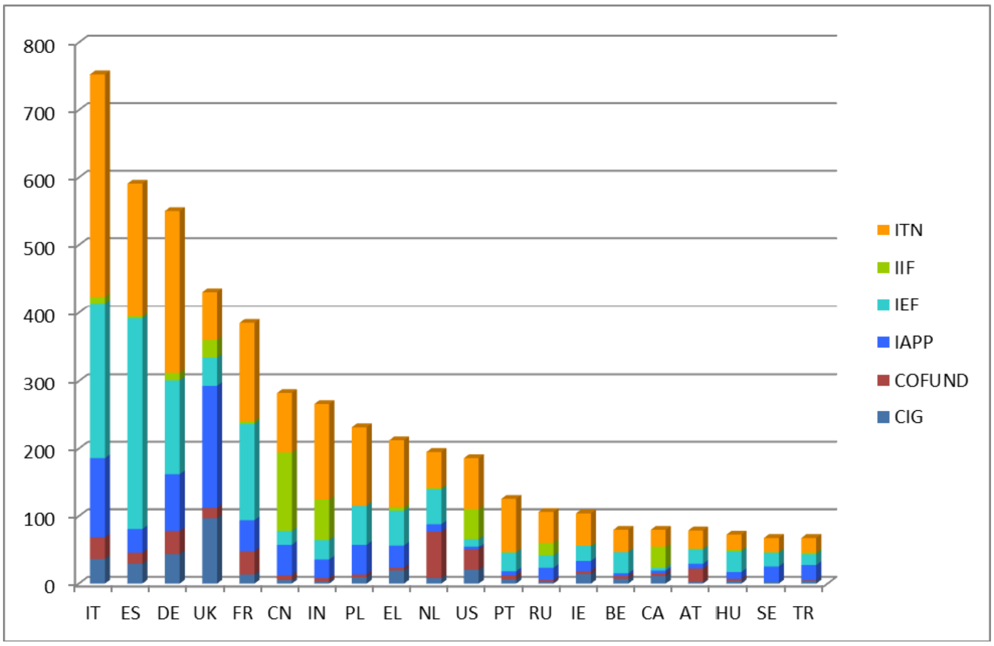


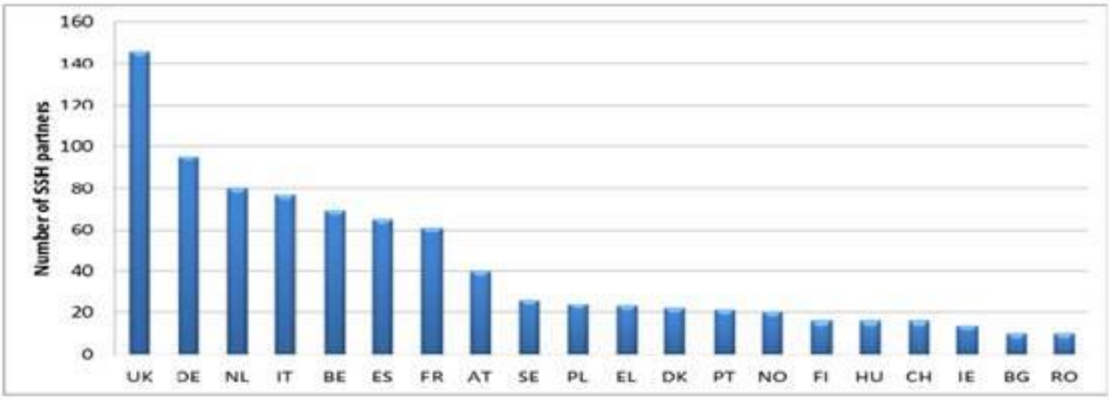
Figure extracted from FP7- People Marie Curie Actions fact sheet[413]

413 http://ec.europa.eu/research/mariecurieactions/funded-projects/statistics/index_en.htm, UK based fact sheet

Annex C: Social Sciences and Humanities participations in FP7 by country

The 20 most represented countries listed below account for 92% of all SSH partners.

Country affiliation of SSH partners - top 20 countries																				
Country	UK	DE	NL	IT	BE	ES	FR	AT	SE	PL	EL	DK	PT	NO	FI	HU	CH	IE	BG	RO
Partners	146	95	80	77	69	65	61	40	26	24	23	22	21	20	16	16	16	14	10	10
Share	16%	10%	9%	8%	7%	7%	7%	4%	3%	3%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%



Royal Academy of Engineering (RAEng) – Written evidence (EUM0066)

About the Royal Academy of Engineering
As the UK's national academy for engineering, we bring together the most successful and talented engineers for a shared purpose: to advance and promote excellence in engineering.

Introduction

1. The Royal Academy of Engineering welcomes the opportunity to submit evidence to the House of Lords Select Committee on Science and Technology inquiry on the relationship between EU membership and the effectiveness of science, research and innovation in the UK. This response builds upon the 2013 UK national academies' joint submission to the Department for Business, Innovation and Skills' call for evidence on research and development as part of the Coalition Government's Review of the Balance of Competences between the United Kingdom and the EU.[414]

2. The European Union offers significant funding to the UK research and innovation community, which facilitates, and is complemented by opportunities for international collaboration, interdisciplinary and multidisciplinary research and access to world-class facilities. The EU offers businesses the opportunity to collaborate, scale-up, contribute to standard setting and access the single market. The UK has a globally excellent and highly productive research base, to which EU support for research and innovation, both financial and non-financial, has contributed.

Funding

3. The UK has a strong track record in securing EU research funding as outlined in the most recent and final monitoring report of the European Framework Programme (FP7), which ran from 2007 to 2013.[415] The UK held 14.9% of all FP7 grants (17,561 grant holders) which equated to 17.2% of the total financial grant contributions, at a value of €6,940 million. The UK was second only to Germany both in terms of number of grant participants and budget share, with Germany having 15.4% of grant holders and 17.7% of the budget. UK Higher education institutions (HEIs) are particularly successful in winning EU funding, with UK universities holding the top 4 positions for institutions with the greatest number of signed grants and 70.7% of the UK's total FP7 funding being awarded to higher and secondary education institutes. EU research funding is of particular importance to engineering research conducted in UK HEIs, where the amount of EU research funding received has increased by 50% in value from 2007/08 to 2013/14.[416] We would direct the Committee's attention to a forthcoming report from the Royal

[414] Joint National Academies submission to the Department for Business, Innovation and Skills' call for evidence on research and development as part of the Coalition Government's Review of the Balance of Competences between the United Kingdom and the EU, August 2013
[415] European Commission, Seventh FP7 Monitoring Report 2013, March 2015.
[416] Campaign for Science and Engineering (CaSE) and the Engineering Professors' Council (EPC) submission to the House of Lords Science and Technology Select Committee Inquiry on the Relationship between EU membership and the Effectiveness of the Science, Research and Innovation in the UK, 2015.

Society for further analysis of the contribution of EU research and innovation funding to the UK.

4. In 2014, Horizon 2020, the EU's current research and innovation programme was launched. Horizon 2020 has a budget of nearly €80bn available over the 7 years from 2014 to 2020, but has a more strategic, challenge-based approach than FP7. Horizon 2020 has a role in implementing the Innovation Union, a Europe2020 flagship initiative aimed at securing Europe's global competitiveness. The majority of Horizon 2020 funding requires collaboration between three or more partners, which can include businesses. In addition, Horizon 2020 has allocated €3bn for an instrument to support innovation in SMEs.

5. Horizon 2020 also includes the budget of circa €13bn for the European Research Council (ERC), the European mechanism to support investigator driven or 'bottom-up' frontier research. The premise of the ERC, as for the UK Research Councils, is to fund excellent research, although proposals that cross disciplinary boundaries are encouraged. The UK does exceptionally well from ERC funding, with 17% of ERC funded Principal Investigators during FP7 and 4 out of the top 10 host institutions, more than any other country.[417] The UK is also consistently the most successful country across every domain (life sciences, physical sciences and engineering, and the social sciences and humanities), for each of the ERC's Starting Grants, Consolidator Grants and Advanced Grants. UK-based academics working within the physical sciences and engineering domain win 19%, 22% and 23.4% of the Starting, Consolidator and Advanced Grants respectively, substantially more than those won by other participant countries.[418] The UK also received the largest number of ERC Proof-of-Concept grants at 17.8%.[419]

6. The ERC, as for the UK Research Councils, uses peer-review to assess grant applications. The Academy continues to support the peer review process, regarding it as a trusted and reliable way of ensuring that quality prevails in funding decisions. Nevertheless, as for the UK Research Councils, there is room for improvement.[420] Increased transparency would be welcomed, particularly to allay concerns of politically and geographically motivated decision making.

7. In comparison to UK universities the picture is more mixed for UK businesses. UK businesses received 18.12% of the UK's total FP7 funding, with Latvia as the only member state whose proportion of total FP7 funding for businesses was lower at 11.97%.[421] Nevertheless this equates with the UK being the third most successful country, behind France and Germany, when assessed by the financial contribution to businesses and by number of business participants in FP7. The UK's participation by businesses was comparable to France with 4544 and 4547 business participants

[417] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[418] European Research Council website statistics page: https://erc.europa.eu/projects-and-results/statistics accessed on 9 November 2015
[419] European Research Council website statistics page: https://erc.europa.eu/projects-and-results/statistics accessed on 9 November 2015
[420] Royal Academy of Engineering's submission to the Nurse Review of Research Councils, April 2015
[421] European Commission, Seventh FP7 Monitoring Report 2013, March 2015

respectively, but was considerably less than Germany at 6241.[422] In terms of financial contribution, both France and Germany, with €1416 million and €1912 million respectively, received significantly more than the UK at €1257 million.[423] Interestingly, SMEs accounted for 13.7% of the UK's total FP7 budget share, which is greater than France at 11.94% and similar to Germany at 13.54%.[424] Therefore it appears that it is big businesses that are particularly underrepresented in the UK's EU funded research and innovation portfolio, accounting for just 4.95% of the UK's FP7 budget, compared to 16.20% and 13.76% for France and Germany respectively.

8. The UK also had the lowest success rate of business applicants, at 24.81%, compared to France at 28.14% and Germany at 27.30%, with the UK ranking 7th out of all 28 member states.[425] A relatively low success rate aligns with the feedback received from the engineering community, who feel that UK businesses are not adequately supported when they apply for EU research and innovation funding. Previously the UK's Regional Development Agencies (RDAs) provided support and guidance to businesses interested in applying for EU research and innovation funding. There are concerns that following the disbanding of the RDAs in 2012, the same high quality of guidance and support is no longer available, or as easily accessible, which hampers efforts to increase the participation of UK businesses. There is a sense that Innovate UK and the UK Research Councils could take a more coordinating and strategic role to support UK businesses to access and navigate the EU research and innovation funding landscape. Furthermore, the Academy is aware of efforts to simplify and strengthen local innovation support for UK businesses, but it is too early for any assessment of its effectiveness.

9. There are concerns among some in the engineering community that the application procedures and consequent administering and monitoring of EU research funding is particularly burdensome. The application procedure can be eased by dedicated staff, both in HEIs and businesses, who are familiar with the EU research funding landscape and are able to provide advice and support. However, given that the majority of Horizon 2020 calls require applications from consortia and are likely to involve international collaboration, a certain level of complexity in the application and administration of funds is understandable. Nevertheless, with Horizon 2020's focus on supporting innovative SMEs it is important that those schemes have satisfactory levels of visibility and low administrative burdens, as it is well reported that SMEs are under-resourced both in time and money.[426]

10. The seven year funding cycles characterised by the Multiannual Financial Frameworks, such as FP7 and Horizon 2020, provide stable, long-term funding in cycles longer than the UK's national programmes tend to provide. This stability, combined with policy consistency, enables UK researchers, institutions and businesses to deliver research excellence with long-term planning, and can impact upon leverage as the long-term visibility can give investors confidence. Furthermore, EU research and innovation funding

[422] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[423] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[424] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[425] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[426] The Dowling Review of Business-University Research Collaborations, July 2015

can provide support for UK research activities beyond that supported by the UK's research and innovation funding portfolio.

11. The European research and innovation funding landscape is greater than just FP7 or Horizon 2020, with several other EU funding mechanisms also providing support for research and innovation. The European Structural and Investment Funds (ESIF) support growth and jobs across the EU. The fund includes money from the European Regional Development Fund (ERDF) which aims to support research and innovation, alongside SMEs and the creation of a low carbon economy. These funds are particularly important for building capacity in the least economically developed areas of the UK. The newly created European Fund for Strategic Investment (EFSI) will also support investments in infrastructure and innovation, as well as offering finance for SMEs.

Collaboration

12. There is widespread agreement across the engineering community that international collaboration brings huge benefits to engineering research and innovation in the UK. Collaboration gives UK researchers and businesses access to a broader range of knowledge, people and facilities than could be obtained in the UK alone. Collaboration facilitates innovation as new ideas are generated, shared, refined and challenged. Collaboration between EU member states is frequently a requirement of the EU research funding instruments. Consequently, the UK's membership of the EU makes collaboration with other EU member states relatively easy, much more so in comparison to collaboration with non-EU countries, where a lack of dedicated funding hinders engagement. The attractiveness of collaborating with the EU is highlighted by the presence of international cooperation partner countries - non-EU countries such as Brazil - which participate in the EU research and innovation programmes.

13. The EU provides support for collaboration at many different levels, from the Marie Sklodowska-Curie Action grants which enable individual researchers to experience training in different countries, starting at the PhD level, right up to large consortia projects to address the grand challenges of the day such as EUROfusion, a consortium of 29 partners representing 40 laboratories with the ambitious aim of realising fusion electricity by 2050. Although it is clear that substantial benefits can be reaped from collaboration, the benefits are perceived to be maximised when funding is focussed on research that requires collaboration to succeed. Furthermore, there is a sense that a tension can sometimes arise between the emphasis on research quality and the prioritisation of collaboration.

14. Collaboration between businesses and universities is an important part of the research and innovation ecosystem and can provide a myriad of benefits to the participants, as has recently been highlighted in the Dowling Review of Business-University Research Collaborations.[427] The review also recorded the lack of funding as one of the most frequently cited barriers to collaboration for both businesses and universities. Therefore, that much EU research funding requires or encourages collaboration between businesses and universities is welcomed by the Academy. However, as noted previously, UK

[427] The Dowling Review of Business-University Research Collaborations, July 2015

businesses could do better at accessing such funds and participating in such collaborations.

15. Collaboration between industrial partners can also be facilitated by EU research and innovation funding as the creation of common funding frameworks increases the ease with which businesses can engage with each other. The EU could be regarded as a neutral convener, providing opportunities for industrial competitors to collaborate with each other and work together towards common goals, often for societal benefit. One such example is the Clean Sky aeronautical research programme, which was established in 2008 as a Joint Technology Initiative (JTI), and is now receiving support from Horizon 2020 as it addresses the key societal challenge of developing smart, green and integrated transport. Clean Sky is a public-private partnership and has brought together aeronautical industry leaders including Rolls-Royce and Airbus, along with their supply chains with the joint objective of creating cleaner skies through the reduction of carbon dioxide and nitrogen oxide emissions as well as noise reduction. Such pre-competitive collaborations often require public funds to de-risk the venture and incentivise the businesses, which are frequently competitors, to work together.[428] Support for such large-scale and high-cost collaborations, which the UK is eligible to participate in, are relatively rare outside of the EU.

16. The free movement of people in Europe is of critical importance for the UK in maintaining its excellent research base. The combination of the UK's world-class universities, excellent scientific reputation and quality of life, as well as the fact that English is in practice the lingua franca of research, makes the UK a very desirable location for non-UK Europeans to study and pursue their academic careers. The benefits to the UK are clear: well-skilled individuals choosing to study, work and live in the UK bring with them knowledge, ideas and talent, as well as contributing to the national economy. Conversely UK nationals are also able to benefit from free-movement by studying and working in other EU member states to learn new skills, experience different cultures and gain access to facilities.

17. The free movement of people means that the ease of recruiting non-UK EU individuals is very straightforward and requires relatively little paper work or time. This is in direct comparison to recruitment, whether to work or to study, of individuals from non-EU countries. However it is felt that difficulties in recruiting students and employees from non-EU countries is due to the immigration restrictions as decided by the UK government, and are unrelated to EU legislation.

18. The UK faces an engineering skills crisis, needing more than a million new engineers and technicians by 2020.[429] While efforts to boost the supply of UK engineers are underway, inward migration to the UK of individuals who can fill the skills gap will also be essential. It is also noteworthy that non-UK EU nationals make up a significant proportion of engineering students. In 2013 16% of all postgraduate taught engineering degrees were

[428] Investing in Innovation, Royal Academy of Engineering, September 2015,
[429] The Universe of Engineering, Engineering the Future, Royal Academy of Engineering, October 2014

awarded to non-UK EU nationals, falling to 14% for engineering doctorates, this compares to 39% and 26% of UK nationals respectively.[430]

19. Membership of the EU gives UK researchers access to excellent international facilities that are otherwise unavailable in the UK. The UK also hosts a number of international facilities that are supported by the EU. One such example is the Joint European Torus (JET) hosted at the Culham Centre for Fusion Energy (CCFE) in Oxfordshire. The JET facilities are collectively used by all European Fusion laboratories under the EUROfusion consortium. Around 350 scientists participate in JET experiments every year and the facility employs around 500 people.[431] Operation of the JET facilities is provided as an in-kind contribution to the consortium via a contract between the European Commission and the CCFE. However, there is a perception by some in the engineering community that more work is needed to increase awareness within the research and innovation sector of the international facilities available through EU membership to ensure that UK researchers are deriving the maximum benefit from them.

Regulation

20. Engineering is a pervasive force in almost every economic sector, from advanced manufacturing to software, from financial services through to the media and the medical sector. Consequently there are numerous regulatory frameworks that affect the engineering community. Regulatory frameworks can help to improve and harmonise conduct across the EU, and have the potential to become internationally adopted. It is important that government and UK stakeholders maximise their engagement with all EU institutions to ensure that new regulatory frameworks deliver favourable outcomes with minimal risk of unforeseen consequences so that the UK remains competitive. For example, by being involved in the development of regulations UK stakeholders can help ensure regulations do not adversely affect the development and delivery of their products and services.

21. Standards can help drive innovation and the harmonisation of standards across the EU creates a common language which can aid multidisciplinary teams. Membership of the EU enables UK researchers and businesses to inform, influence and draw up standards that become harmonised across the EU and, in some cases become internationally adopted. In emerging fields of strategic importance to the UK it is vital to ensure first mover advantage in the creation of standards. For UK companies to not lose out against international competitors the UK needs to play a leadership role in developing international standards, as it has done in the past for standards relating to the telecommunications sector.

Science Advice

22. There is widespread agreement in the engineering community that if the UK is to reap the maximum benefit from its EU membership in terms of research and innovation, then it is also critical that the UK participates fully in informing and influencing relevant EU

[430] Engineering UK 2015, The state of engineering, Engineering UK, 2015
[431] Culham Centre for Fusion Energy website

public policies. Although there are clear mechanisms for officials to engage in the public policy debate, it is less clear to the UK's science and engineering community how they are able to inform and influence decisions. Euro-CASE, the organisation of National Academies of Engineering, Applied Sciences and Technology in Europe, of which the Royal Academy of Engineering is a member, does co-ordinate and promote members' positions on critical research and technology policy issues to the EU, but there is the perception that UK scientists and engineers struggle to engage, in part due to limited opportunities for consultation offered by the EU institutions, and see little result from their efforts. This is in contrast to the situation in the UK, where scientists and engineers feel they have better representation and influence in the public policy debate.

23. The provision for science advice in the EU is complicated by the presence of three different institutions, the Commission, the Council and the Parliament, all of which should have access to independent scientific advice. The Council has no dedicated scientific advice service, the Parliament has access to the Science and Technology Assessment Panel (STOA) and the European Parliamentary Research Service (EPRS) while the Commission has access to the Joint Research Centre (JRC) and a new Scientific Advice Mechanism (SAM) which is currently under development following its announcement in May 2015.

24. The motivation behind the creation of the SAM is to be commended as the Commission has previously lacked provision of independent scientific advice. The JRC, the Commission's in-house science service, employs scientists to carry out research in 7 scientific institutes throughout the EU and although it is tasked to provide customer driven scientific and technical support to Union policies there have been long-standing concerns that the Commission lacks a mechanism to provide it with timely, independent, high level science advice. In 2009 the Commission addressed this concern by appointing a Chief Scientific Adviser (CSA) to the President, similar to the Government Chief Scientific Adviser role in the UK where the role has, in general, been considered a success. Professor Dame Anne Glover FRSE, who had been the first CSA for Scotland, was appointed to the role in 2012. Unfortunately the role was abolished at the end of 2014, once again leaving the Commission without a satisfactory source of independent scientific advice. However, the need for the Commission to have access to independent science advice was made clear by numerous member states and, in part, contributed to the announcement of the SAM.

25. The SAM will draw on the wide range of scientific expertise available in Europe through a close relationship with national academies, as well as a high-level group of seven scientific advisors, including the UK's Professor Dame Julia Slingo OBE FRS. Five umbrella academies including Euro-CASE will employ the resources of 90 academies and more than 10,000 eminent scientists and engineers across the EU to contribute to the SAM. The Academy welcomes the opportunity to be involved in the formal administration of scientific advice to the Commission. By harnessing the power of the major European Academies including the French, Swedish and UK national academies, and the Leopoldina and Berlin-Brandenburg academies in Germany, the SAM has the potential to provide rich long-term advice with a European perspective. This requires the SAM to over-ride disciplinary silos and create new opportunities and audiences for interdisciplinary policy

advice both on a European and national level. If successful, the SAM should also result in a more transparent process for sourcing scientific expertise and advice, and a simpler route for commissioning and making use of science advice across the Commission. As the SAM develops, careful planning and thought is required to ensure its full potential is realised.

27 November 2015

Royal Academy of Engineering, the Royal Society and the Academy of Medical Sciences – Oral evidence (QQ 25-40)

Transcript to be found under The Royal Society

Royal Academy of Engineering – Supplementary written evidence (EUM0077)

Analysis of HESA data, Table 17 HE qualifications obtained by location of HE provider, mode of study, domicile, sex, level of qualification and class of first class degree 2013/14, shows that in 2013/14:

- 57% of doctorates were obtained by UK domiciles
- 14% of doctorates were obtained by non-UK EU domiciles
- 30% of doctorates were obtained by non-EU domiciles

(Rounding means the total percentage is greater than 100%).

Engineering UK 2015, The state of engineering, shows that in 2012/13:

- 39% of engineering doctorates were obtained by UK domiciles
- 14% of engineering doctorates were obtained by non-UK EU domiciles
- 47% of engineering doctorates were obtained by non-EU domiciles

Engineering UK 2015, The state of engineering, shows that in 2012/13:

- 26% of postgraduate degrees achieved in engineering were obtained by UK domiciles
- 16% of postgraduate degrees achieved in engineering were obtained by non-UK EU domiciles
- 58% of postgraduate degrees achieved in engineering were obtained by non-EU domiciles

(Excluding doctorates and PGCE)

22 January 2016

Royal Astronomical Society – Written evidence (EUM0031)

Declaration of interests

1. The Royal Astronomical Society (RAS) has around 3900 members (Fellows) and is the leading UK advocate for the fields of astronomy, space science and geophysics. Our membership includes professional scientists working in academia and industry as well as many people with occupations across diverse sectors of the economy who use the skills and knowledge obtained during their time in academic research.

2. This is the official response from the Society to the Committee inquiry. The RAS represents many UK astronomers and geophysicists who depend on public funding, including grants from the EU, for their research, so has an interest in the subject of the inquiry. Although we fund a small number of research fellowships, and those who benefit from this financial support might seek funding from the research councils and the UK Space Agency, we have no direct financial relationship with the bodies referred to in this response.

3. In framing this submission, we have consulted with our governing Council and our wider Fellowship.

Response to Committee questions

What is the scale of the financial contribution from the EU to UK science and research, and vice versa?

4. In the areas of astronomy, space science and geophysics, the UK has received significant funding via the Framework Programmes, including Horizon 2020. One of the most useful resources has been the European Research Council (ERC), in which the UK wins one of the largest shares of grants.[432]

5. Astronomy and space science are funded by ERC panel PE9, via starter, consolidator and advanced grants. From 2007-14 UK research groups led 44 projects supported by a total of more than €80 million (£58 million).

6. Geophysics is a similar beneficiary. Although grants in this area are covered by the broader framework of Earth sciences (PE10), geophysics made up a large proportion of the substantial sums granted. In the period 2007-14, starter, consolidator and advanced grants in this area gave more than €95 million (£68 million) to UK-led research projects.

7. The Committee should note too that the UK received more grants than any other participating nation, almost twice as many (108 in astronomy and Earth sciences) as our closest competitor, France (56 over that time). In all these areas, the size of grants awarded (often several million Euros) is significantly larger than the majority of those

[432] See https://erc.europa.eu/projects-and-results/statistics for optional breakdown by panel area, country and type of grant

available through the UK research councils, and allows research groups to hire staff on a stable basis for the duration of their projects.

How effectively are funds managed in the EU, compared to the management of science funding in the UK?

8. There are different views on this question. Astronomers and geophysicists are on the whole strong supporters of, for example, the European Research Council, but others are critical of the excessive reporting and bureaucracy associated with other Horizon 2020 grants, which demands too much administrative time. The Society therefore argues that although the UK is a major beneficiary of this funding, the EU should take these concerns seriously and work to streamline its administrative requirements.

What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

9. Active astronomers and geophysicists see the ERC and the wider Horizon 2020[433] programme, with its total budget of almost €80 billion, as extremely important. Beyond direct financial support, these programmes are a means to support astronomy and geophysics projects that are beyond the means of one country without complicated agreements between individual national agencies. These grants are mobile within the EU, giving awardees the flexibility to work wherever they choose. If the UK thus no longer participated in the ERC, there is a risk that current grant holders, who are international scientific leaders in their respective fields, would simply leave the UK and use their grants elsewhere.

10. An example in geophysics is the development of new wave theory, which also feeds into many other fields such as communication, defence and non-destructive testing. Mainland Europe has sophisticated laboratories that test and help to develop the theoretical framework in this area, and an RAS Fellow has an EU-funded project, with 15 PhD students, that links this infrastructure with researchers in the UK. Such collaborations are routine and well supported by current arrangements but would be at risk if the UK were no longer involved in these programmes, to the detriment of researchers here.

11. Alongside the ERC, the broader Horizon 2020 programme supports research infrastructures across the EU, with active involvement from the UK. Scientists in astronomy and geophysics recognise that the development of the largest scale, and often most important, facilities of the 21st century is beyond the means of single nations. European infrastructures allow multiple nations to work collaboratively to tackle major questions in science and to plan the facilities needed to answer those questions.

12. A good example in astronomy is the ASTRONET[434] project, an EU project established in 2005 by the major European funding agencies and research organisations (the

[433] http://ec.europa.eu/programmes/horizon2020/
[434] http://www.astronet-eu.org/

European Space Agency or ESA[435], and European Southern Observatory or ESO[436]) to prepare long-term scientific and investment plans for European astronomy for the next 10-20 years. The first stage was the development of a Science Vision, published in 2007, which reviewed and prioritised the main science questions that Europe should address over that period. This was then followed in 2008 by the publication of the ASTRONET Infrastructure Roadmap which detailed and prioritised the facilities and resources required to realise the Science Vision.

13. EU-funded projects that interacted directly with ASTRONET include:

    - The Optical Infrared Coordination Network for Astronomy (OPTICON[437])
    - Radionet[438], which provided a similar network in radio astronomy
    - Europlanet[439], led by the Open University in the UK, a €10 million (£7 million) Horizon 2020 project, which links planetary science researchers in 34 institutions across 19 European countries.

14. UK scientists are active participants in these networks and see a high added value from their contribution. They give UK researchers access to trans-national work in cutting-edge science, including adaptive optics used to deliver the sharpest possible images from large telescopes, reconstruction of images from networks of telescopes and training researchers in instrumentation.

15. The networks support conferences, in the case of Europlanet run major public engagement programmes, and through OPTICON, give UK scientists access to the world-class telescopes supported by different EU states, even those that receive no UK funding.

16. More widely, the UK has benefitted by active participation in the European Strategy Forum on Research Infrastructures (ESFRI[440] - recently providing the chair) and AStroParticle European Research Area (ASPERA[441]), the astroparticle equivalent of ASTRONET. Both ESFRI and ASPERA fed directly into the ASTRONET Science Vision and Infrastructure Roadmap development. ASPERA led to the creation of the Astroparticle Physics European Consortium (APPEC[442]), an international organisation working to deliver the scientific goals in astroparticle physics set out in the earlier roadmap.

17. Similarly, whilst the European Space Agency (ESA) is a separate entity from the EU, the EU provides funds for the scientific exploitation of European space missions under H2020, with around 75% of its space budget made up of payments to ESA. The EU contribution makes up around 20% of the overall ESA budget.

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[435] http://www.esa.int/ESA
[436] http://www.eso.org/public/
[437] http://www.astro-opticon.org/
[438] http://www.radionet-eu.org/
[439] http://www.europlanet-eu.org/
[440] http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri
[441] http://www.aspera-eu.org/
[442] http://www.appec.org/

18. Horizon 2020 space projects must have a minimum level of international involvement to secure funding. The UK would risk missing out on partnership in such collaborations if it left the EU, and this could reduce the scientific return we get from our substantial investment in space technology and astrophysical/planetary space missions.

19. Collaboration via these routes has also helped lead to seed-corn funding for early stage development of crucial aspects of several of the UK's highest (non-EU) priority projects, where we have substantial capital investment, such as the Square Kilometre Array (SKA[443]) and European Extremely Large Telescope (E-ELT[444]). Much of that funding has been utilised in the UK.

20. ESFRI identified the SKA and E-ELT as EU strategic facilities, though the national membership of SKA and E-ELT extend beyond the EU member states. The UK in particular has also benefited from trans-national scientific and technological EU funding for these facilities e.g. through the ASTERICS research infrastructure cluster.

21. The Society believes that it is almost impossible to get large scale funding for this type of work through UK-only routes and that creating such international networks would be far more difficult without the overarching EU framework.

22. Astronomy and its associated public engagement also see benefits from participation in regional programmes, such as the European Regional Development Fund (ERDF) and the European Social Fund (ESF). These initiatives offer direct benefit to employment, skills and wider technology development regionally in the UK.

23. A specific example was the ERDF-supported New Generation Astronomical Telescopes (NGAT) project on Merseyside which led to the founding of a university subsidiary company and regional SME supplier chain creating or safeguarding over 150 FTE jobs by designing, building and delivering state-of-the-art large telescopes to an international market. These included the prototype, Liverpool Telescope (LT)[445], which is the world's largest and most capable robotic telescope and is a UK national research facility.

24. Associated with the Liverpool Telescope is the National Schools' Observatory (NSO)[446] which was kick-started by ESF funding as a regional project, but now has the participation of over 2000 schools across the UK, with the aim of using the innate interest of our young people in astronomy and space to enthuse them about the study of Science, Technology, Engineering, Mathematics and Medicine (the so-called STEMM subjects). The NGAT project also spawned the 'Spaceport' visitor centre, showcasing our science to the general public, again part-funded by ERDF, attracting over 60,000 visitors per year and whose establishment led to the creation or safeguarding of an estimated 50 jobs and the injection of over £3m annually into the economy of a deprived area of Merseyside.

[443] https://www.skatelescope.org/
[444] http://www.eelt.org.uk/
[445] http://telescope.livjm.ac.uk
[446] http://www.schoolsobservatory.org.uk

25. Another public engagement example is the highly successful Discovery Centre[447] at Jodrell Bank radio observatory, which received £1 million of its initial £3.1 million construction cost from the ERDF, with the remainder coming from the now abolished North West Development Agency.

26. In geophysics, researchers take the view that ERC funding gives them opportunities that are not available from the main UK funding body, the Natural Environment Research Council (NERC). The ERC starting grant, for example, is not concerned with large collaboration or impact, but encourages 'risky' science and so allows new researchers to really pursue cutting edge projects. ERC also promotes knowledge exchange to a greater degree than NERC with doctoral and postdoctoral programs like the Marie Curie Fellowships.

27. Another major UK organisation, the Tyndall Centre for Climate Change Research[448] at the University of East Anglia (UEA), receives nearly all its income through the EU. This in turn gives the organisation global international prestige, while simultaneously giving its scientists the ability to carry out bigger, more interesting and more policy relevant research for the UK than would be possible with support from domestic research councils alone.

28. The Tyndall Centre is also now the Future Earth European Regional Centre for all of Europe (Future Earth being the new planet-wide coordinating body for global environmental change research) giving it a significant leadership role that would not be possible if the UK were outside of the EU.

How is private investment in UK science and research influenced by EU membership?

29. Leading geophysicists argue that EU programmes are more effective at generating engagement with industry than RCUK. This kind of mechanism in turn helps foster private sector R&D investment.

What contribution does EU membership make to the quality of UK science and research through the free movement of people?

30. Scientists working in astronomy and geophysics see the free movement of people as vital to the strength of the European science base. Both disciplines have students and employees who work internationally and are very mobile. Research in the UK depends on the flow of PhD students and postdocs – the most talented early career researchers - between here and the rest of the EU.

31. This movement also allows scientists to move seamlessly between EU countries during their careers, without the complexity of visa applications required for, e.g. employment in the United States.

[447] http://www.jodrellbank.net/
[448] http://www.tyndall.ac.uk/

32. For academics seeking a permanent position, there is an expectation that they should have international experience and be part of international networks, which enhances their scientific output. EU membership - and its stipulation that all citizens should be given equal treatment throughout the Union - greatly reduces the administrative burden on these personnel through some degree of harmonisation of access to pensions, healthcare and transparent taxation.

33. There is therefore a risk that if the UK elected to leave the EU, it would greatly hinder the international mobility of scientists.

Does EU membership inhibit collaborations with countries outside the EU?

34. In astronomy and geophysics, there seems to be no strong evidence of EU membership having a negative impact on collaboration with non-member states. In contrast, programmes such as European Cooperation in Science and Technology (COST)[449] enhance these partnerships.

Overall impact of EU membership

35. The Society believes that UK research in astronomy and geophysics is a clear beneficiary, in both financial and collaborative terms, of membership of the European Union. On a per capita basis, we have one of, if not the most, productive scientific community in the world in these sciences, which has enabled researchers here to win a disproportionate share of EU funding.

36. If the UK leaves the EU, the Society would be extremely concerned about the resulting shortfall in resources for science, the impact on international collaboration and the possible 'brain drain' if leading scientists as a result chose to work elsewhere. In those circumstances the Society would undoubtedly join the rest of the UK scientific community in arguing for this shortfall to be made good by the UK government.

37. It would however be much harder to adjust to other changes, such as restrictions on freedom of movement and to membership of collaborations, where UK scientists might face access costs without full decision making powers.

38. One option if the UK did leave the EU is to move to Associated Country status, for example to enable it to remain a member of the ERC. If however the UK did end the right of free movement to and from EU nations, then as in the case of Switzerland, it could be relegated to 'third country' status and lose the right to bid for most of this funding.

20 November 2015

[449] http://www.cost.eu/

Royal Society of Biology – Written evidence (EUM0068)

About the Royal Society of Biology

The Royal Society of Biology is a single unified voice, representing a diverse membership of individuals, learned societies and other organisations. We are committed to ensuring that we provide Government and other policy makers, including funders of biological education and research, with a distinct point of access to authoritative, independent, and evidence-based opinion, representative of the widest range of bioscience disciplines.

The Society welcomes the House of Lords Science and Technology Select Committee consultation on The Relationship between EU Membership and the Effectiveness of Science, Research and Innovation in the UK. We are pleased to offer these comments which have been informed by input from our members from across the biological disciplines.

Executive Summary

i. EU science and innovation funding streams and mechanisms have been beneficial for UK bioscientists and for bioscience infrastructure. EU funding is competitively awarded and the UK performs well receiving 15% of funds across recent Framework Programmes (FPs). UK research income from the EU averaged €1bn per year in FP7, equivalent to about 15% of the national science budget at current exchange rates. Horizon 2020, the largest ever EU research FP with a budget of €74.8bn, aims to remove innovation barriers and ensure that Europe produces world-class science across public and private sectors. EU funding is deemed increasingly important and complementary to UK research funding. EU funds support some long-term research and the management of larger scale projects and are particularly important for fundamental research.

ii. The UK contributes to the total EU budget in proportion to its share of EU GDP. On a net basis the UK is the fourth largest contributor to the EU budget (behind Germany, France and Italy). Allocation of the UK budget contribution specifically to Science R&D is not easy to quantify. Should the UK leave the EU there is no guarantee that the same funds currently allocated to the R&D budget would be allocated back to the national R&D budget. If the allocation was less than currently earned this would be a significant risk to the research community and innovation landscape.

iii. As a member of the EU the UK benefits from the free movement of researchers across borders enabling easier connection and collaboration. Working across the EU facilitates shared knowledge, infrastructure and resources, allowing UK scientists to utilise facilities not otherwise available. The mobility of researchers enables the UK to freely recruit and hire the best researchers on an international scale. **EU researchers are in some cases able to provide specialist skills that are not readily available in the UK.** If unable to do this then the maintenance of UK scientific research excellence is likely to be inhibited. Researchers reported little doubt that the UK innovation landscape is influenced by the networks and access to EU researchers facilitated by EU membership. International collaborations enable countries to achieve in ways not possible at national level, providing opportunities to address and answer international questions at an appropriate

scale. A key motive for researcher participation in EU funding programmes was access to researcher networks, extending their knowledge base and accessing essential scientific skills and capabilities.

iv. The UK's position as a leading research nation within the EU makes it attractive to external collaborators and business partners seeking a European gateway. The UK has taken a leading role in projects such as the European Molecular Biology Laboratory/European Bioinformatics Institute (EMBL-EBI) and European Life‑Science Infrastructure for Biological Information (ELIXIR), based in Cambridge. Access to EU Infrastructure and Networks offers pan-European platforms for education and training. UK researchers recognise the requirement for funding of large Research Infrastructure (RI) projects on a European basis.

v. EU legislation aims to support a parity of standards, enabling cross border cooperation for science projects. Directives can provide a framework to prioritise applied research, offering guidelines as to why research should be conducted and benchmarks to facilitate study design; therefore increasing the impact of research. The UK has played a leading role in shaping EU directives and harmonisation with national policies removes competitive disadvantage and facilitates easier collaboration. However, the evolution of directives is challenging.

vi. The EU has recently established the Science Advice Mechanism (SAM) which is now beginning to function. The societal impact of science demands that independent scientific advice be available to the EU and its member states.

vii. The questions posed in this inquiry act as an effective framework to gather information and inform discussion about the UK's relationship within the EU and the impact this has on the bioscience sector. However, in addition to the focus they bring on the financial assessment of research funding, its regulation and use, it is essential that the debate includes the many other broad and important qualitative aspects of EU membership that are more difficult to measure in quantitative terms.

Funding

Q1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

1. EU funds are competitive and the UK competed well receiving on average between 14.2 and 15.9% of Framework Programme (FP) funds across FP5-7[450]. The UK ranked second behind Germany in terms of successful receipt of total FP7 EU funds[451]. In

[450] The impact of the EU RTD Framework Programme on the UK, (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 27)
[451] Creating the Future a 2020 Vision for Science & Research: A Department for Business Innovation and Skills Consultation on Proposals for Long-Term Capital Investment in Science & Research (2014) (pp 32-33)

2014 (Horizon 2020) the UK reversed this and secured 15% of EU research and development (R&D) funds (vs 10% for Germany); more than double the EU average[452]. With regards to R&D and innovation budgets the UK performs relatively well among our comparator nations (Germany, France etc.)[453]. The UK performs better than predicted by its population total, gross expenditure on R&D (GERD) or its number of full-time equivalent researchers (FTE researchers), but less well than predicted by its share of EU GDP. This latter statistic is similar for Germany and other large EU member states which also under-receive on this measure. However, relative UK performance has improved between FP6 and FP7, with UK funding share rising from 7% to 1% below expected levels[454].

2. UK Universities in particular show a strong orientation towards and success in competitive funds and have performed well[455] representing >20% on average of a large study sample of recipients of European Research Council (ERC) grants (2007 – 2014)[456]. UK research income from the EU averaged €1bn per year in FP7, equivalent to about 15% of the national science budget at current exchange rates[457]. In all funding programme areas with a strong science component, including the ERC, Life Sciences, Marie Skłodowska-Curie and Research Infrastructure (RI) funding the UK research community secured close to double the expected share of total EC income based on the size of the UK economy[458].

3. EU bioscience funds have steadily increased in successive FP budgets[459]. Approximately 40% of the UK FP7 competitive science funding was awarded to the biosciences, receiving €2.9 bn to fund over 2,000 projects. Natural and life science projects (encompassing food and agriculture, evolution and ecology, climate change and environmental challenges) received 30% of these awards[460]. The UK led coordination of 20% of the grants awarded in FP5-6. The UK therefore participates in

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[452] EU budget at a glance: "In 2014 the UK received €6.98 billion in EU funding. Of this, €3.95 billion, or 57%, went on farm spending, which is above the EU average of 42%. Regional policy accounted for €1.72 billion (25%), well below the EU average of 42%. Research and development accounted for €1.02 billion (15%), more than double the EU average of 7%. In 2014 Germany received €11.48 billion in EU funding. Of this, €6.15 billion (54%) went to agriculture, well above the EU average of 42%. Regional policy accounted for €3.54 billion (31%), below the EU average of 42%, but nonetheless a significant share for an "old" member state. Research and development took €1.13 billion (10%), slightly more than the EU average (7%)."(accessed 13/11/15)
[453] The impact of the EU RTD Framework Programme on the UK, (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 28)
[454] The impact of the EU RTD Framework Programme on the UK, (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 28)
[455] European university funding and financial autonomy (EUR 24761 EN – 2011): A study on the degree of diversification of university budget and the share of competitive funding (p 1, pp 13-14)
[456] European Research Council Statistics Country of Host Institution per Year (accessed 03/11/15)
[457] Overview of EU funds for research and innovation (2015), European Parliamentary Research Service
[458] The impact of the EU RTD Framework Programme on the UK, (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 2)
[459] Budgets:30 years of EU Investment in Research and Innovation (accessed 07/10/15)
[460] European Research Council Statistics Country of Host Institution per Domain (accessed 03/11/15)

and coordinates a high proportion of the health-related projects by comparison with other EU members[461].

4. Funds are also received through Life Science Infrastructure and Marie Skłodowska-Curie Scholarships; with UK life sciences, genomics, and biotechnology and sustainable development named as some of the most significant areas to receive funding in terms of volume[462]. The European Regional Development Fund (ERDF) Convergence funding has had a big impact upon the environmental biosciences at the University of Exeter's Penryn Campus. The funding supported the development of the Centre of Ecology and Conservation and the Environment and Sustainability Institute, providing undergraduate and postgraduate course infrastructure, lectureships and research positions. The EU investment bank can also fund loans for science and research projects on a project-by-project basis[463].

5. Whilst the UK science budget has remained ring-fenced, and reduced in real-terms, EU funding received by the UK has risen. Case studies indicate EU funding is therefore increasingly important and a complementary component to UK research funding. This is believed to be particularly important for fundamental research within the context of a perceived focus on applied research across UK funding. For Government Research Institutes that cannot access UK Research Council (RC) funds, EU research funding is critical. FP funding has in some cases crucially supported the national capability in areas not well covered by UK national funds; and some researchers[464] rely heavily on EU and other non-national funding sources[465].

Q2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

6. The UK contributes to the total EU budget in proportion to its share of EU GDP. On a net basis the UK is the fourth largest contributor to the EU budget (behind Germany,

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[461] An analysis of subject areas and country participation for all health-related projects in the EU's FP5 and FP6 programmes (2013) Galsworthy *et al*, *European Journal of Public Health*, 24;3, 514–520 (pp 515-16)

[462] The impact of the EU RTD Framework Programme on the UK, (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (pp 2, 26–27, 30-31)

[463] Creating the Future a 2020 Vision for Science & Research: A Department for Business Innovation and Skills Consultation on Proposals for Long-Term Capital Investment in Science & Research (2014) (pp 33-34)

[464] A selection of bioscience research topics reported to be missing from, or insufficiently addressed by, the UK's national research funds: Agricultural research in developing countries, Fisheries genetics/ biodiversity/climate change, Low input agricultural systems for developing countries, Microbiological aspects of food safety, Multi-disciplinary approaches to medical interventions, Multi-sectoral climate change impacts within ecosystems, Plant cell wall research, Plant health policy e.g. Control of non-statutory diseases, Prion diseases, Genomics for Sustainable Animal Breeding, Global monitoring for environment and security, Infectious disease networks, Soil Sensing; Robotics in Agriculture, Sustainable energy technologies, Telomerase/telomere research (cancer and ageing) The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (pp 58-59)

[465] The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 2)

France and Italy)[466]. Allocation of the UK budget contribution specifically to Science R&D is not easy to quantify.

7. At present the UK invests in science and research at a lower rate than many of our competitor countries in terms of percentage of national GDP. The UK spend is below the average for EU and Organisation for Economic Co-operation and Development (OECD) countries[467].

Q3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

8. UK Government and EU research funding streams are not readily comparable. EU funds are managed across many large scale projects and therefore incur increased administrative burden. The ERCs decision-making, allocation of funds and advisory processes are in outline similar to those of the UK RCs and similar national bodies. These frameworks therefore operate relatively effectively. The streamlining of Horizon 2020 protocols may encourage more applications from UK scientists.

9. The perceived link between EU-level spending on research and innovation and growth-enhancement in the eyes of a number of participants and analysts is noted in the BIS report on the balance of competencies relating to research and development[468]. A target spend of 3% GDP on R&D was officially adopted by the ERC in 2002. However this has not yet been achieved; in 2002 spending was at 1.9% GDP having only risen to 2% by 2013[469]. To achieve the target, greater investment in or reallocation of the EU budget will be needed.

10. EU policies relating to research funding programmes decide many of the priorities and general research agendas for the wider community and are therefore regarded as important to UK researchers; particularly in the fields of environmental sciences and ecology. EU grants often incorporate within their budgets capacity for management costs and overheads to support applications and reporting. Marie Skłodowska-Curie Fellowship grant schemes provide guidance for management of the grant relating to finances and training deliverables without directing scientific output. UK Institutions' research and enterprise offices aid and guide applicants for these external grants, highlighting the importance placed upon securing EU funding.

11. Long-term (5-year) support is offered by ERC fellowships for both early career researchers and professionals in areas of environmental and ecological sciences that do not have equivalent opportunities in UK funding. Researchers report to us that these EU funds therefore allow researchers to build their own groups and tackle in-

[466] How does the UK contribute to the EU budget? (accessed 13/11/15)
[467] Campaign for Science and Engineering: Spending Review Representation (2015) (p 9)
[468] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (p 35)
[469] Campaign for Science and Engineering: Spending Review Representation (2015) (p 25)

depth questions. ERC flexibility in grant programmes is reported as particularly welcome by the scientific community[470]. UK funding has been assessed by some as short term and therefore the balance of EU funds offers more opportunity and scope. High-risk funding is not easily available through either EU or national funding streams[471].

12. Researchers expressed that UK RC funds are easier for recipients to administer than EU funds. Conversely EU funding was seen as more attainable, especially for early career researchers. Overall, the competitive nature of funding applications in the EU and the UK ensures that the best research is funded for the right purposes and there is recognition that national funding schemes are also subject to regulations and requirements. The collaborative nature of EU funded projects promotes a skilled and accessible workforce that demonstrates efficiency in spending.

13. Should the UK leave the EU there is no guarantee that the same funds currently allocated to the R&D budget (from the UK contribution) would be allocated to the national R&D budget[472]. Allocation of less than is currently earned would be a significant risk to the research community and innovation landscape.

Collaboration

Q4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

14. Collaborations across the EU demonstrate the international reach of UK science. EU programmes involve a wider community of science and practice than is common in UK RC programmes. The scale and ambition of EU projects is reported as much higher (with upwards of 10 - 20 interdisciplinary partners across EU countries). EU collaborations can therefore help to create the environment for more applied bioscience innovation with some of the best minds in Europe able to engage with UK science. International collaboration provides an invaluable resource in building the effectiveness of science, research and innovation in the UK. The House of Lords European Union Committee reported that EU R&I programmes represent an excellent financial and networking opportunity for UK businesses as well as higher education institutions[473].

15. The EU is a world leading knowledge block; through membership the UK can influence this knowledge and in turn draw strength from it[474]. The diversity of member states is a resource for researchers across the EU and provides a broad range in perspective

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[470] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (pp 34-35)
[471] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (pp 28, 31,33)
[472] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (p 28)
[473] House of Lords European Union Committee, The Effectiveness of EU Research and Innovation Proposals (2013)
[474] Dame Julia Goodfellow speaking at Universities for Europe launch (accessed 07/10/15)

and approach. Interdisciplinarity and multicultural participation is essential when addressing societal issues in Europe. Scientific discovery and technology are often a component of these issues; and innovation and implementation of solutions requires societal adoption. The EU R&D funding programmes not only enable multidisciplinary research but also the free movement of researchers across member states.

16. By supporting collaboration and breaking down international barriers the EU facilitates cutting edge research, enhancing UK global influence. Collaboration breeds further collaboration and Horizon 2020 offers funding opportunities for large scale collaborations as well as more blue-sky research. The benefit of EU funding extends beyond monetary worth and is valued by our researcher community as facilitating the UK innovation landscape.

17. International collaborations enable countries to achieve in a way not possible at the national level[475], providing opportunities to address and answer international questions at an appropriate scale. The EU research landscape contains an enlarged pool of world-class researchers beyond that available nationally[476,477]; the UK must operate in this arena to maintain momentum as a leading research base. International collaboration can lead to more robust scientific output with demonstrable scientific impact[478]; it has been asserted that a quarter of REF (the UK Higher Education Research Excellence Framework) submissions drew upon EU partnerships[479]. Facilities can be shared and there is greater access to resources, thereby adding strength to UK research and innovation in bioscience. Ninety percent of researchers agreed a key motive for participating in funding programmes was access to European networks, extending their knowledge base and accessing essential scientific skills and capabilities[480]. The coordination of complementary researcher skill-sets between those that would otherwise not have collaborated is possible, and has demonstrated successful outcomes.

18. Marie Skłodowska-Curie funding develops international experiences and collaborations, also providing funding for the Institutions that host these research

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[475] Chuka Umunna MP speaking at Universities for Europe launch (accessed 07/10/15)

[476] The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 4)

[477] A selection of bioscience research areas where respondents believe FP activities have strengthened previously weak UK capabilities: Health related systems biology, hypothesis free research of high impact which is completely ignored in the UK, Gene and genetic therapies; rare diseases, In vitro protein synthesis in the UK was relatively weak, Molecular diagnostics, Cellular engineering approach for cancer, I have been impressed with FPs in that they are often ahead of the curve in terms of funding areas with a lot of potential. The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (pp 58-59)

[478] Collaboration: Strength in diversity (2014) Freeman and Huang. *Nature News.* 513 p 305

[479] Professor David Richardson speaking at Excellent Research in the UK: Do we need the EU? (accessed 07/10/15)

[480] The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (pp 3-4)

activities. ERC awards allow collaborative exploration into new fields of fundamental research. European Cooperation in Science and Technology (COST) also provides collaboration opportunities for those who can't access Horizon 2020 funds; this is not restricted to EU member states but complements EU Programmes to bridge COST-inclusive countries, and supports increasing researcher mobility across Europe[481].

19. Non-member states can incur considerable difficulties when applying for EU scientific grants. Following the Swiss adoption of the mass immigration limitation initiative in 2014 they now only have partial association with Horizon2020 (as an industrialised third country). Under the scientific excellence pillar Swiss researchers can apply for ERC grants, Marie Skłodowska-Curie Actions, Future and Emerging Technologies (FET) and RI (subject to change in 2017 to prevent participation[482]). However under the Industrial Leadership and Societal Challenge pillars, Swiss researchers are not entitled to EU funding, and cannot be counted toward the required minimum three research partners from different EU member states or associated countries. SMEs cannot participate[483]. If collaborative projects are EU funded, Swiss partners must apply for their funding from the Swiss State Secretariat[484].

Q5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

20. UK collaborations between EU and non-EU partners have increased with the UK only choosing to engage in initiatives when they represent a good opportunity for the UK[485]. Within the EU the free movement of researchers enables ease of connection and collaboration.

21. The UK is involved in a number of international groups that discuss the priorities and proposals for long-term, large-scale, strategic international collaborations in science and research. Both EU and non-EU countries participate in the G7, the European Strategy Forum on Research Infrastructures (ESFRI)[486], OECD[487] and the Consultative Group on International Agricultural Research (CGIAR)[488] amongst others. EUREKA[489] is

[481] COST Countries (accessed 27/10/15)
[482] The Partial Association of Switzerland in Horizon 2020, EU Research: Swiss Guide to European Research & Innovation
[483] Fact Sheet on the Status of Switzerland in Horizon 2020, EU Research: Swiss Guide to European Research & Innovation
[484] Swiss Transitional Measures for Horizon 2020, Funding of Swiss partners (accessed 10/11/15) The Swiss Government is required to finance Swiss inclusion in collaborative projects with other EU nations, this may be the case for future UK collaborations with EU member states if the UK were to leave the EU.
[485] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (p 30)
[486] Includes Bioscience Initiatives: The European Mouse Mutant Archive (EMMA), GÉANT (high-speed knowledge exchange network) and The European Molecular Biology Lab (EMBL), RI in the EU with information describing the EU Landscape and Map (accessed 21/09/15)
[487] The Organisation for Economic Co-operation and Development covers Bioscience Topics (accessed 21/09/15)
[488] CGIAR (accessed 21/09/15)

a predominantly European initiative, but not an EU one, within which an intergovernmental network coordinates national funding for innovation. These programmes enable agreement on joint research priorities, leading to coordination of investment amongst international partners[490].

22. The UK is a leading research nation within the EU, and as a member, the UK can compete globally with larger states. Opinions suggest that the UK gains advantage as the gateway nation to international collaborations between English speaking countries and the EU. Many UK research programmes alone could not recruit global participation on such a large scale. An additional benefit is the opportunity to showcase UK research excellence across networks that extend beyond UK and even EU.

23. Selected research themes within EU programmes facilitate strengthened EU collaborations and can produce research of improved quality. Outside these programmes, collaborations within the EU are more easily facilitated than with non-members, due to transnational funding mechanisms. EU research programmes can provide funding for collaboration beyond the EU, with USA, Russia, Australia and Eastern economies able to participate on an opt-in basis; these collaborations are subject to bilateral agreements[491]. Some international collaborations allow the establishment of links but do not tend to fund the research; whilst travel and exchange visits may be compensated, researcher salaries are not, whereas this is possible through EC funding. Where transnational funding streams do not exist collaborators must apply for local funding as part of joint research projects.

24. EU funding support is as wide-ranging as UK national funding, and can in addition significantly address gaps in the national provision. The UK domestic portfolio of international projects is considerably outweighed by EU funded international projects; owing to the greater availability of large-scale project funds from the EU[492]. EU funding mechanisms simplify process in some cases; dealing with a single entity avoids reliance on a combination of in-country funding mechanisms and renegotiations of contracts and intellectual property (IP) between collaborators[493]. Member states outside the EU encounter considerable difficulties with joint applications for EU grants; it is reported that these collaborative applications are subject to considerable preparative paperwork and bureaucracy.

25. There is a contrary view that collaboration between UK and EU research groups would still occur regardless of EU membership, owing to the strong scientific merit of the UK

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[489] EUREKA (accessed 04/11/15)
[490] Creating the Future: A 2020 Vision for Science & Research: A Department for Business Innovation and Skills Consultation on Proposals for Long-Term Capital Investment in Science & Research (2014) (pp 41-42)
[491] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (p 19)
[492] The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 4)
[493] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (p 30)

science base. Some researchers also felt some EU funding encouraged collaboration for collaboration's sake, potentially leading to partnership with less research innovative member states.

Q6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

26. The UK's position within the EU makes it attractive to external collaborators and business partners seeking a European gateway. The UK successfully competes within EU funding programmes, obtaining 22% of the total funding offered by the ERC[494]. Around 20% of UK domestic R&D funding comes from abroad, this is a far greater proportion than our comparator countries such as the USA, Japan, China and Germany[495,496]. This in part must be attributed to UK excellence in research.

27. As a platform ERDF and funding awards and collaborations have helped secure new research grants and follow-on-funding. EU Convergence funding has been fundamental to the University of Exeter's Penryn Campus[497]. In particular the MSc course in Conservation and Behavioural Ecology is well respected at international level, with attendance by international students. Continued investment maintains this addition to UK infrastructure. Communication from colleagues in SMEs have noted that EU income was critical to their proprietary research programmes and, moreover, that these awards have helped to leverage secondary investments[498]. These exemplify the additional benefits of EU membership that enhance the access, experience and contacts needed to develop scientific careers and businesses.

Q7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

28. Researchers and businesses appreciate that funding of large RI projects requires a European basis. International research facilities come under a number of different institutional arrangements and funding models. In most cases, EU funding covers the planning, coordination and networking of infrastructures, but the construction costs are borne by participating countries. Making better use of existing large facilities within the EU will also be more beneficial to the UK. The UK often contributes a

[494] Joint National Academies Submission to the Department of Business, Innovation & Skills Call for Evidence on Research and Development (p 1)
[495] Universities UK Submission to the 2015 Comprehensive Spending Review (p 5 taken from: Economic Insight (2015). What is the relationship between public and private investment in science, research and innovation?)
[496] Leverage from public funding of science and research, Department for Business, Innovation and Skills (BIS) (2013)
[497] Universities in Cornwall contribute more than £490 million to the Cornish economy (accessed 10/11/15)
[498] The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 2)

leadership role in establishing international facilities, without necessarily a leading role in financing.

29. The UK competed well for FP6-7 funded RI projects[499]. These include The European Molecular Biology Laboratory/European Bioinformatics Institute (EMBL-EBI) in Cambridge, which is home to other bioinformatic resources such as, the European Life‑Science Infrastructure for Biological Information (ELIXIR), Serving Life‑Science Information for the Next Generation (SLING), Impact and BioMedBridges. BioStruct‑X is also at the EMBL covering genomics and proteomics research. The Transnational Infrastructure for Plant Genomic Science (transPlant) is also within the EMBL. Imperial College London is home to the Infra‑Structure for Systems Biology (ISBE) and the Mosquito repository INFRAVEC. The University of Oxford is home to Instruct, the Integrated Structural Biology Infrastructure[500].

30. Without EU membership the UK would not have access to the Innovative Medicines Initiative (IMI) the world's biggest public-private partnership in the life sciences. As an EU led partnership with the European pharmaceutical industry the IMI budget is funded thorough Horizon 2020 and consortia of EU Pharmaceutical companies with the aim to improve the drug development process[501]. Similarly access to the European Medicines Research Training Network (EMTRAIN) provides a sustainable, pan-European platform for education and training[502].

Q8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

31. As a member of the EU, the UK benefits from the free movement of scientific researchers across borders. Working across the EU facilitates shared knowledge, infrastructure and resources, allowing UK scientists to utilise facilities not otherwise available. Free researcher movement is essential to carrying out field work and provides the capacity to share and transport samples across borders. Researchers are able to attend and present their research at international conferences across the EU enhancing their collaborative networks.

32. It has been reported that prior to EU membership, considerable restrictions applied to UK researchers' residencies working within Europe, which also created uncertainty. For example, the need for annual registration and renewal of documents with authorities was common. Membership considerably relieved such restrictions and facilitated ease of mobility across Europe. Within the EU at present there are essentially no barriers, and added to the fact that English is universal in science, UK researchers have exceptional professional and private mobility. As well as removing

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[499] European Commission Research Infrastructure (accessed 04/11/15)
[500] Enabling science, EU support to research infrastructures in the life sciences (2013) Directorate General for Research and Innovation Research Infrastructures
[501] The Innovative Medicines Initiative (accessed 28/10/15)
[502] EMTRAIN (accessed 28/10/15)

barriers to the mobility of single scientists between the UK and the EU, conditions for scientists' families would otherwise be more complicated, regarding regulations, education and development. This ease of movement is crucial for science and if these facilities were not available to UK scientists, EU employers would be effectively discouraged from collaborating with or hiring from within the UK.

33. The absence of visa restrictions across the EU is a major benefit when compared with international collaborations particularly in Asia and Africa. We have heard of UK companies that under freedom of movement legislation now spend less time and money on visa applications, and redirect these resources back to research. The mobility of researchers is significant in enabling the UK to freely recruit and hire the best researchers on an international scale. If unable to do this then the maintenance of UK scientific research excellence is likely to be inhibited.

34. The recruitment and contribution of researchers from EU countries has enabled further development of STEM subjects in the UK. The loss of experts from UK research disciplines, often due to retirement, can lead to the loss of knowledge within certain fields, reported particularly in systems biology and physiology. The Confederation of British Industry (CBI) has also reported that 63% of their members view the free movement of staff across the EU as beneficial to business; only 1% of members felt this impact was negative[503]. In addition EU researchers are in some cases able to provide specialist skills that are not readily available in the UK. It is more difficult and more complicated to recruit from beyond the EU.

35. The ERASMUS (European Community Action Scheme for the Mobility of University Students) programme provides a very efficient framework regarding the administration and regulation of collaborations between EU universities[504]. Similarly, Marie Skłodowska-Curie Fellowship grants provide a beneficial framework within which to arrange researcher movement. The 125,000 EU students studying at UK universities during 2012-13 generated £2.27 bn for the UK economy[505]. Continuing to remain attractive to EU students will be important for universities and the economy.

Regulation

Q10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

36. EU legislation supports a parity of standards, enabling cross border cooperation for science projects and harmonising standards. EU competency on environmental legislation has increased in line with the environmental standards in the UK leading to improved performance in addressing environmental issues[506]. Directives including

[503] CBI Factsheet: Benefits of EU membership outweigh costs (accessed 18/11/15)
[504] Professor David Richardson speaking at Excellent Research in the UK: Do we need the EU? (accessed 07/10/15)
[505] Dame Julia Goodfellow speaking at Universities for Europe launch (accessed 07/10/15)
[506] Review of the Balance of Competences between the United Kingdom and the European Union Environment and Climate Change (2014) (p 7)

Water, Birds and Habitats (including the Natura 2000 network of protected areas) and Marine Strategy provide a framework to prioritise applied research, offering benchmarks to facilitate study design and therefore increasing the impact of research. Directives such as the Environmental Impact Assessment offers guidelines as to why research should be conducted, helping to inform the research questions. REACH legislation guides use and exposure to chemicals.

37. With multinational legislation, the UK can maintain expertise at the international level, aiding the UK's international competitiveness in these sciences. The Protection of Animals for Scientific Purposes Directive 2010/63/EU set out to harmonise standards across the EU. This is an area in which the UK has played a leading role and harmonisation can remove any competitive disadvantage and facilitate collaboration and respond to leading opinion and expertise[507].

38. The UK life sciences industry views the European Medicines Agency (EMA)[508,] and the Unified Patent Court (UPC), both based in London, as providing beneficial regulation regarding scientific advice on medicinal products. Advanced Therapy Medicinal Products (ATMPs) including cutting edge cell and gene therapies are governed by a European framework for assessment and marketing. Pooled expertise at the European level and direct access to the EU single market are beneficial[509].

39. The EC has been conducting a more flexible programme, whereby participants from member states determine their research agendas and investment portfolios. The European Technology Platforms and ERANETS are strong examples, and there is interest in the proposed Joint Programming method with EU frameworks in place to help with IP[510]. UK RCs have expressed that funding programmes have not shaped their research priorities or budgets[511]. Involvement as a partner in EU projects offers valuable insight when applying for coordinator funding. Once funded, coordinating organisations provide guidelines into reporting mechanisms and navigation of administrative requirements.

40. The EU commission has committed to reduce bureaucratic load on participants of its programmes, in particular within Horizon 2020[512], with explicit plans for the inclusion of better mapping and monitoring[513], greater transparency, centralized open-access and equivalent incomes across member states[514].

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507 Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (p 44)
508 BIA UK Life Sciences Manifesto 2015-20
509 BIA Briefing Paper: Advanced Therapy Medicinal Products and Regenerative Medicine
510 European Commission webpages on Intellectual Property (accessed 04/11/15)
511 The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (pp 2-4)
512 An analysis of subject areas and country participation for all health-related projects in the EU's FP5 and FP6 programmes (2013) Galsworthy *et al*, *European Journal of Public Health*, 24;3, 514–520 (p 514)
513 Horizon 2020 – Impact Assessment Report.(2011) (5 March 2013, date last accessed in paper)
514 An analysis of subject areas and country participation for all health-related projects in the EU's FP5 and FP6 programmes (2013) Galsworthy *et al*, *European Journal of Public Health*, 24;3, 514–520 (p 518)

41. A recent change in EU law has made the participation of non-EU countries in Horizon 2020 grants more difficult. It was reported that this has had direct effect on scientists in more advanced countries like Switzerland (refer back to Q4: paragraph 19).

42. Acknowledged as an area for improvement, the administrative and bureaucratic burden of EU funding has been a commonly cited theme. For larger ERC grants, many Institutions employ external consultants, at cost and feel the lengthy process is further burdened by the requirement to report back to the EU on deliverable milestones relevant to that funding. Others report the employment of consultants as an expression of the value placed on these grants. In some cases a seemingly arbitrary requirement for collaborations between countries to attract specific funding was said to compromise the focus on excellence. Collaboration for collaboration's sake was viewed as having a negative impact on productivity. The cost-to-income ratio of national funds, and the extended timetable of the funding programmes compared with national schemes are additional hindrances reported as reasons for non-involvement in application for EU funds. This appears to be particularly challenging for businesses (SMEs) and for policymakers[515]. Bureaucracy associated with national funds is however also felt, and a level of burden is unavoidable and beneficial to avoid fraud[516].

Q11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

43. The Campaign for Science and Engineering (CaSE) has highlighted concern about tax policy affecting collaboration between UK institutions, and business activity in new research institutes[517]. Recommendations were made to reassess how EU (and UK derogated) legislation is interpreted and ensure that it is compliant with government science and innovation policy to promote innovation to drive economic growth[518].

44. A report by the Working Group on Expanding Access to Published Research Findings[519] recommended a reduction of the VAT burden on online access to e-journals. Restricted access to e-publications acts against research efficiency whilst also raising research institute expenditure[520].

45. Commercial R&D in Europe has declined as a consequence of the EU regulatory environment. Recent amendments to allow decision-making about the cultivation of GM crops in Europe on a national basis may alter the landscape for research.

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[515] The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 4)
[516] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (pp 28, 39)
[517] CaSE Briefing on tax policy concerns in the science and engineering sector (2015)
[518] Our Plan for Growth: Science and Innovation (2014)
[519] Accessibility, sustainability, excellence: how to expand access to research publication (2012)
[520] Accessibility, sustainability, excellence: how to expand access to research publication (2012) (pp 9, 64)

46. Current UK legal frameworks come from EU legislation. If the UK were to leave the EU the same legislation could be followed, but with the UK having significantly less influence over subsequent development. If the UK were outside the EU there would be an increased regulatory burden regarding compliance for those who operate in both UK and remaining EU markets.

Q12. How is the innovation landscape affected by EU membership?

47. Horizon 2020 is the largest ever European funding programme for research and innovation, with a budget of €74.8 bn that will run until 2020. Horizon 2020 aims to remove barriers to innovation and ensure that Europe produces world-class science across public and private sectors. A main area of focus is scientific excellence; supporting and developing European talent with the encouragement of private investment and industrial leadership in innovative R&D whilst reflecting societal challenges through policy priorities of the EC[521].

48. Access to the EU single market is a key reason for global biopharmaceutical companies to establish their European headquarters in the UK; investing in UK R&D and therefore the innovation landscape[522].

49. The EU has supporting competence with regard to innovation; therefore competency is shared between the EU and member states[523]. Researchers reported that there is little doubt that the innovation landscape is facilitated by the networks and access to EU researchers facilitated by EU membership.

Scientific advice

Q13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

50. Centrally administered EU policies face challenges because of the differing research structures across the EU, and the variations in public, private and grant based funds. Within the EU 2015 budget the spend on external policy has been increased by 22%[524]. Coordination as well as amplification of member state activities is seen as an important EU policy strategy; actions taken at the European Level can add significant value to actions taken by member states[525].

51. The UK has clear formal advisory structures relating to provision of evidence and advice for policy formation. The government chief scientific advisor (GCSA) as the

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[521] Innovate UK: Horizon 2020: what it is and how to apply for funding (accessed 03/11/15)
[522] BIA UK Life Sciences Manifesto 2015-20
[523] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (p 5)
[524] EU budget 2016: Council ready to negotiate with EP (accessed 03/11/15)
[525] Review of the Balance of Competences between the United Kingdom and the European Union Health (2013) (pp 40, 58)

most senior figure[526] and in principle each Government department has a chief scientific advisor (CSA) (some departments have vacancies or an advisor with additional roles). The core role of CSAs is to ensure that departmental decisions are informed by the best science and engineering advice[527]. In addition the UK has specific protocols for the provision of scientific advice in emergencies[528]. The focus on evidence-informed policymaking in the UK is long-standing. There is recognition that science will ultimately be considered with other aspects in final decisions which are taken by Parliament.

52. The UK is one of three EU member states to appoint CSAs (Ireland and Czech Republic also having positions)[529]. Some EU member states instead have advisory bodies, councils or committees with representatives from academia, industry, higher education and civil society. The UK has a number of strong learned societies that are active in the promotion of independent evidence for policy-making. Following a decision not to appoint a successor CSA to the President of the Commission the EU has instead established the Science Advice Mechanism (SAM) with a core group of seven experts drawn from across the EU and across specialisms[530]. This process is just beginning. Scientific advice must be available to the EU and its member states because of its profound societal impact. Developing a trusted relationship with policy makers, while maintaining transparency and accountability in the eyes of the public and the science community, is a common challenge[531].

Q14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

53. The UK is considered an influential member within the EU, and there is strong consensus that the UK plays an important role in shaping EU agendas. As an EU member the UK's voice is amplified globally[532] and the UK maintains a seat at the international leaders' table[533].

54. Projects involving UK partners produce a significant amount of policy benefit[534] and the UK has influenced and aided the improvement of EU codes of conduct. Long term negotiations over EU mechanisms have resulted in greater support to UK

[526] Science Advice to Governments: Diverse systems, common challenges A briefing paper for Auckland conference (2014) (p 7)
[527] Science Advice to Governments: Diverse systems, common challenges A briefing paper for Auckland conference (2014) (p 42)
[528] Scientific Advisory Group for Emergencies (SAGE) (accessed 03/11/15)
[529] European Parliamentary Research Service: Scientific advice for policy-makers in the EU (2015) (p 3)
[530] The Scientific Advice Mechanism (accessed 20/10/15)
[531] Science Advice to Governments: Diverse systems, common challenges A briefing paper for Auckland conference (2014) (pp 7-8)
[532] Review of the Balance of Competences between the United Kingdom and the European Union (2012) (p 7)
[533] Chuka Umunna MP speaking at Universities for Europe launch (accessed 07/10/15)
[534] The impact of the EU RTD Framework Programme on the UK (2010) Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS) (p 5)

institutions[535] and it is considered important that the UK continues to influence EU agendas. The UK is therefore able to make a positive contribution to the EU policy landscape and benefitting in the process.

55. The UK has been active in promoting open access to research, encouraging access to publicly funded publications and data; the EU also acknowledges these perspectives within Horizon 2020[536]. Horizon 2020 requirements on embargo periods may be reviewed in its mid-point review; meanwhile there are disciplinary differences in capacity to comply. Any major changes to open access policies will affect learned societies, many of which own journals. In addition approximately 23% of global publications are published through UK journals; the international policies are highly relevant[537].

56. The League of European Research Universities (LERU)[538] and the Young European Research Universities Network (YERUN) have been established as mechanisms to highlight the role and activities of research intensive universities across Europe, promote joint initiatives in research and teaching (including the mobility of researchers) and act to influence EU research policy. LERU comprises 21 European Universities, 5 of which are UK based, and has a strong voice regarding the ERA, ERC, FPs and the EU innovation landscape. The development of supporting organisations helps to demonstrate the interest of UK institutions in EU engagement. EU members can offer scientific advice through European bodies; the new EU advice mechanism is untried and has yet to have effect. Within the EU the UK can seek to influence and shape European policies in line with UK ones.

27 November 2015

Member Organisations of the Society of Biology:

Full Organisational Members
Agriculture and Horticulture Development Board
Amateur Entomologists' Society
Anatomical Society
Association for the Study of Animal Behaviour
Association of Applied Biologists
Biochemical Society
Biosciences KTN
British Andrology Society
British Association for Lung Research
British Association for Psychopharmacology
British Crop Production Council

[535] Review of the Balance of Competences between the United Kingdom and the European Union Research and Development (2014) (p 41)
[536] Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020
[537] Public access to publicly-funded research: Oral statement to Parliament (accessed 18/11/15)
[538] League of European Research Universities (accessed 23/11/15)

British Ecological Society
British Lichen Society
British Microcirculation Society
British Mycological Society
British Neuroscience Association
British Pharmacological Society
British Phycological Society
British Society for Gene and Cell Therapy
British Society for Immunology
British Neuroscience Association
British Society for Matrix Biology
British Society for Medical Mycology
British Society for Neuroendocrinology
British Society for Parasitology
BSPB – British Society of Plant Breeders
British Society for Plant Pathology
British Society for Proteome Research
British Society for Research on Ageing
British Society for Soil Science
British Society of Animal Science
British Toxicology Society
Experimental Psychology Society
The Field Studies Council
GARNet
Gatsby Plants
Genetics Society
Heads of University Centres of Biomedical Science
Institute of Animal Technology
Laboratory Animal Science Association
Linnean Society of London
Marine Biological Association
MONOGRAM – Cereal and Grasses Research Community
Nutrition Society
The Rosaceae Network
Royal Microscopical Society
Science and Plants for Schools
Society for Applied Microbiology
Society for Endocrinology
Society for Experimental Biology
Society for General Microbiology
Society for Reproduction and Fertility
Society for the Study of Human Biology
SCI Horticulture Group
The Physiological Society
Tropical Agriculture Association
UK Environmental Mutagen Society
UK-BRC – Brassica Research Community

UK-SOL – Solanacea Research Community
University Bioscience Managers' Association
VEGIN – Vegetable Genetic Improvement Network
Wildlife Conservation Society Europe
Zoological Society of London

Supporting organisational members
Association of the British Pharmaceutical Industry (ABPI)
Association of Medical Research Charities
Astrazeneca
BASIS Registration Ltd.
Bayer
BioIndustry Association
Biotechnology and Biological Sciences Research Council (BBSRC)
The Donkey Santuary
The Ethical Medicines Industry Group
Food and Environment Research Agency (FERA)
Forest Products Research Institute
Huntingdon Life Sciences
Institute of Physics
Ipsen
Lifescan (Johnson and Johnson) Scotland Ltd
Medical Research Council (MRC)
MedImmune
Pfizer UK
Plant Bioscience Limited (PBL)
Royal Botanical Gardens Kew
Royal Society for Public Health
Select Biosciences
Syngenta
The British Library
Understanding Animal Research
Unilever UK Ltd
Wellcome Trust
Wiley Blackwell

Royal Society of Chemistry – Written evidence (EUM0051)

We have drawn upon information available form a range of external sources, as well as the experiences of researchers from across the chemical sciences community to inform our response. We have changed the order that we answer the questions in our submission, to aid its overall narrative.

Executive Summary

EU membership has a strong influence on science, research and innovation in the UK. From the responses that we received, EU membership was regarded as having a mostly positive influence on the effectiveness of UK science, research and innovation, especially with respect to funding and collaboration. Negative effects that were highlighted focussed mainly on the formation of regulation and its unintended impacts.

There are a range of EU funding schemes that contribute to UK science, research and innovation. Data from previous schemes shows that the UK draws in a significant share of funding allocated for research. We heard from those in academia that EU funding is an important complement to UK research funding, especially given current levels of UK science spending, with the science ring-fence during the last parliament equating to a real-terms cut.

There were criticisms of the accessibility of funding schemes for small and medium enterprises (SMEs), though we also heard examples of successful participation from UK SMEs, who have been able to expand manufacturing or further develop technologies as a result of EU funding. Recent developments in EU funding have seen an emphasis on innovation, which the UK community is already capitalising on. The UK is an active participant in EU public-private partnerships and through mechanisms such as the European Regional Development Fund and European Structural and Investment Funds, the UK can use EU funding to improve UK competitiveness and innovation.

Collaboration opportunities that come as a consequence of EU membership were seen to be important in advancing UK research. There was a sense that EU mechanisms help to facilitate effective collaboration that can go on to outlast the initial project. Whilst it was acknowledged that collaboration can be achieved outside of the EU framework, researchers felt that the mechanisms provided were effective and drew added benefits, such as career development opportunities for early career researchers.

Respondents drew links between the mobility across the EU and the increasingly international nature of research careers. Free movement is seen to encourage the flow of talented scientists to and from the UK, creating opportunities for UK researchers to work elsewhere, as well as bringing the best researchers from overseas to the UK. This was also mentioned in relation to access to EU infrastructure; free movement facilitates easy access, which is often be funded by the EU.

In relation to regulation, a point made by industry respondents was the potential for divergent regulatory frameworks if the UK left the EU. The ability for the UK to set its own regulation was not viewed positively due to the perception that businesses would still need to comply with EU regulation, as well as any newly-developed UK regulation.

Some speculated on the possible effects that may occur in the event of a 'Brexit' across the four themes covered in this consultation. However, at this stage, it remains unclear what the exact effects of an EU exit would be on UK science, research and innovation.

Funding

Q1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

There are several streams of EU funding that can contribute to science and research in the UK. These include Horizon 2020, European Structural & Investment Funds and the European Fund for Regional Development.

As an indicator of the scale that these funds can contribute, the UK received £4.4bn from the Seventh Framework Programme (FP7 – the predecessor to Horizon 2020), which ran from 2007 to 2013. This is equivalent to 15.4% of the total fund and second only to Germany.[539] This level of funding alone is the equivalent of an additional research council, averaging higher than the annual investment by the Biotechnology and Biological Sciences Research Council (£509M in 2014-15), and equates to a higher percentage of FP7 funding than either our share of EU Gross Domestic Product (GDP) or population. [540] The proportion received from FP7 only represents one of the EU funding streams that has contributed to science and research.

In 2013, UK University chemistry departments received more than 21% (~£43m/€60m) of their funding from EU institutions (including businesses, charities and other national governments), compared to only 6% from non-EU overseas sources.[541]

Q2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

To our knowledge, the only available assessment of this has been carried by the Office of National Statistics. They calculated that the indicative UK contributions to the EU for science, engineering and technology (SET) research and development (R&D) expenditure

[539] *Creating the future: a 2020 vision for science & research*, Department for Business Innovation and Skills, April 2014 (paragraph 87)
[540] *Review of the Balance of Competences between the United Kingdom and the European Union: Research and Development*, HM Government, February 2014 (page 10)
[541] Data provided by the Higher Education Statistics Agency and available at https://public.tableau.com/profile/rsc.ict#!/vizhome/Chemistryresearchfunding/Story1

in 2013 were £0.8bn/€1.1bn.[542] In 2013, the UK's net contribution (after rebates and public sector receipts) to the EU was £10.5bn/€14.7bn.[543]

Q3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

Our members who have applied for EU funding generally found the process more involved than that for funding from Research Councils UK. There was a general appreciation that often this was due to the larger sums involved in many EU funding schemes but smaller schemes were also cited, such as ERC starter grants, which required lengthy paperwork. It was reported that many Universities have employed specialist staff familiar with specific scheme requirements to maximise the chance of gaining EU funding.

Some EU funding schemes (e.g. ERC grants) typically have a two-step process with applications being filtered based on a short proposal at the first stage and a longer full proposal being assessed by a scientific panel at a second stage. In many cases, both the first and second stage proposals must be submitted at the same time. The quality of refereeing at the first stage was particularly felt to be at a lower standard than comparative UK funding schemes. Members also stated that the EU processes led to unnecessary work as full proposals were required at the start of the process and so were still required for applications which would not pass the first stage. It was felt that this compared poorly to e.g. the EPSRC's process for programme grants, where applications only initially required a short document on initial application.

However, a member specifically involved in the assessment panel of a major EU funding scheme viewed the UK as only being marginally better in administering grants with reference to the quality of decision making. The close monitoring of large EU grants was seen as a positive feature as it enabled funding to be stopped where funds were not being used for their stated aims, curbing misuse.

The European Commission itself has committed to reduce bureaucratic load on participants of its programmes such as Horizon 2020, with explicit plans for the inclusion of better mapping and monitoring.[544]

Q6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

One mechanism that aims to encourage private investment in science and research alongside public funds provided by the EU is public-private partnerships (PPPs). These enable the formation of collaborative consortia between businesses and universities. In 2013, the European Commission launched eight contractual Public Private Partnerships (PPPs) of strategic importance for European industry. The partnerships were intended to

[542] *Science Engineering and Technology Statistics*, Office for National Statistics, 2013
[543] *House of Commons Briefing Note 06091: UK-EU economic relations*, House of Commons Library, June 2015
[544] *Horizon 2020 – Impact Assessment Report*, European Commission, 2011 (section 5.5)

leverage more than €6bn of public investments implemented through open calls under Horizon 2020.[545]

The Innovative Medicines Initiative (IMI) is Europe's largest PPP. IMI consists of a number of different projects that work towards an overall aim of speeding up the development of better and safer medicines for patients.[546] The first phase had a budget of €2bn, half of which came from the EU's Seventh Framework Programme (FP7) and half of which came from in-kind contributions from European Federation of Pharmaceutical Industries and Associations (EFPIA) companies. The next phase (IMI2) is expected to attract €1.6bn from Horizon 2020, €1.4bn from the EFPIA and €213m from other industries or organisations.

The UK-based Chem21[547] consortium is part of the IMI and has leveraged funds of over €26m from both public and private sources to develop the manufacture of sustainable pharmaceuticals The project brings together six pharmaceutical companies (2 UK based), 13 Universities (4 UK based) and four SMEs (2 UK based) from across Europe. The aim is to develop sustainable biological and chemical alternatives to finite materials, such as precious metals, which are currently used as catalysts in the manufacture of medicines. One of the university researchers involved commented "This is a unique opportunity for academic groups to work alongside pharmaceutical companies and specialist SMEs to develop innovative catalytic processes for pharmaceutical synthesis. We believe that challenging problems of this nature are best solved on a pan-European basis by bringing together under one roof the combined expertise of many groups to establish a world-class research hub in catalysis and sustainable chemical synthesis."

Another PPP relevant to UK industry is Sustainable Processing in Resource Efficiency (SPIRE)[548] which is concerned with the development of innovative technologies in ways that minimise consumption of raw materials and energy as well as maximising recycling and re-use of waste by-products and end use products, in line with the EU Circular Economy initiative. This has a budget of about €900M over the seven years of Horizon 2020 and covers eight industry sectors, many of which link directly to sectors within the UK economy (cements, ceramics, chemicals, engineering, non-ferrous metals, minerals, steel and water management), offering opportunities for UK involvement

Horizon 2020 encourages participation from universities, large companies and SMEs. Specifically, SMEs are being encouraged to participate as part of consortia or through a dedicated SME instrument. For example, MOF technologies, a spin-out from Queen's University Belfast recently secured €1.2million to expand their UK manufacturing base to scale up production of clean technology to produce Metal Organic Frameworks, a nanoporous material. The funding was part of a European Horizon 2020 consortium project worth €7.6m which also includes partners Johnson Matthey and GDF Suez.[549]

[545] European Commission press release, December 2013
[546] http://www.imi.europa.eu/
[547] http://www.chem21.eu/
[548] http://www.spire2030.eu/
[549] *Enterprise Plus newsletter*, Royal Society of Chemistry, October 2015

More generally, a study conducted by Technopolis on behalf of BIS examining the impacts of the sixth and seventh Framework Programmes on the UK found that in many cases FP funding had helped to secure further follow-on funds for research projects.[550] Some UK SMEs surveyed for the study stated that the EU's reputation for rigorously assessing applications has meant securing EU funding has been seen as a validation of their strategy, helping to secure further investment from other sources.

With the aim of extending this effect to "runner-up" projects submitted under Horizon2020, the EU Commission recently introduced the "Seal of Excellence" quality label.[551] This label is to be awarded to promising projects submitted under Horizon 2020 which did not secure funding due to budgetary constraints but received high assessment scores in the evaluation process. In its pilot phase, the "Seal of Excellence" will first be given to proposals by SMEs submitted under the SME instrument of Horizon 2020. If successful, the action could potentially be extended to cover more areas of Horizon 2020.

Q12. How is the innovation landscape affected by EU membership?

The EU provides a range of mechanisms that support and enhance the UK's innovation landscape. These include, but are not limited to:

- Horizon 2020 and the Framework Programmes that preceded it support research and innovation. Within each of these programmes, there are or have been instruments dedicated to encouraging innovation. For example, the *Innovation in SMEs* stream under the Industrial Leadership pillar of H2020 and *Research for the Benefit of SMEs* under the Capacities programme under FP7.
- An example of a research and innovation project funded under FP7 is the SHYMAN project. In this project Promethian Particles, a spinout from Nottingham University, leads a €10 million research project to investigate the sustainable manufacturing of nanomaterials. It involves 5 academic institutions and 12 companies from across Europe. The eventual aim of the project is a 1000 ton per year nanomaterial manufacturing plant in the UK, alongside the development of commercial products that can be manufactured at the site.[552]
- Under the H2020 *Innovation in SMEs* stream, the dedicated SME instrument has €3.0bn, and is aimed at supporting innovation with the potential to grow and internationalise all the way from feasibility assessment (phase 1) to commercialisation (phase 3). One successful UK company that has secured funding this way is Cambridge based Abcodia who received funding to advance its pancreatic cancer early diagnosis test.[553]
- The European Regional Development Fund (ERDF), will provide funds of €5.8bn to support local growth across the UK between 2014 and 2020.[554] €1.4bn of this is

[550] *The impact of the EU RTD Framework Programme on the UK*, Technopolis Group carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS), May 2010 (page 2)
[551] *New Seal of Excellence to increase the quality of regional research funding*, Lithuania 24, October 2015
[552] http://www.prometheanparticles.co.uk/eu-projects/
[553] *Abcodia press release*, September 2014,http://www.abcodia.com/news_180914.php
[554] EU Cohesion Funding information https://cohesiondata.ec.europa.eu/country?country=United%20Kingdom

earmarked to support 'research and innovation, with a further €1.3bn for 'low carbon economy' and €2.0bn for 'SME competitiveness'.

- The European Structural and Investment Funds will be used to build a smart specialisation hub in England. The aim of this hub is to 'share best practice in innovation' by bringing together universities, businesses, investors and the Catapult centres.[555] In a speech at Innovate UK's annual conference earlier this month, Business Secretary Sajid Javid announced this as one of a number of measures that would 'help make Britain the best place in Europe to innovate'.
- This summer, Santander UK has signed an agreement with European Investment Fund (EIF) to increase lending at favourable rates to UK SMEs to support research, development and innovation activities. The agreement will provide €140M (£100M) over the next 2 years and the loans will be guaranteed by the EIF, enabled by financial backing from the Horizon 2020 programme.[556]
- The European Investment Bank may be less well-known for providing innovation support, but does act in this capacity, for example, by providing £50m to the company *Imperial Innovations* to allow them to increase the rate and scale with which they support new companies and technologies in the biotech and medtech sectors.[557] This follows on from an earlier £30m loan provided to the company by the EIB in 2013.[558]
- Managed by the EIB, the recently established European Fund for Strategic Investments (EFSI) includes 'education, research, development and innovation' as one of its focus areas.[559] The announcement to establish the fund, shortly after the Commission President Jean-Claude Juncker took office, was criticised by many in the scientific community, due to proposals that it would divert money from H2020 to EFSI. This has been countered by claims from the Commission, including the Commissioner for Research, Science and Innovation, Carlos Moedas, that EFSI will provide more money for research and innovation, not less.[560] To date, many European academics remain critical of the fund, in particular the idea that the fund will be distributed as loans and not grants.[561] This has been perceived by some in the European science and research community as shifting money away from research that can be carried out in universities and towards research and technology organisations and businesses.

Collaboration

Q4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

From responses' gathered from our community, there was a general consensus that the key benefits to the UK were:

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555 - *Department for Business, Innovation & Skills press release*, November 2015
556 - *Santander press release*, July 2015
557 *European Investment Bank press release*, July 2015
558 *Imperial innovations press release, July 2013*
559 http://www.eib.org/about/invest-eu/index.htm?media=shortlink
560 - *Speech at the Royal Society of London - Science without Borders*, Carlos Moedas - Commissioner for Research, Science and Innovation, March 2015
561 *Academics not convinced, despite Commission pledges*, Research Fortnight, November 2015

- Access to sources of funding
- Opportunities for collaboration and knowledge exchange
- Career development opportunities for early career researchers
- Access to EU research infrastructure

a) Access to sources of funding

Many of those who responded from our community attested that EU funding *via* the Framework Programmes has proved to be an important source of funding for research. The UK's ability to access such funds contributes to overall national research outputs. Some researchers mentioned that the magnitude and timescale of some EU funding programmes (e.g. ERC starting, consolidator and advanced grants can last up to 5 years) provides an important mechanism for securing long-term funding for specific research projects. European funding programmes provide what is seen as an important complement to UK funding programmes; this was seen as especially important by some respondents in light of the current research funding environment in the UK. Many are acutely aware that the science ring fence provided by the last government has still equated to a real-terms cut in science spending in recent years.[562]

Several members gave examples of where collaborations were formed through access to EU funding. UK universities also benefit from access to the funding schemes of other European countries, enabling them to create beneficial collaborations. For example, one member has hosted students from Spain in his academic group through funding from the Spanish Government. The collaboration has lasted beyond the initial funding and has led to the publication of 3 research papers since 2013. A member from industry also stated that access to EU funding benefited UK companies as it facilitated access to the best research networks in the EU.

Some respondents specifically referenced access to the European Research Council (ERC) funding being beneficial to the UK community. As ERC grants are awarded on the basis of excellence alone, there is no requirement for even distribution across member states or associated countries. In 2014 the UK received nearly 24% of the European Research Council (ERC) grants[563] and in 2013, seven of the top twenty European institutions hosting at least 30 ERC grantees were in the UK, more than in any other EU nation.[564] Some respondents suggested that UK universities' international reputation for excellence made them favoured host institutions for both UK and non-UK nationals who hold ERC grants.

b) Opportunities for collaboration and knowledge exchange

Collaboration was seen as an integral part of scientific research, particularly in relation to devleoping solutions to global challenges in areas such as health, food and energy. Many

[562] *Parliamentary briefing: Science & innovation in the UK*, Royal Society of Chemistry, September 2015
[563] *European Research Council Grants: projects and results*, 2007-2015
[564] *Annual report on the ERC activities and achievements in 2013*, prepared under the authority of the ERC Scientific Council, 2013

EU funding programmes provide inherent opportunities for collaboration as a condition of award.

Another motivation for participating in EU collaborations is the opportunity for knowledge exchange. Access to EU networks helps UK researchers broaden their own knowledge which can then be applied to UK research and is reflected in UK research outputs, for example, collaborative research papers.

c) Career development opportunities for early career researchers

Linked to this are the opportunities that EU collaborative programmes offer for the development of early career researchers. Innovative training networks (ITNs) offer the opportunity for PhD students to work in cohorts that span several EU countries and institutions. These allow the students to establish links with other researchers across the EU early in their training, allowing them to be exposed to a greater breadth of knowledge and research practice. This can be particularly useful to help establish networks and develop expertise in newer, interdisciplinary sciences. An example of this is the LASSIE initiative,[565] which trained early career researchers in the field of astrochemistry capable of assimilating techniques, ideas and practices from a wide range of scientific disciplines.

Funding provided by European Cooperation in Science and Technology (COST) actions is specifically dedicated to building networks and collaborations; it cannot be used for research itself. Part for the funding allocated to COST networks is used for what are known as 'short scientific missions'. These exchanges, which vary in duration from a few weeks up to 6 months, often involve early-career researchers, including PhD or Masters' students. Whilst the visit will have a scientific aim, there is often a developmental aspect to the mission also, allowing the visitor to gain insights into how other research groups work or even specific technical skills, such as learning a new practical technique that could potentially be applied back in their home institution. Opportunities like this are seen to help to develop the future UK scientific workforce.

d) Access to EU research infrastructure

See our response to question 7 below.

A more general point about the UK's EU membership related to the influence that the UK has on the direction of EU funding programmes. Currently, UK priorities for research can be fed into negotiations around the shape and scope of EU funding programmes as they

[565] The Laboratory Astrochemical Surface Science in Europe (LASSIE) initiative is one of the largest interdisciplinary training networks (ITNs) under FP7 in the field of solid state astrochemistry and was established from a UK-focussed network (AstroSurf) to address issues of relevance to the chemical evolution of the Universe. From 2010-14 the consortium of 13 experimental and theoretical groups with 5 industrial and 1 outreach partners supplied training and research opportunities for 28 Early Stage Researchers and 4 Experienced Researchers. Researchers involved in LASSIE have gone on to apply for further Horizon2020 funds based on the collaborations formed through this ITN and are currently awaiting the results of those bids. Those involved in founding the LASSIE programme believe its creation also influenced the European Commission's decision to have laboratory astrophysics recognised as a potential area for a research infrastructure in H2020.

are developed, helping to develop synergies between the two. It is unclear whether the UK would retain this level of input over future EU research funding if it were to leave.

Q5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership?

Most EU funding programmes are multilateral with some requiring bids to include several EU countries as partners, but bilateral collaboration is also supported by mechanisms like the European Industrial Doctorates (EID), European Cooperation in Science and Technology actions (COST), and the Marie Skłodowska-Curie (MSC) Actions.

Our members have highlighted in general that bilateral collaborations with colleagues within the EU are more straightforward than with countries outside it, even if they are similarly accessible geographically and have associate state status (e.g. Turkey). The reasons cited for this include easier access to funds for students and researchers and reduced administrative burdens in terms of visa restrictions for students and researchers to travel for conferences, short and medium term research visits, sabbaticals and placements.

Q7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

Access to both excellent national and international large scale facilities is essential for chemical sciences research.[566] The chemical sciences community benefits from access to a variety of large scale European facilities. Several members expressed the view that no single country can operate every type of large facility needed for scientific research; international cooperation is vital. Access to equipment in Europe such as the European Synchrotron Radiation Facility (ESRF) in Grenoble, France enabled members to undertake experiments that would not be possible in the UK. Similar arguments apply to, for example, central neutron and X-ray facilities in Europe (for example the Institut Laue-Langevin (ILL), the Laboratoire Léon Brillouin (LLB), Elettra Sincrotrone Trieste and the Swiss Spallation Neutron Source (SINQ).

Access to such facilities is often dependent on EU membership or association. Funds for travel and accommodation to enable researchers to use these facilities are also only available for EU member states. The value of EU infrastructure was seen to be linked with that of free movement across the EU; access to such facilities was seen as straightforward and so now formed a significant component of some researchers' work.

One UK institution highlighted their provision of equipment to the European XFEL. The European XFEL is currently under construction in Hamburg, Germany and due to be

[566] *Response to the House of Lords Select Committee on Science and Technology consultation on Scientific Infrastructure*, Royal Society of Chemistry, June 2013

completed in 2017.[567] It will generate ultra-short X-ray flashes to enable scientists to map the atomic details of viruses, decipher the molecular composition of cells, film chemical reactions, and study processes such as those occurring deep inside planets. Early involvement of the UK research community in the setting up of this facility will mean that the UK research community can help shape its future running.

None of the responses we received highlighted restrictions in the creation and operation of international facilities outside of the EU.

Q8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

Attracting world-class researchers to the UK is essential to maintaining the UK's reputation as the best place to do science. The UK must be seen as "open for business" and welcoming to scientists and researchers.

Our members cited many positive benefits which arise from the free movement of people within the EU. Free movement of top researchers between EU member states allows UK universities and businesses to recruit the best researchers for their field with ease.

Researchers who are willing to move across borders both to and from the UK were seen as being highly motivated. One member stated that this created a healthy competitive atmosphere within research groups, with the result being raised standards of work across the whole team. Through long-term recruitment, sabbaticals, short-term research visits and attendance at conferences across the EU, UK workplaces benefit from a greater diversity of knowledge and expertise that enhance their research culture, increasing creativity, productivity and innovation. Free movement also means that UK researchers can easily travel to specialised equipment throughout Europe to undertake experiments (see response to question 7).

As EU members, the UK benefits from access to the EU-wide MSC actions designed to support researchers at all stages of their careers. These actions include prestigious individual research fellowships, Innovative Training Networks (ITNs) and Research and Innovation Staff Exchanges (RISE), European Researchers' Night (NIGHT) and co-funding of regional, national and international programmes (COFUND).[568] These actions were cited by members responding to this inquiry as essential for supporting post-doctoral researchers in addition to meeting the actions' aims of boosting scientific excellence and business innovation and enhancing researchers' career prospects through developing their skills in entrepreneurship, creativity and innovation.

A further point was made by one respondent regarding MSC fellowships. These fellowships are highly competitive and the respondent felt that they help to mobilise the best scientists across Europe. In some cases, these fellows go on to win permanent appointments in the institute that hosted their MSC fellowship. This benefits both the

[567] http://www.xfel.eu/overview/in_brief/
[568] http://ec.europa.eu/research/mariecurieactions/about-msca/quick-guide/index_en.htm

researcher who could continue their work and the institute, who have been able to secure excellent scientists early in their career who go on to produce high-quality research at the host institution. The emphasis on mobility of excellent researchers reflects the increasingly international nature of research careers – there are opportunities for UK nationals to work elsewhere, as well as for overseas nationals to work in the UK.

Being able to recruit from outside the EU was perceived as more difficult, due to a combination of work permit issues and fewer funding opportunities.[569] One respondent in industry suggested that being able to recruit from a pool of newly-qualified EU scientists was important to businesses, given the difficulties in recruiting non-EU students who had qualified in the UK. In some science subjects, the proportion of non-EU students is increasing, but many companies feel it is difficult to recruit them on graduation due to immigration law.

Q9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU wide immigration policies rather than bespoke ones for the UK?

This was not a specific issue raised by our members. Many cited membership of the EU as a positive facilitator of international collaboration, with collaborations outside the EU being more challenging (see our response to Question 5).

Regulation

Q10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

There are several regulatory frameworks that apply to chemical sciences research. These frameworks cover: chemical substances manufactured or imported into the EU in quantities of 1 tonne or more per year; human and veterinary medicines; food and foodstuff additives; plant protection products and biocides; radioactive substances; and waste. Of these frameworks the first mentioned, the Registration, Evaluation, Authorisation of Chemicals (REACH), is likely to have the greatest impact, not only on the chemical sciences research community and its connected industry but also to all businesses which use chemicals and materials further down a value chain.

REACH entered into force on 1 June 2007 and aims to improve the protection of human health and the environment from the risks that can be posed by chemicals, while enhancing the competitiveness of the EU chemicals industry.

REACH requires that manufacturers and importers of chemicals supplied in the EU above 1 tonne per year (over 30 000 substances) must be registered with the European Chemicals Agency (ECHA) by June 2018. Substances that have not been registered may not be placed on the EU market. A fee is charged for substance registration. Substances used in scientific research and development in amounts of less than one tonne a year are exempted from authorisation and restriction.

[569] *UK Immigration law and its impact on chemistry research and education*, Royal Society of Chemistry, September 2014

While this exemption exists for scientific research and development, there are concerns that future innovation may be impacted by a reduction in the availability of some chemicals because of compliance with REACH. If manufacturers and importers find the financial cost of registering some chemicals outweighs the potential economic returns, manufacturers and importers may decide not to register some chemicals and potentially cease production or import. Despite the exemptions for use in scientific research and development, this could lead to barriers in obtaining the chemicals for research in the first place, if they are no longer available on the EU market.

Although REACH mostly directly affects businesses, any reduction in chemical diversity at a larger scale could potentially impact upon collaborative research undertaken between universities and businesses. There is potential to affect further development of research carried out within academia, by businesses, if specific chemicals are no longer available at a larger scale.

However, some members in our community representing large, multinational companies highlighted the value of a common language in terms of regulatory affairs. Some actually felt that it facilitated a faster procurement of chemicals for research within the EU as there are no regulatory barriers to importing chemicals from other EU nations if the substances are registered under REACH, suggesting that at this stage the potential reduction in chemical availability outlined above is not actively impacting research.

Q11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

Many of those we consulted highlighted concerns about the risks of divergent regulatory practices emerging between the UK and the EU and the impact this would have on their research or businesses. A key issue for some that we consulted in industry seems to be the uncertainty around how regulation would be affected, and the potential (resource or financial) consequences this could eventually have on research within the sector.

For the pharmaceutical industry, the European Medicines Agency (EMA), a decentralised agency of the European Union, located in London, is a key stakeholder in the assessment and approval of new medicines and maintenance of product licences. One of our members working in pharmaceutical research speculated that if the UK were not a member of the EU, then regulatory submissions may well proceed *via* national regulatory procedures through the Medicines and Healthcare Regulatory Authority (MHRA). However, it is unclear whether or not there would need to be a re-evaluation of product licenses previously approved under EMA centralised procedures. It is unclear whether this would affect the availability of medicines to patients and what other consequences (e.g. resourcing or financial) it may have for the companies involved.

Regulation of chemicals is not only a European issue, but a global one, with trading blocs each devleoping their own rules in an ever-changing global environment. An example is the current Transatlantic Trade and Investment Partnership (TTIP) negotiations between

the USA and the EU, aimed at creating a free trade area covering both current trading blocs. Part of the negotiation is concerned with regulatory legislation such as REACH within the EU and regulations set by the Environmental Protection Agency within the USA. Whilst it has been reported that harmonisation between the two blocs is not feasible, steps towards regulatory cooperation between the two bloc are being examined during the negotiations. Though it is foreseen that the TTIP negotiations will have been concluded by the end of next year, it is unclear how UK would be affected by the agreement if it left the EU, both with respect to regulation and more broadly.

From the responses that we received, there was a perception that even if the UK did leave the EU, UK businesses would still have to comply with EU regulations if they wished to sell their products in the EU. Even if UK regulation could be reformed, it was felt that this would simply lead to more regulation that would need to be complied with.

Scientific advice

Q13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

The Royal Society of Chemistry believes that scientific evidence has an important role in the formulation of evidence-informed policy. This evidence will be further balanced against wider social, economic and political factors, which are more complex at EU level, given the scale and range of stakeholders involved.

Q14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

There are many opportunities for UK scientists to inform and influence public policy at EU or international levels. These include responding to consultations, representation on advisory panels and expert stakeholder groups.

A member who has been involved in both UK and EU level committees that provided scientifc advice found that the EU-level committee was more labour-intensive for the scientists involved. They suggested that this is partially a reflection of the more complex stakeholder landscape that the EU represents. They felt that UK researchers were both well represented and respected for their advice and input by their EU colleagues.

Some in our community have indicated that research pertinent to regulatory matters is being rejected from the European regulatory decision making process on the basis that it has been generated by industry researchers or academics in receipt of industry funding. In some cases this has been reported to have occurred where prior links to industry are not relevant to the regulatory matter being investigated. An alternative approach would be to take account of all evidence available but in doing so, declare all conflicts of interest openly and transparently – this includes research that has links to industry, non-

governmental organisations, charities and/or national governments, as well as research with links to industry.

About us

With over 51,000 members and a knowledge business that spans the globe, the Royal Society of Chemistry is the UK's professional body for chemical scientists, supporting and representing our members and bringing together chemical scientists from all over the world.

A not-for-profit organisation with a heritage that spans 170 years, we invest in educating future generations of scientists, we raise and maintain standards and work with industry and academia to promote collaboration and innovation. We advise governments on policy and we promote the talent, information and ideas that lead to great advances in science.

20 November 2015

Royal Society of Chemistry, Professor Paul Boyle, University of Leicester and Diamond Light Source – Oral evidence (QQ 9-24)

Transcript to be found under Professor Paul Boyle, University of Leicester

Royal Society of Chemistry – Supplementary written evidence (EUM0080)

Letter from Professor Dominic Tildesley CBE FRSC, President, Royal Society of Chemistry to the Committee Chairman

Firstly, I would like to take the opportunity to thank the committee for inviting me to give evidence on behalf of the Royal Society of Chemistry, as part of your inquiry into the Relationship between EU membership and UK science. Following on from the evidence session, I wanted to write to the committee with some further information in relation to questions that were raised during my oral evidence session on the issue of scientific advice.

One of the areas that the committee is examining as part of this inquiry is the quality and effectiveness of scientific advice on matters of public policy and how this compares between the EU and the UK. As mentioned in our original evidence submission, the scale and range of stakeholders involved in the development of UK and EU policy are vastly different, making a direct comparison between the two challenging. Below, we outline some brief points on the current situation at both UK and EU level, followed by our comments on the differences.

The UK's current Government Chief Scientific Adviser (GCSA) is Professor Sir Mark Walport. He is supported by a network of Chief Scientific Advisers (CSAs) within government departments (with the exceptions of vacancies in the Department for Culture, Media and Sport, the Ministry of Justice and the devolved administrations in Northern Ireland and Scotland at the time of writing). In addition to this some departments (e.g. Department for Food, Environment and Rural Affairs, Home Office) also have a science advisory council that supports the departmental CSA, providing expert scientific advice on specific topics.

A key part of the role of the GCSA is to ensure that adequate systems are in place across government departments to support the use of scientific evidence in policy making. Working closely with the network of departmental CSAs and supported by a set of 'Principles of Scientific Advice to Government', the UK system of science advice aims to ensure that 'robust, joined-up evidence is at the core of decisions within departments and across government'.

In contrast, EU science advice has undergone a number of changes in recent years. Under President José Manuel Barroso (President of the European Commission 2004-2014), the post of Chief Scientific Adviser to the President of the European Commission was created. The post was held by Professor Anne Glover from 2011-2014. In November 2014, the new President of the European Commission, Jean-Claude Juncker ended the post and charged the Commissioner for Research & Innovation, Carlos Moedas, with developing a new system to provide scientific advice to the European Commission.

In May 2015, Moedas announced a new Scientific Advice Mechanism (SAM) to provide 'high-quality, timely and independent scientific advice' to the European Commission. A key part of the mechanism is a High Level Group (HLG) of seven scientists, providing complementary expertise across different areas of science. The HLG, reporting to the College of Commissioners via Commissioner Moedas, will provide scientific advice on specific policy

issues at the request of the European Commission, but they are also free to provide advice in a proactive manner on topics that they identify as requiring scientific input. They are also tasked with improving the interface between scientific evidence and policy-making across the European Commission. The High Level Group will work closely with existing structures across the European Commission, such as the Joint Research Centre, as well as European and national academies.

An important point to make about the different systems of scientific advice in the UK and EU and their effectiveness is that direct comparison between the two is difficult, given the vast differences between the two environments that they operate in. Different systems may prove more suited at addressing the specific complexities of different environments. However, the key point is that there is an open and transparent way for scientific advice to be incorporated into the policy making process.

Scientific evidence has an important role in the formulation of evidence-informed policy. However, scientific evidence needs to be balanced against wider social, economic and political considerations in the development of policy. There will be differences in how such balances are achieved according to the culture and environment that the policy is created in.

We welcome the instigation of the SAM and note the efforts of the European Commission to demonstrate an open and transparent process in the selection of the HLG and its subsequent operation. Making the details of the selection process publically available, alongside the agenda and minutes of the HLG's first meeting, is encouraging. We welcome the confirmation that the SAM will be provided with operational support from the Directorate General for Research & Innovation and that specific funds earmarked for research and evidence gathering will be provided via Horizon 2020. The new structure actively incorporates the role of a range of existing mechanisms (e.g. national academies and specialised advisory boards) through which scientists from across all member states can already provide scientific advice on European policy issues.

However, it is too early to determine the effectiveness of this new system; the HLG have, to date, met only once. We have yet to see how the interactions between the different parts of the SAM (the new HLG, existing European Commission structures, European and national academies and specialised advisory boards) will work in practice.

I sincerely hope that this extra information around the evidence that we have provided to date proves useful. If you require anything further, please do not hesitate to contact us. Once again, I would like to thank the committee for the opportunity to provide evidence to this inquiry and we look forward to seeing the conclusions of the committee in their report.

1 March 2016

The Royal Society – Written evidence (EUM0067)

Summary

- The European Union is one of the major research funders in Europe alongside individual European countries, charities and businesses. The European research landscape is complex. Researchers collaborate with each other and on the international stage.
- The UK is one of the largest recipients of research funding in the EU: it receives a greater amount of EU funding for research and development than the proportion of its contribution analysis suggests is earmarked for this.
- There are two major routes by which the EU directly funds research in the UK – Framework Programme funding and Structural funds. The UK is more successful in attracting Framework Programme funding, particularly that allocated for excellence, than structural funding, which is largely targeted at building capacity in the least economically developed regions of the EU. If you consider Framework Programme funding alone, the UK was the second largest recipient after Germany in the most recent Framework Programme (FP7). The UK remains a high performer when adjusting for the size of each country's economy, with Germany performing less well. If you also take into account structural funds, Poland is second and the UK comes fourth out of the 28 countries eligible for both Framework Programme and structural funding.
- The UK is the top performer among participating countries in attracting European Research Council and Marie Sklodowska-Curie Actions funding, receiving respectively 22.4% and 25.5% of the total budget for these programmes.
- UK universities attracted 71% of the total Framework Programme funds awarded to the UK during Framework Programme 7.
- UK businesses attracted 18% of Framework Programme funding awarded to the UK. This is below the EU average and much lower than countries such as Germany and France where businesses secured 33% and 27% of Framework Programme funding awarded to them.
- EU funding is of increasing importance to UK universities. Since the last UK spending review, universities have seen their total research income rise slightly, despite experiencing a drop in UK government funding for research through the Higher Education Funding Council and the Research Councils, due to increases in research income from several sources including the private sector and the EU.
- The monetary value of a funding stream is not the sole guide to its value for research. Small amounts of funding in areas where little funding is available, or that offer researchers mobility and encourage collaborations can have a bigger impact than its monetary value might suggest. For example the EU has provided seed funding in areas where the UK now has a reputation for global excellence. This value is difficult to quantify.
- As a European Union Member State, the UK is represented on the European Council, and in the Parliament, through which it can influence the shape of EU research funding and regulation.

- The UK takes part in a number of collaborations with other European countries including joint programmes and sharing research infrastructure. The EU plays a role in many of these collaborations.
- Science is international and researchers commonly move across borders to take new jobs, collaborate with researchers or access scientific infrastructure. Freedom of movement within the EU facilitates this. The Society is undertaking further work to better understand the mobility of researcher.
- Harmonised regulation across the EU offers opportunities for facilitating research collaborations and attracting global investors but it must be developed with input from the research community to ensure it does not have unintended, prohibitive consequences for research.
- The Society welcomes the Commission's renewed commitment to obtaining high-quality scientific advice with the creation of the new Science Advice Mechanism and believes could offer a powerful instrument to deliver effective scientific advice to EU policymakers. As the new system is still in the process of being established, it is too early to assess its effectiveness

Introduction

1. The Royal Society welcomes the opportunity to submit evidence to this inquiry on the relationship between EU membership and the effectiveness of science, research and innovation in the UK. The Society is the UK's national academy of science. It is a self-governing Fellowship of many of the world's most distinguished scientists. The Society draws on the expertise of the Fellowship to provide independent and authoritative advice to UK, European and international decision makers.

2. This submission focuses on the most recent two cycles of EU research funding. This response includes an overview of the European research landscape and the role of the EU within this. It focuses on issues of funding but also addresses questions regarding collaboration, regulation and scientific advice.

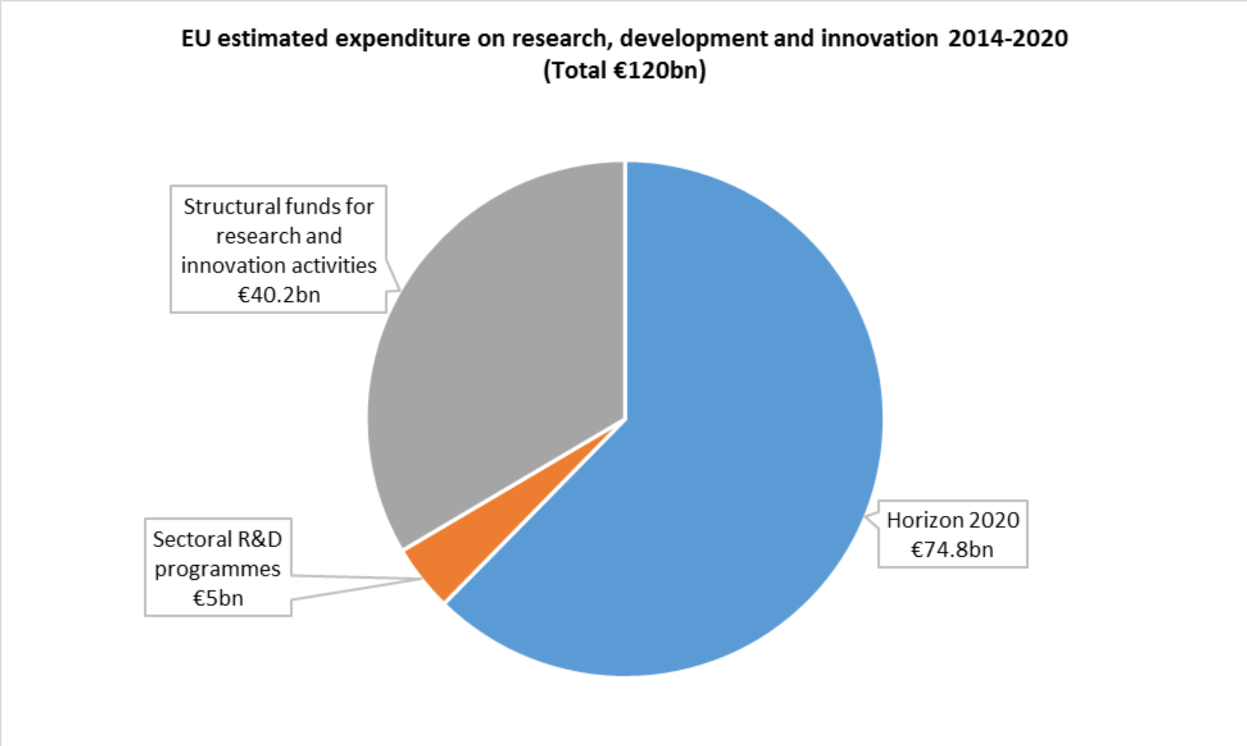
Funding

Overview of EU research funding

3. The EU plays an important role in the European research landscape, by funding and supporting research, but is not the only actor playing this role in Europe. The European research landscape is complex. Regional, national and international actors interact at multiple levels. These actors range from individual researchers, regional institutions, national governments and research communities, businesses, NGOs, intergovernmental organisations and the EU and its institutions. According to estimates by the League of European Research Universities (LERU), 15% of publicly funded research conducted by EU Member States comes from, or is coordinated by, the EU or by intergovernmental organisations. [1]

4. For the period 2014-2020, the EU will provide a total estimated budget of €120bn to directly support research, development and innovation activities. This includes Framework programme funding, sectoral research and innovation programmes that fund research in specific sectors such as space and nuclear energy, and structural

funding directed towards research and development. This figure does not capture indirect investment in research and development through EU programmes such as COSME, some of which supports small and medium enterprises to develop R&D capabilities, and Erasmus+, which supports student mobility.



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[570] Sources:
ERC: http://erc.europa.eu/about-erc/facts-and-figures
MSCA: http://ec.europa.eu/research/mariecurieactions/about-msca/actions/index_en.htm
Structural funds: EU Cohesion Funding, Available Budget 2014-2020 : https://cohesiondata.ec.europa.eu/
Sectoral programmes: European Parliamentary Research Service (EPRS) 2015 briefing Overview of EU funds for research and innovation.
http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568327/EPRS_BRI(2015)568327_EN.pdf

5. The following table provides an indicative breakdown of Horizon 2020 funding, subject to the annual budgetary procedure.[571]

		EUR million in current prices
I	**Excellent science**, of which:	**24 232,1**
1.	European Research Council (ERC)	13 094,8
2.	Future and Emerging Technologies (FET)	2 585,4
3.	Marie Skłodowska-Curie actions	6 162,3
4.	Research infrastructures	2 389,6
II	**Industrial leadership**, of which:	**16 466,5**
1.	Leadership in enabling and industrial technologies	13 035
2.	Access to risk finance	2 842,3
3.	Innovation in SMEs	589,2
III	**Societal challenges,** of which	**28 629,6**
1.	Health, demographic change and well-being	7 256,7
2.	Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy	3 707,7
3.	Secure, clean and efficient energy	5 688,1
4.	Smart, green and integrated transport	6 149,4
5.	Climate action, environment, resource efficiency and raw materials	2 956,5
6.	Europe in a changing world – Inclusive, innovative and reflective societies	1 258,5
7.	Secure societies – Protecting freedom and security of Europe and its citizens	1 612,7
IV	**Spreading excellence and widening participation**	**816,5**
V	**Science with and for society**	**444,9**
VI	**Non-nuclear direct actions of the Joint Research Centre (JRC)**	**1 855,7**
VII	**The European Institute of Innovation and Technology (EIT)**	**2 383**
TOTAL		**74 828,3**

6. Framework programme funding is agreed at the outset of the Framework for the entire period of its operation. These funds are allocated to specific projects during its operation and subject to annual budgetary procedures. This means that changes to the agreed funding can be politically easier than they might be for other EU budgets that are allocated to specific countries at the outset. In 2015 €2.2bn of agreed Horizon 2020 funds was redeployed to form part of €16bn of seed funding for the new European

[571] Official journal of the European Union, 2015 *Regulation EU 2015/1017* http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32015R1017&from=EN

Fund for Strategic Investments[572] (EFSI, also known as the Juncker Plan is intended to leverage €315bn of investments). It is proposed that EFSI will fund projects related to research and innovation. However it is as yet unclear how this will operate and concerns have been raised over restrictions on access to this[573].

Access to EU research funding

7. In addition to the 28 EU member states, non-EU countries are also able to participate in, and receive funding from, EU Framework Programmes through a number of mechanisms.

8. Thirteen counties (including Norway, Israel and Switzerland) enjoy 'Associated Country' status and contribute to framework programme budgets proportionally to their GDP. This enables their researchers and organisations to apply for Horizon 2020 projects with the same status as those from EU Member States.[574]

9. 'Associated countries' are not represented on the European Council or in the European Parliament so have limited ability to influence the direction of European research funding.

10. **Case study - Switzerland.** Switzerland is not an EU member state but is partially associated to with the EU Framework Programmes until the end of 2016. During this time, researchers based in Switzerland can access some parts of Horizon 2020 funding. Extension of this access through till 2020 is dependent on Switzerland's ratification of an agreement on free movement of people related to Croatia joining the EU.

11. **Case study – Norway.** Norway is not an EU member state but is an official 'Associated Country' meaning it participates in Framework Programmes under the same conditions as EU Member States[575].The nature of the agreement signed between Norway and the EU means that terms do not need to be renegotiated with each new Framework Programme.
    Mechanisms also exist to enable non-associated countries to participate in EU research funding under specific criteria. In some circumstances they may receive direct funding while others are required to establish match-funding to finance their contribution.

EU research funding in the UK

12. Methodological note: All graphs in this section refer to the period 2007-2013, the most recent completed EU financial framework, unless otherwise stated. All figures are in euros unless otherwise stated. This is done for ease of comparison as EU funding follows 7 year cycles, year-on-year data is not always available and exchange rates have fluctuated significantly over the period in question.

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[572] European Commission, 2015, *The European Fund for Strategic Investments* http://ec.europa.eu/priorities/jobs-growth-investment/plan/efsi/index_en.htm

[573] Research Fortnight, 2015, *Doubts grow over university access to EFSI* https://www.researchprofessional.com/0/rr/news/europe/universities/2015/11/Doubts-grow-over-university-access-to-Efsi.html

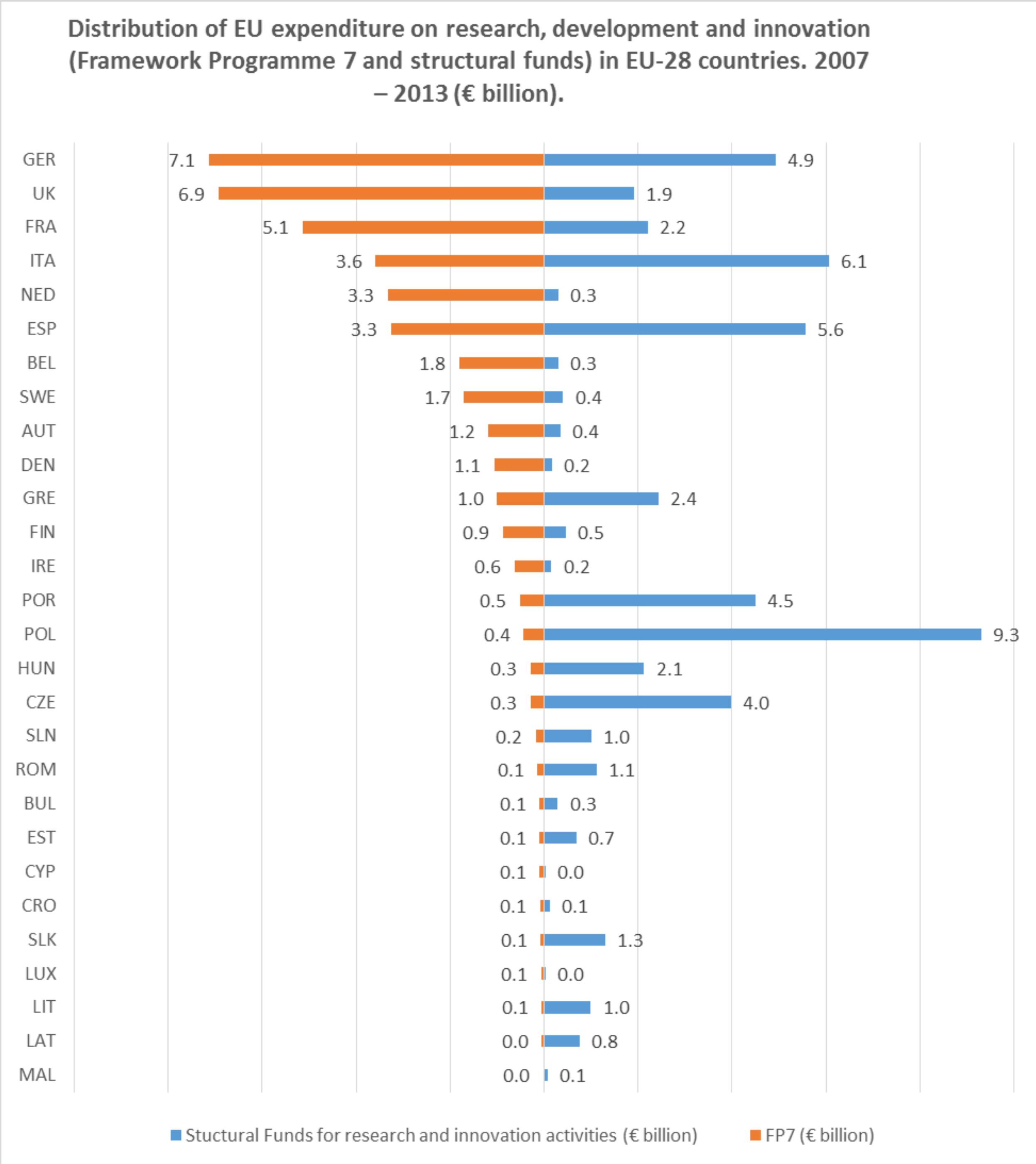
[574] EPRS 2015, EU scientific cooperation with third countries. http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/564393/EPRS_BRI(2015)564393_EN.pdf

13. Overall the UK is a net contributor to the total EU budget. Over the period 2007-2013, the UK contributed €77.7bn to the EU (10.5% of the total EU income from member states), and received €47.5bn in EU funding (6% of the total EU expenditure to member states of €802.7bn).[576]

14. However the UK is one of the largest recipients of research funding in the EU and, although national contributions to the EU budget are not itemised, analyses suggest that the UK receives a greater amount of EU research funding than it contributes. The UK Office of National Statistics has produce an indicative figure for the UK's contribution to EU research and development expenditure of€5.4bn over the period 2007-2013[577]. During this time, the UK received €8.8bn in direct EU funding for research, development and innovation activities. The Society recommends that the Committee seeks advice from HM Treasury and the ONS to better understand how this figure is derived and the robustness of this.

15. The UK received 8% of total direct EU expenditure on research, development and innovation[578], over the period 2007-2013, the fourth largest share in the EU-28. This includes €6.9bn of FP7 funding and €1.9bn of EU structural funds for research, development and innovation activities.[579] Structural funds and Framework Programmes have different objectives and awarding criteria, and support different activities, but funding from the two programmes are increasingly coordinated and synergies are encouraged.

[576] Source: EU expenditure and revenue 2007-2013. http://ec.europa.eu/budget/figures/2007-2013/index_en.cfm
[577] See UK Government Expenditure on SET 2013, ONS. http://www.ons.gov.uk/ons/rel/rdit1/science--engineering-and-technology-statistics/2013/stb-set-2013.html. Exchange rates from UKforex.co.uk
[578] This figure includes Framework Programme and Structural funding but not sectoral research programmes
[579] European Commission Cohesion policy data. https://cohesiondata.ec.europa.eu/ (accessed 28/08/2015)



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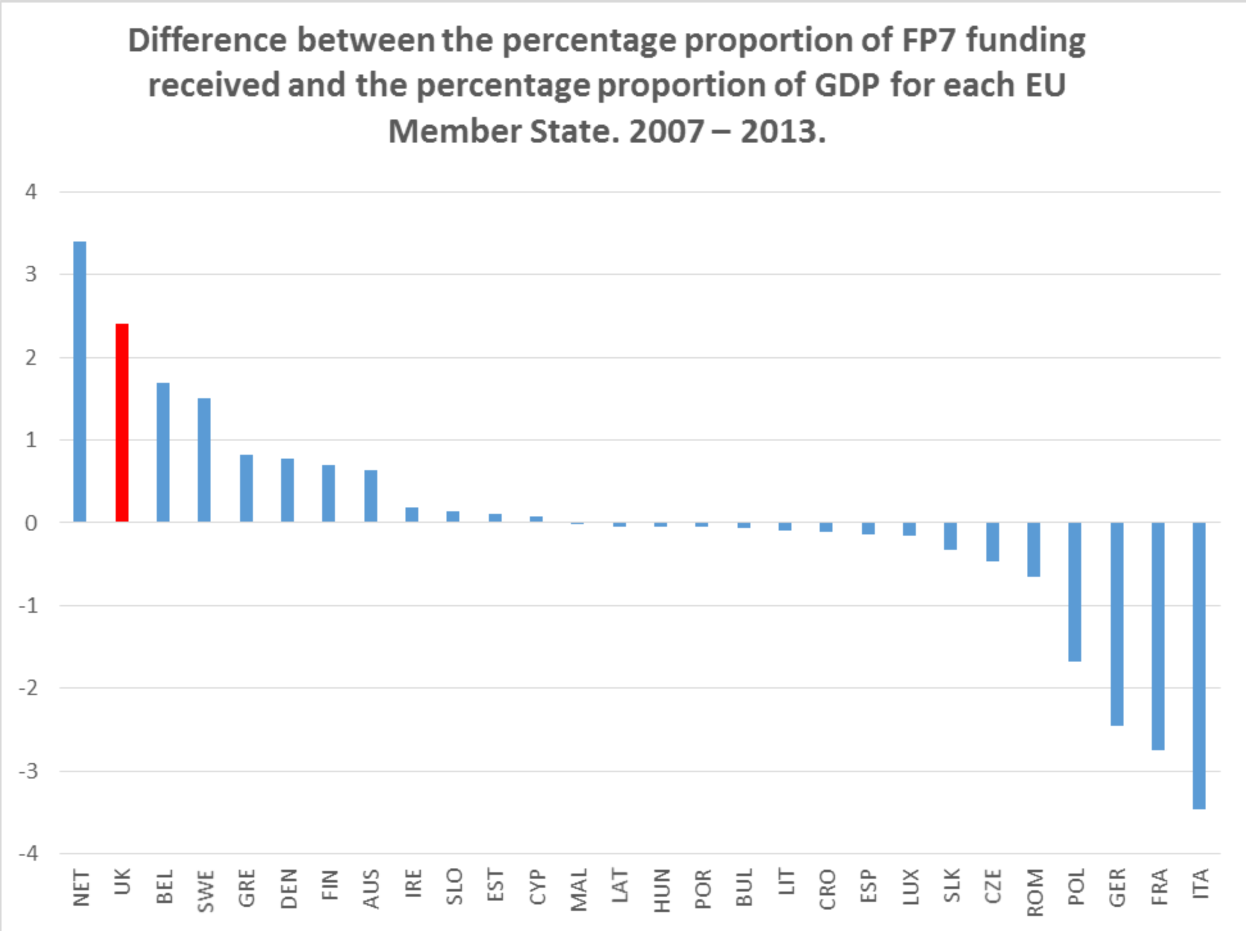
16. These figures do not take into account the relative size of each country's economy. Adjusting the Framework Programme 7 figures for GDP shows that the UK performs

[580] Sources:
European Commission, 2015, *EU Cohesion Funding, Available Budget 2014-2020*. https://cohesiondata.ec.europa.eu/
European Commission, 2015, *Seventh FP7 Monitoring Report* *https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf*

well for the size of its economy, second only to the Netherlands. In contrast, Germany, France and Italy perform less well. A similar adjustment for structural funds shows that those countries with lower GDP perform better relative to the size of their economy, as would be expected for funds targeted at building capacity in the least economically developed regions of the EU. Indeed, the UK, France and Germany are the three lowest ranking EU countries in this ranking.



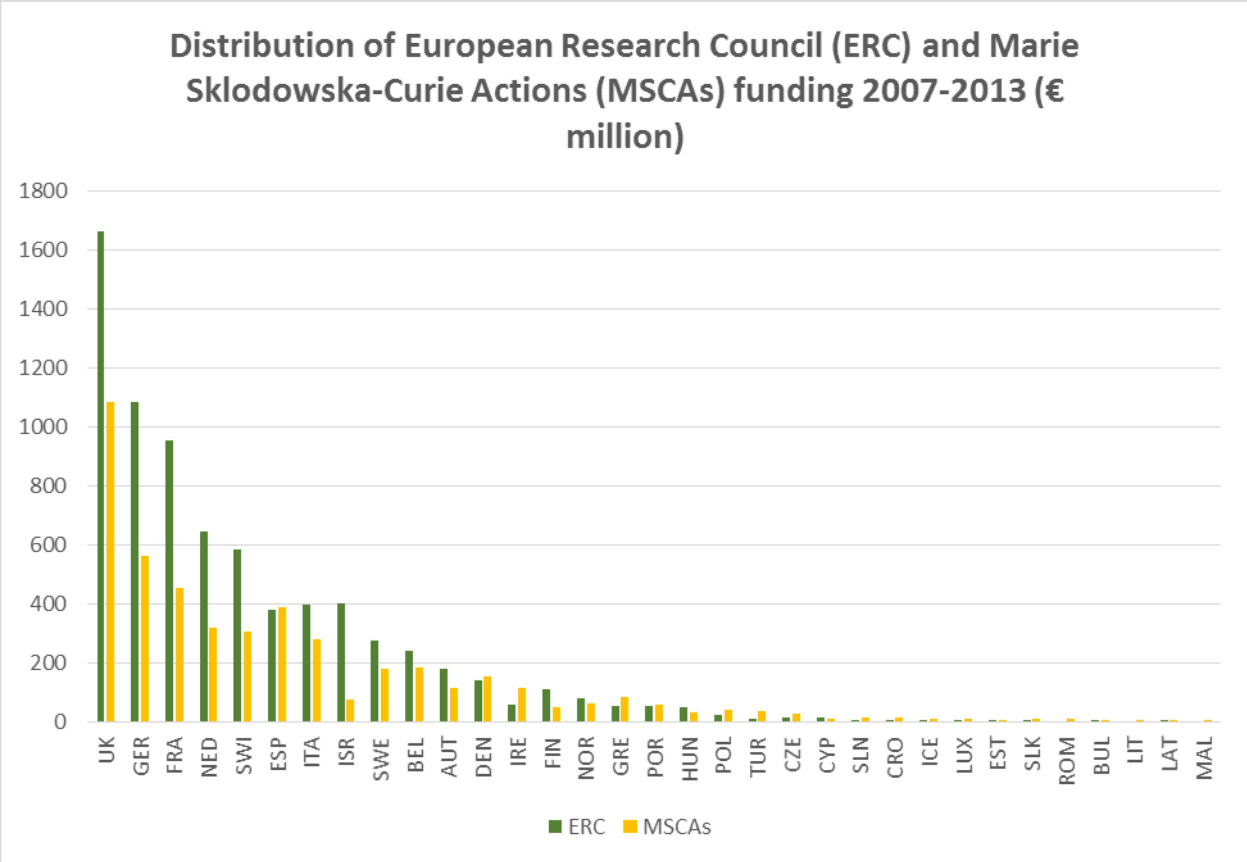
[581]

17. In terms of Framework Programme 7 funding, which is awarded on a competitive basis, the UK was the second largest recipient after Germany, securing €6.9bn out of a total of €55.4bn (12.5%).[582]

18. Breaking down further to look at specific streams of Framework Programme 7 funding, the UK is the top performer among participating countries in attracting European Research Council and Marie Sklodowska-Curie Actions funding. These are awarded solely on the basis of scientific excellence. Researchers based in the UK received

[581] Source:
European Commission, 2015, *Seventh FP7 Monitoring Report* https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf
European Commission, 2015, *Eurostat* http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tec00001&plugin=1
[582] European Commission, March 2015, *Seventh FP7 Monitoring Report*

€1.7bn for European Research Council grants and €1.1bn for Marie Sklowdowska-Curie Actions, respectively 22.4% and 25.5% of the total budget for these programmes.[583]



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19. Framework Programme funding is mostly allocated on a competitive basis, similarly to Research Council funding in the UK. Calls for applications are issued regularly and proposals are peer-reviewed by a panel of experts. Depending on the specific funding stream, different criteria are applied to the calls. For example, calls can be linked to specific scientific or technological themes or address specific challenges.

20. Calls usually require the proposed project to be collaborative and span across different countries and sectors. Other calls, for example those from the European Research Council, are relatively less restricted and evaluated solely on the basis of the scientific excellence of the applicant and of the proposed project.

21. Over the years that Framework Programmes have been in operation, concerns have been raised by the research community about what is perceived as the sometimes

[583] European Commission, 2015, *ERC funding activities 2007-2013*
http://erc.europa.eu/sites/default/files/publication/files/ERC_funding_activities_2007_2013.pdf
[584] Sources:
European Commission, 2015, *ERC funding activities 2007-2013*
http://erc.europa.eu/sites/default/files/publication/files/ERC_funding_activities_2007_2013.pdf
European Commission, 2015, *FP7-PEOPLE Marie Curie Actions Country fact sheets*

excessive bureaucracy of the application and reporting processes for EU funding.[585] In addition most EU funding projects are collaborative with at least three organisations from different countries and building these consortia can pose challenges.

22. The Commission has undertaken evaluations[586] to address many of these concerns in subsequent Framework Programmes and, although not yet resolved, the situation appears to be improving in the current Framework Programme Horizon 2020. At a national level, the system of UK National Contact Points provide advice on how to build a consortium and apply for Framework Programme funding.

23. The UK higher education sector has developed considerable expertise in applying to EU research funding and institutions often employ specialised staff to deal with the application and management of EU research grants. The system of UK National Contact Points play a key role in providing advice on how to apply for Framework Programme funding and a number of organisations, such as the UK Research Office in Brussels (UKRO), also inform and assist the UK research community in accessing such funding.

24. Turning to look at the role of EU research, innovation and development funding in the UK, EU funding from Framework Programme 7 represents 3% of the total UK expenditure on R&D in the period 2007-2013.[587] This figure does not include EU funding from structural funds for research and innovation activities, as only some of these activities fall under the ONS definition of R&D used to calculate the data below. The total proportion of UK R&D expenditure coming from the EU is therefore likely to be higher than 3%.

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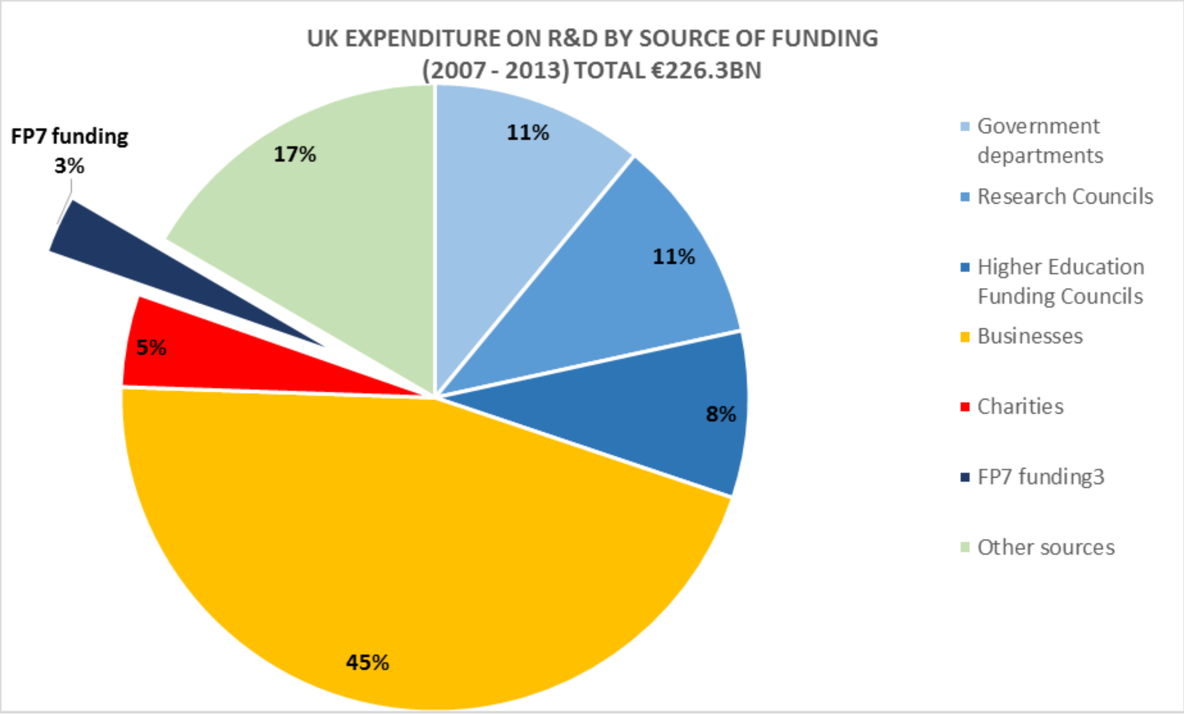
[585] Department of Business, Innovation and Skills, 2011, *Funding for EU research and innovation from 2014: a UK perspective*

[586] European Commission, 2014, *Study on Assessing the Research Management Performance of Framework Programme Projects*

[587] Data from:
Office for National Statisitics, 2013*, UK Gross Domestic Expenditure on Research and Development,*
http://www.ons.gov.uk/ons/rel/rdit1/gross-domestic-expenditure-on-research-and-development/2013/stb-gerd-2013.html
European Commission, 2015, *Seventh FP7 Monitoring Report.*
https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf



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25. In the UK, the university sector is by far the largest beneficiary of EU research funding, receiving 71% of total Framework Programme 7 funding awarded to the UK over the period 2007-2013 (€4.9bn out of a total of €6.9bn). **Br**eakdown by sector is not available for structural funds.

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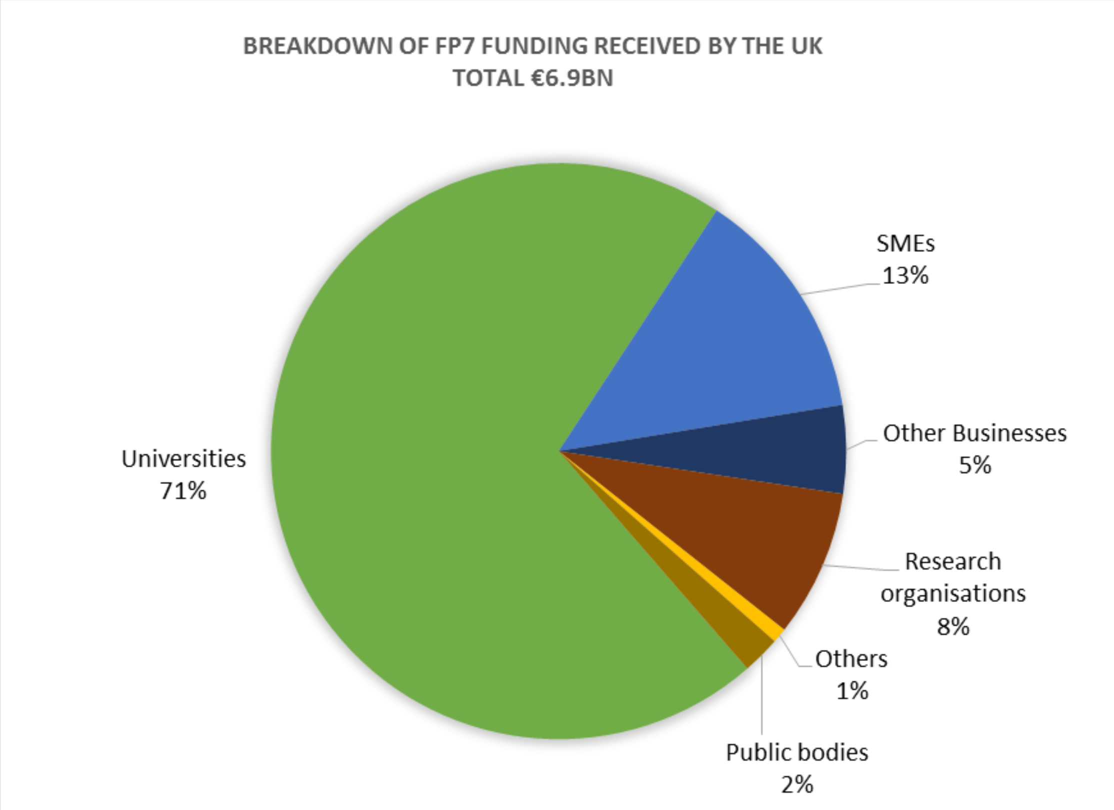
[588] Sources:
Office for National Statisitics, 2013*, UK Gross Domestic Expenditure on Research and Development,* http://www.ons.gov.uk/ons/rel/rdit1/gross-domestic-expenditure-on-research-and-development/2013/stb-gerd-2013.html
European Commission, 2015, *Seventh FP7 Monitoring Report.* *https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf*



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26. Oxford, Cambridge, Imperial College and UCL are the top four European universities in terms of their number of participations in Framework Programme 7 projects, and a total of 13 UK universities are present in the top 25. It is important to note that research architecture varies across participating countries, with research strength in some countries being concentrated in institutes rather than universities.

27. 64% of UK research and development is conducted by businesses[590] yet UK businesses attracted just 18% of the total funds awarded to the UK through Framework Programme 7. This is below the EU average and much lower than countries such as Germany and France where businesses secured respectively 33% and 27% of the Framework Programme 7 funding received by the country. In the rankings of private-for-profit organisations, 2 UK companies (NEC Europe Ltd and Rolls Royce) were ranked in the top 50 European companies in terms of FP7 participations.

28. This relatively low rate of UK private sector participation in EU research funding was highlighted by the Confederation of British Industries in their 2013 submission to the UK Government Review of the Balance of Competences between the UK and EU.[591]

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[589] European Commission, 2015, *Seventh FP7 Monitoring Report* https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf

[590] Office for National Statistics, 2015, *UK Gross Domestic Expenditure on Research and Development 2013*

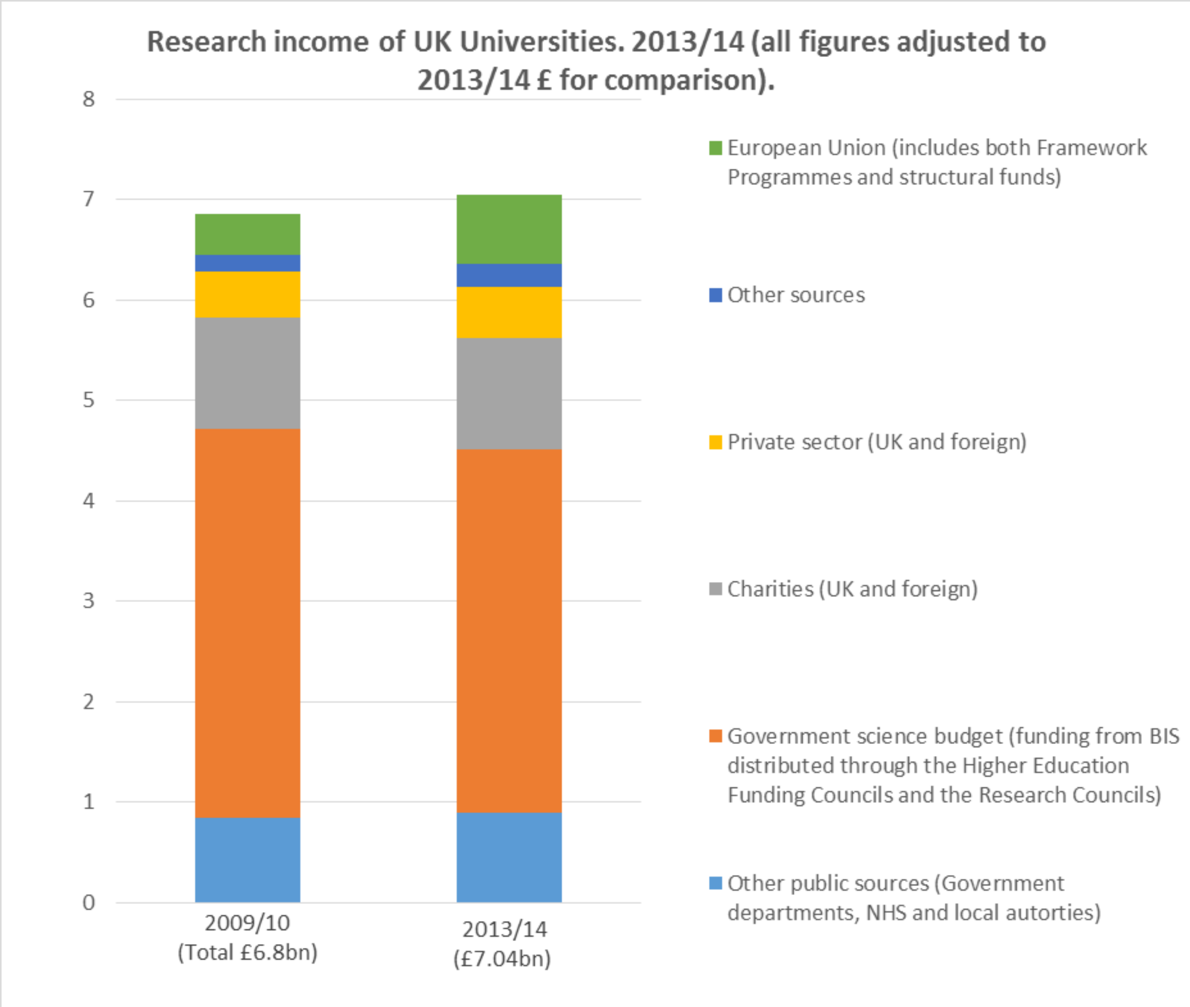
[591] Confederation of British Industry, 2013 *Review of the Balance of Competences between the UK and the EU: Research and Development* http://www.cbi.org.uk/media/2344170/balance_of_competences_review__r_d__-_cbi_response.pdf

29. EU funding plays an increasingly important role in the research activities of UK universities, helping mitigate the impact of domestic fiscal constraints in recent years. The EU's seven year funding cycle provides a more predictable and longer-term source of funding than domestic funding. In 2013/14 (latest data available), EU funding[592] represented 9.7% of UK universities' total research income[593], an increase of almost 4 percentage points from 6% in 2009/10 (the year of the last UK spending review). Over the same period, research income from BIS 'science budget'[594] has declined by 4.5 percentage points, from 56% to 51.5%. In real terms, income from EU funding has increased by 68.2% over this period, while income from BIS has declined by 6.2%. Overall research income has increased by 2.7%.%. However, it is important to note that an increase in EU research funding does not represent replacing like with like - EU funding does not always cover the full cost of research overheads, meaning that recipients will need to meet such costs from other sources of research income, such as QR funding or endowments.

[592] This includes both Framework Programmes funding (FP7 and Horizon 2020) and other EU sources, such as structural funds.

[593] Total research income is defined here as the sum of recurrent research income from funding councils (HEFCs QR) and research grants and contracts

[594] This include research grants from the Research Council's, Royal Society, British Academy, RSE and Higher Education Funding Councils



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30. Participation in EU programmes has also historically performed a capacity building function, providing seed funding to develop research expertise in areas where the UK has later won a reputation for global excellence. For example, European research programmes have enabled the UK to become a global leader in the academic study of climate change impacts. Programmes such as Groundwater Resources and Climate Change Effects (GRACE) and Production of Precipitation Scenarios for Impact Assessment of Climate Change in Europe (POPSICLE), both pursued by the University of Newcastle with funding from the third Framework Programme (1990-1994), gave UK researchers early opportunities to build research excellence and forge strong links with European partners. The networks and research capacity engendered by this early EU funding have helped UK researchers to secure further EU funding, produce cutting-

[595] Source:
HESA, 2015 *Finances of Higher Education Providers 2013/14*, https://www.hesa.ac.uk/component/pubs/?task=show_pub_detail&pubid=1719
GDP deflator from ONS.

edge research, and establish the UK as an internationally recognised leader in this field.[596]

Collaboration

31. Collaborations are vital for science, and scientists want to work with the best in their field irrespective of their geographical location and institutional affiliation. Mobility is a key part of the research endeavour and the UK historically has had a strong track record of attracting the best researchers, however, institutional frameworks can enable, facilitate and promote these collaborations. Most EU funded research is intrinsically collaborative, bringing together experts from different sectors and countries to share knowledge and expand networks. For example, researchers in different countries might operate on different funding cycles, which makes collaborations difficult. By pooling resources together and distributing them in a centralised way, EU funding can simplify this.[597]

32. To facilitate collaborations and the mobility of researchers and scientific ideas, work is underway to create a European Research Area (ERA). This is intended to be: "a unified research area open to the world based on the Internal Market, in which researchers, scientific knowledge and technology circulate freely and through which the Union and its Member States strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges."[598] The aim of the European Research Area is to maximise the return on research investment for both the EU and individual Member States; avoid unnecessary duplication of research and infrastructure investment at national level; and improve the effectiveness and efficiency of the European research community.

33. Research is international and the UK attracts an international research workforce. Of the total academic staff employed by UK Higher Education Institutions in 2013/14 (including both teaching and research staff), 15% were non-British EU nationals and 11% non-EU nationals.[599] European funding can support this mobility. Over Framework Programme 7 (2007-2013), 3454 UK based researchers received funding from Marie Sklodowska-Curie Actions, and 8120 overseas researchers received Marie Sklodowska-Curie Action funding to visit UK organisations.[600]

34. In addition a number of specific EU initiatives seek to promote and support bilateral and multilateral research collaborations between member states. These include Joint

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[596] Royal Society, British Academy, Academy of Medical Sciences and Royal Academy of Engineering joint response, *Government review of the Balance of Competences between the United Kingdom and the European Union*

[597] Royal Society, British Academy, Academy of Medical Sciences and Royal Academy of Engineering joint response, *Government review of the Balance of Competences between the United Kingdom and the European Union*

[598] European Commission, 2012, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A Reinforced European Research Area Partnership for Excellence and Growth* : http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012DC0392&from=EN (accessed 20/10/15)

[599] HESA (2015) *Overview of 2013/14 staff data*

[600] European Commission, 2015, *FP7-PEOPLE Marie Curie Actions Country fact sheets*

Programming Initiatives (JPIs), Joint Technology Initiatives and a number of European intergovernmental agreements and frameworks.

Research infrastructure

35. Broadening access to different pieces of research infrastructure (RI) also represents an important part of the European and international research landscape. The research value of national research infrastructures can be greatly increased by creating international networks and granting reciprocal access to researchers based elsewhere. Different countries, including the UK, play host to the headquarters of international research facilities. The EU provides a forum, the European Strategy Forum on Research Infrastructures (ESFRI), for member states to plan and coordinate international research facilities and provides some start-up funding while operating costs are usually borne by participating countries. Framework Programme 7 earmarked €1.85bn for research infrastructures and Horizon 2020 about €2.4bn.[601]

36. Over the course of FP7, 3539 UK-based researchers have been supported to access 1055 European RIs.[602] Moreover, 107 UK national RIs receive support from the EU to grant access to international researchers, fostering collaborations and the exchange of ideas.[603]EU funding is also available to create and coordinate Europe-wide networks of RIs in the same research area.[604]

37. The UK hosts the headquarters of 6 pan-European RIs, with facilities distributed across multiple participating countries. [605] The UK also hosts 10 facilities that are part of Pan-European RIs headquartered in other European countries[606] and is a member of pan-European RIs entirely based beyond its borders, such as the European Hard X-Ray Free Electron Laser (European XFEL) based in Germany. They are funded by participating countries but the EU can support planning and coordination of these through the European Strategic Forum on Research Infrastructures (ESFRI). The 6 UK-headquartered pan-European RIs are:
    a. High Power Laser Energy research Facility (HiPER) - Harwell, Oxfordshire (Central Laser Facility)[607]
    b. ELIXIR (European Life-science Infrastructure for Biological Information) - Hinxton
    c. Integrated Structural Biology Infrastructure (INSTRUCT) - Oxford
    d. Infrastructure for Systems Biology-Europe (ISBE) – London (Imperial College)

[601] European Commission website https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=framework_prog Accessed on 20 November 2015

[602] Direct communication from the European Commission

[603] European Commission, map of national research infrastructures. Accessed on 21 Aug 2015. https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=mapri

[604] A list of FP funded networks of RIs can be found at https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=ri_projects_fp7

[605] European Commission, map of Pan European research infrastructure. Accessed 21 Aug 2015. https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=mapri_european

[606] European Commission, map of Pan European research infrastructure. Accessed 21 Aug 2015. https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=mapri_european

[607] The HiPER project is currently in planning phase and the location of the actual facility has not yet been established. The Central Laser Facility in Harwell currently coordinates the project.

e. Square Kilometre Array (SKA) – Manchester (Jodrell Bank)
f. European Social Survey (ESS ERIC) – London (City University)

38. The UK is also a part of 12 European intergovernmental research organisations. Each of these organisations has its own institutional arrangements and membership rules, and the EU plays a different role in each. Some, such as the ITER fusion experiment, are directly managed by the EU. Others predate the EU itself and receive only a marginal part of their budget from the EU, such as CERN.

39. It is difficult to quantify the role of the EU in establishing these bilateral and multi-lateral collaborations and whether they would develop in its absence. For example, the European Organisation of Nuclear Research (CERN) was not an EU-initiated project. However it developed at the same time as the European Union was forming and was one of Europe's first joint ventures so should not be considered in isolation. The EU has 'observer status' at CERN and, while its direct investment is relatively low, EU-funded research projects conduct work at CERN and collaborate with researchers working there. Similarly the European Space Agency (ESA) is not an agency or body of the EU but maintains close times with it. The two organisations have jointly developed a European Space Policy. Roughly 23% of ESA's funding in 2015 was provided by the EU, which is more than an individual member nation.
40. Another example is the European Molecular Biology Organisation (EMBO). This led the creation of the European Molecular Biology Laboratory (EMBL) in 1974 that is now housed in 5 sites in Europe including the European Bioinformatics Institute in Hinxton, UK. EMBL is funded by its individual member nations with additional contributions coming from external private investment. EMBO and EMBL work closely with the EU but are independent of it.

41. As part of its work to better understand the impact of the UK's membership of the EU on UK research and its international scientific collaborations, the Society is planning to gather information on the mobility of researchers. The Society will share its findings with the Committee in due course.

Regulation

42. The Royal Society plans to do further work to analyse issues around regulation and will keep the Committee informed of progress. Below we comment on a few specific examples that the Society has engaged with over recent years.

43. The introduction of EU legislation and regulation across the 28 Member States can foster cross-border collaborations by harmonising the procedures under which research is conducted. However it must be carefully designed so as not to be unnecessarily prohibitive for research. For example, the 2001 Clinical Trials Directive aimed to harmonise the standards of trials in the EU, facilitating multi-centre collaborations and promoting multi-national trials. However there were difficulties with its implementation in practice, leading to the development of a Clinical Trials Regulation in 2014 to replace it.

44. Current plans to revise EU data protection legislation with a General Data Protection Regulation have raised concerns that the proposals could prevent important research making use of personal data. The original draft Regulation provided research exemptions allowing for research using personal data, subject to certain safeguards. However, amendments introduced by the Parliament removed these. Negotiations are expected to conclude shortly and the Regulation will, if adopted, be directly binding in all member states. This illustrates the need for Government and UK stakeholder groups to maximise their engagement with all the European institutions to ensure that new legislation, particularly that which is not directly focused on research, does not result in unintended consequences for research.

45. It is important to note that non-EU countries that access EU research funding are obliged to conform to relevant EU regulation.

46. The Society is currently following other areas where the EU plays a regulatory role including intellectual property, copyright and open access.

Scientific advice

47. Policy making is increasingly dependent on complex evidence that could help unlock solutions of great economic and social value. It is crucial that policymakers can access independent expert advice and structures must be in place to ensure they can do so.

48. Currently, the European Commission receives advice from a number of arms-length agencies (such as the European Food Safety Authority, EFSA), expert committees and its own in-house research service, the Joint Research Centre (JRC). Other EU institutions also need and receive expert advice. The European Parliament for example, has a dedicated in-house Research Service, the EPRS. Its functions are similar to the Library services of the UK parliament and the UK Parliamentary Office of Science and Technology (POST). Moreover, informal mechanisms exists to provide scientific advice to EU policymakers. For example, scientific academies and their European networks can brief EU parliamentarians and civil servants on scientific issues of policy relevance.

49. The Society welcomes the Commission's renewed commitment to obtaining high-quality scientific advice with the announcement in May 2015, of a new Science Advice Mechanism (SAM), replacing the expired post of Chief Scientific Advisor to the President of the Commission. The Society was pleased to contribute to the development of this new advisory mechanism. It is particularly welcome that this will be adequately resourced by a secretariat of around 25 officials from the Commission.

50. By institutionalising the role of the European networks of scientific academies to engage with the SAM, and providing financial support to enable them to do so, this new structure could offer a powerful instrument to deliver effective scientific advice to EU policymakers. The Society will engage with the SAM through its membership of two European academies networks, EASAC (European Academies Science Advisory Council) and ALLEA (All European Academies).

51. As the new system is still in the process of being established, it is too early to assess its effectiveness.

52. Many international agreements could benefit from the input of scientific evidence during their development. National governments and the EU provide routes by which this may be possible. For several international conventions the EU exercises its right to vote “en-bloc” on behalf of its Member States (MS). However the EU’s negotiating power can be limited if members states cannot agree the negotiating position. For example, the EU Negotiations at the Conference of the Parties (COP) meeting in Copenhagen, December 2009 broke down at least partly due to the lack of flexibility for the EU to change its position - unanimous support of member states was required to change the agreed negotiating position.

53. With The Lisbon Treaty – signed in December 2009 – the European Parliament gained the right to veto future international agreements, which may serve to strengthen the influence of EU member states in global negotiations. The Warsaw Conference of the Parties in 2013, involved a delegation of 10 Members of the European Parliament, accompanied by members of Committee secretariats including Environment, Public Health and Food Safety. They entered into a series of bilateral meetings with MPs, NGOs and charities, and also received briefings from think tanks.

27 November 2015

The Royal Society, the Academy of Medical Sciences, and the Royal Academy of Engineering – Oral evidence (QQ 25-40)

Evidence Session No. 3 *Heard in Public* *Questions 25 - 40*

TUESDAY 12 JANUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Kakkar
Baroness Manningham-Buller
Baroness Neville-Jones
Lord Peston
Lord Vallance of Tummel

Examination of Witnesses

Professor Alex Halliday, Vice-President, Royal Society, **Professor Sir Robert Lechler**, FKC, President, Academy of Medical Sciences, and **Professor Ric Parker** CBE FREng, Director of Research and Technology, Rolls-Royce plc, representing the Royal Academy of Engineering

Q25 The Chairman: On behalf of the Committee, I welcome our three representatives from the learned societies to our session. We are most grateful to you. We are being recorded and broadcast, so you may wish to note that. Could you therefore introduce yourselves for the record, and, if you would like to give a brief opening statement, feel free to do so at the same time. Perhaps we could start with Professor Halliday.

Professor Alex Halliday: I am Alex Halliday, a professor at Oxford University and vice-president of the Royal Society. I would like to say a few things. I left this country in the mid-1980s to go to work in America because even though, as I saw it, I was very successful here, the amount of funding was not adequate for doing what I needed to do science-wise. I went to America and built a big research programme and was there for about 12 years. I then moved to Switzerland and was there for about six years, so I have experience of the Swiss system. I have also had experience of trying to organise European Union networks through Switzerland. In 2004, I moved to Oxford and became a professor there. After three years, I became head of science and engineering at Oxford University, which are the non-medical sciences, and so I have a perspective on the critical dependence we have nowadays on European Union funding in non-medical science and engineering. I stepped

down from that role about a year ago and became vice-president of the Royal Society, which is why I am here today.

Professor Ric Parker: Good morning, your Lordships. My name is Ric Parker and I am here on behalf of Dame Ann Dowling, the president of the Royal Academy of Engineering. I am the chairman of the research committee of the academy. My day job is director of research and technology at Rolls-Royce. I am also the chairman of the Clean Sky joint technology initiative in Europe, which is a €4 billion research programme. I have been chairman of that for the last three years, so I think I have a fair amount of interaction with Europe, both in my role in the academy and at Rolls-Royce. Rolls-Royce is one of only two UK companies in the top 50 in Europe that are beneficiaries of the Framework 7 research funding, the last complete programme, so I think we have a fair amount of experience in that area.

Professor Sir Robert Lechler: Good morning. My name is Robert Lechler. I am the recently appointed president of the Academy of Medical Sciences, as of six weeks ago. I have two day jobs; I am vice-principal of King's College London, the biomedical half of the university, and I lead King's Health Partners, one of the UK's six academic health centres.

By way of opening remarks I would wish to say that there are four material issues, as I see it, for debate here. The first is funding, and Professor Halliday has referred to that. The EU has become an increasingly important funder. We are a net gainer through our participation in the EU. The second is that collaboration is increasingly important in addressing major questions in science, and the EU has been a very important catalyst of co-operation and continues to be so. Thirdly, people are key to success in science and the mobility of people is essential. We enjoy the freedom of movement of scientists, and the UK receives a lot of continental European scientists into our faculties. Finally, I see the harmonisation of regulation as a very important enabling step in pursuing high-class research.

Q26 The Chairman: Thank you very much, Sir Robert. We would like to start the questions now, if you have nothing further by way of introduction.

Could I address my first question specifically to Professor Halliday, to clear up a point about which I am a bit confused in the evidence that you have kindly submitted to us? You have given us charts which show, as indeed the evidence suggests, that the United Kingdom does well from R&D funds in the European Union. I am looking specifically at the written evidence from paragraph 15 onwards, which shows the balance of framework programme and structural funds. But then, in the recent report put on the Royal Society website, figure 8, which adjusts for total EU research and development funding, with structural funds added, it appears that we are not doing at all well. In fact, it states that the UK receives the third least funding out of all 28 member states. Could you help us by reconciling these two observations?

Professor Alex Halliday: Yes, we do extremely well in framework funding—the competitive research grant side—so it is very important for our university sector in particular. Regarding fundamental infrastructure issues, we do not have quite the same issues that places such as Poland have; a lot of funding is going to countries such as Poland where they need to rebuild. Parts of the UK get that funding, such as Cornwall, parts of Scotland and parts of Wales, where there has been a need for investment, and the European Union has been providing some of that funding for infrastructure. However, the scale of what is needed in

the UK compared with what is needed in some of the other countries in the European Union is not the same at all.

The Chairman: I am still a bit mystified, because in your evidence to us you show €7.1 billion as the figure—I am looking at Germany now rather than the United Kingdom—at the top of the list for Framework Programme 7 and €4.9 billion for structural funds, which is not too bad at all really, compared to most other countries, and us at €6.9 billion, and doing, as you say, not at all well on structural funds at €1.9 billion. Yet when you convert that in your figure 8, Germany is doing even less well than us. I do not see how these two figures stack up.

Professor Alex Halliday: Figure 8 is normalised for GDP, which makes a massive difference to those figures.

The Chairman: So when you normalise for GDP, and if you take structural funds as if they are for research and development, which of course they are not necessarily, you have a position where, quite frankly, the UK, Germany and France are doing rather badly.

Professor Alex Halliday: Yes, and I think that is recognised.

The Chairman: But is it logical to treat structural funds in this way in your chart?

Professor Alex Halliday: Maybe we could think about whether we should have presented them in that way or not. We were trying to be clear with the evidence we had in terms of normalisation for GDP. The key issue for us is that the UK does incredibly well out of framework funding for research, which is the big part that we deal with. The case is not as strong on what infrastructure is needed in the rest of the UK. In the case of Germany there is also, of course, the fact that it has a bigger industrial sector in many respects that can link into European programmes, so there is another issue there. Typically, its industry side is much more successful at getting framework money than our business side.

Lord Kakkar: Just to follow up on that, is the basis on which the allocation of structural funding is made different? It is not by the competitive nature and the excellence of the applications made but rather by local need. Is that correct?

Professor Alex Halliday: I do not honestly know and I should find out about that, but maybe Ric knows.

Professor Ric Parker: I can clarify that. We are talking here only about the element of structural funds that is directly linked to the research programmes, not overall structural funds. The structural funds are allocated separately on the basis of local need, as you say. There has been a directive more recently from the Parliament that a proportion of those structural funds should be linked directly to the research programmes and provide research infrastructure, but it does not actually move where those funds are allocated in Europe, so they fall where they fall. As you say, as a proportion of GDP, Germany does not do very well, but the former East Germany still benefits significantly from structural funding.

Lord Kakkar: Do you think that is an appropriate way to make that allocation? Generally, if I understand things correctly, if we have the opportunity to invest in infrastructure in science in the UK on the basis of competitive bids, those would be independently, rigorously and objectively assessed against criteria and against excellence, and then the funding for those important infrastructure investments would be made on the basis of excellence. That is not

the case with this particular funding stream in Europe. Does that undermine it to an extent or is that the appropriate way for those funds to be allocated?

Professor Ric Parker: I will not argue as to whether it is appropriate or not, but I think it has a different purpose in mind in the eyes of the European Union. It is to stimulate infrastructure in areas that previously would be unable to afford that investment themselves, so I think that is the primary directive. Large infrastructure projects, such as the new fusion torus down in France and CERN, are quite separate from these decisions as to how the local infrastructure funds are allocated under that budget.

Q27 Lord Peston: I have two questions for clarification. The first is that the House of Lords has only been back two days and I cannot work out what all these short names for countries are. Can you tell me where “Mal” is?

The Chairman: Malta.

Lord Peston: Thank you. The real clarification that I need concerns the fact that all these two pictures tell us is what you get. Is that right? They do not tell us anything yet about what you do with what you get or the criteria for allocating the funds. This simply says that this is an outcome story. Am I right about that?

Professor Alex Halliday: How well the UK does in science and technology, as well as in other areas of academia, is measured by things such as the UK’s research assessment exercises or, alternatively, by citation analysis, bibliometrics.

Lord Peston: I know about that, but this does not tell us about that. All this tells us is what we get.

Professor Alex Halliday: It is a contributor to that as regards the funding, yes, so at the same time as our funding has gone down in real terms from UK government sources, we have had this other source of funding that has come in to maintain the UK’s excellence.

Lord Peston: Fine. We will come on to what we do with what we get in the questions.

Baroness Neville-Jones: I, too, need some further clarification, if you do not mind. What precisely is the nature of the link between research and this research-related structural funding? What criteria do they use to determine why there should be this add-on?

Professor Ric Parker: The intention again was to stimulate research capacity as opposed to research excellence in areas that were a little below the line.

Baroness Neville-Jones: Does it mean economic development of the area? What does it mean?

Professor Ric Parker: It is channelled in two ways. It can be channelled into physical infrastructure, creating new laboratories or new facilities. Some regions have chosen specifically to allocate it to stimulating local SMEs to engage in research programmes where they would not engage otherwise. Some of the structural funds are directly linked to some of the large European programmes, such as the Clean Sky programme that I run. They get tied together and become a boost to the total pot of money available to achieve that programme’s objectives, but they are constrained because they are geographically allocated. We do not have the freedom to move them around.

Baroness Neville-Jones: So there is a lot of discretion in there, is there not, if there is that degree of variety?

Professor Ric Parker: There is no discretion on behalf of DG Research or any of the major research programmes in where structural funds fall overall. That is handled by DG Regions in Europe and has nothing to do with DG Research. The cross-linking came fairly recently when there was an instruction under Mr Barroso's presidency that a certain proportion—I forget the exact number—of structural funds should be used directly to support research infrastructure and, as I say, that has been loosely interpreted to mean either physical infrastructure or encouraging more engagement in a local region.

Baroness Neville-Jones: It is that area where the UK does relatively badly?

Professor Ric Parker: Simply because we do not get much by way of structural funds at all, not because we are not good at using them for research purposes.

Baroness Neville-Jones: I see. So it is a small proportion because it is a small proportion?

Professor Ric Parker: Yes.

Q28 Lord Kakkar: Has any kind of assessment been made in determining how effectively the structural funding has been used over time by the European institutions? Has the investment resulted in increased capacity, which in turn has resulted in the delivery of research excellence, for instance? Would it be fair to say that if those funds had been invested elsewhere in the European Union to drive infrastructure development—for instance Germany, France or the UK—the research outputs might have been greater?

Professor Ric Parker: I am not aware of any such analysis, no.

Q29 Lord Hunt of Chesterton: In yesterday's *Guardian* there was an article by a Dutchman who was being critical of Britain's approach to joining the EU. The point he made, which I think is very interesting and relevant to us, was whether we regard Europe in a transactional way or a transformational way. Everybody is looking at the beans and how much money comes in, but the question is whether our involvement in the programmes is transformational. Looking forwards instead of always looking backwards, are there ways in which one can envisage further transformational changes to science, technology and industry where membership of the EU would help us?

Professor Sir Robert Lechler: Again, I am concerned that we do not lose sight of the fact that the UK does very well out of the competitive research funding allocation. We have focused on the structural funds, but as regards the research funding we put in 11% of the budget and we get back 16%, and that is a fairly consistent pattern. That reflects the quality of UK science of course.

On the non-transactional aspects, I would come back to my opening remarks. I think that collaboration and big science and so on are increasingly important to all scientific disciplines, and I think in that sense the EU has been very much a catalyst for that kind of collaboration. I would also observe that over the last decade or two there has been something of a shift of collaborative links between the US and the UK, and continental Europe and the UK. I think that has been very positive, because in some ways, practically, it is easier. I think the mobility of scientists between countries is another very important transformational element. The fact that 30% of the European Research Council grantees working in the UK are from continental Europe is an indicator of the level of mobility and how much European funding supports that.

Another aspect is the industry issue. In its 2014 manifesto, the BioIndustry Association observed that the harmonisation of regulation was one key reason why major pharmaceutical companies had chosen to put their European headquarters in the UK. All those things are relevant to transformational as opposed to merely the transactional, aspects of money.

Professor Ric Parker: I agree. I would add that one of the major transformational contributions is in plugging some of our major skills gaps, even on the research side alone. If you look at engineering doctorates in particular, only 39% of the doctorates completed in the UK are by UK nationals, and we depend on other non-UK European nationals to come and do another 14% of the doctorates in this country. Without that sheer manpower to drive our research forward, we would be in a much poorer state. I think the comments made are quite right. We get too hung up on the straight, "We've put 50p in. Do we get 60p out or 40p out?" That is not the nub of the argument. The nub of the argument is what the overall benefit is. There are huge benefits, as has already been said, not only in the skills gap from mobility of researchers, both in and out of the UK, but from the sheer collaborative framework in Europe, which adds to European competitiveness as a whole.

Lord Hennessy of Nympsfield: Is that 39% for the arts and humanities as well the sciences?

Professor Ric Parker: I only have the figure in front of me for engineering. I can probably find the figures for overall PhDs.

The Chairman: Perhaps if you leave that to one side and if you need to send in written evidence later on, that would be helpful, or we may have it ourselves.

Professor Alex Halliday: I wanted to say that there are of course big European collaborations, such as CERN, which are there as European collaborations but which involve organisations and individuals who are not part of the European Union, but at the same time the opportunity to influence many of the things that happen in Europe is greatly improved by the fact that we are members of the European Union. That is particularly true in framework funding where we have had a disproportionate influence and we do extremely well in getting the funding, and in being able to discuss the things that we should develop within Europe, in a way that you cannot if you are based in Switzerland, for example.

Q30 Lord Kakkar: When we look at the initial public opinion polls on membership of the European Union and the evidence that we have received so far to this inquiry from the scientific community, it appears that the scientific community is more enthusiastic about European Union membership than the public at large. Do the national academies plan to engage in the wider debate with regard to European Union membership? If so, how, practically, are you going to do this and, if not, who do you think should be making the arguments for science and European Union membership?

Professor Alex Halliday: I think it is the role of the academies to lay out the facts so that everybody is aware of them, whether you are for or against, and that is the main thing we have been trying to do. We produced this first report about the funding side just before Christmas. There is another one coming along on mobility issues and a third one on regulation issues. Those will be available for people to see collations of the evidence and for people to think about what being part of the European Union brings to us. That is the primary role that the Royal Society, in particular, has to take part in.

There is no question that individuals such as Paul Nurse and Venki Ramakrishnan have come out and been quite vocal about their views, just as the universities have spoken up on this very clearly. As an academy, it is our job to try to present the evidence to help inform debate. That is the primary role. Some of the evidence could take a bit of unpicking, and that is where individuals may be able to play a bigger role than hitherto. For example, we show in the Royal Society report that the overall contribution of the European Union is about 3% of R&D in the UK. If you look at Oxford University, which is one of the leading universities in the UK, and if you take the science and engineering part, the non-medical sciences, the research funding that we get from the European Union is equivalent to about half of what we get from the whole of Research Councils UK, which is several research councils combined and only about twice what we get from the European Union, so it is a major amount of money that we are getting. One of the reasons why we are so competitive in the European Union in this context is because we have leading academics and institutions in the UK that can go in and get that funding and be competitive in the broader playing field of Europe. That is a great advantage and it has been very important for the growth of research in top institutions in the UK. If you talk about public perception, to go back to your original question, the public has probably heard that universities think they are great and that there is scientific and bibliometric evidence for that. They have probably also heard David Cameron talking about how proud he is of UK universities as one of the things he feels has done really, really well in this country. If the UK is about trying to achieve excellence, despite its size relative to other parts of the world, I think there is a very good story to tell about the way the European Union has fed into that excellence over the last 10 years or so.

Professor Ric Parker: From the academy's point of view, we take the same line. We want to ensure that the debate is science and data rich. As an academy, we are not going to lobby for any particular viewpoint. There are other organisations lobbying out there, subsets of our congregation, such as Universities for Europe and Scientists for EU, which are taking a very firm opinion one way or the other. To build on Alex's point, we need to get the facts in front of people that the UK is a significant beneficiary from European programmes both financially and, more importantly, for the richness of our own research base and the people participating in it as a result.

Professor Sir Robert Lechler: The Academy of Medical Sciences has a similar position in that we wish to ensure the debate is fully informed. We may engage with the media to make sure that information is disseminated as widely and as effectively as possible. Influencing the debate is a different issue and we have not taken a decision on that. I suspect we may find ourselves surveying our fellowship to make sure that I am representing the fellowship's view. Time will tell. It is early days in this whole process and we do not know what the date of the referendum will be, and so on. We certainly want to ensure that the debate, from a science point of view, is as informed as possible.

Q31 Lord Peston: I am supposed to raise the question of EU funding and what is called the vitality and productivity of our science base. I am not clear myself whether my question means specifically EU funding—namely, that it has special characteristics that are especially helpful—as opposed to domestic funding. Could you comment on that? Are there aspects of EU funding that are especially conducive particularly to the productivity of our science base?

Professor Alex Halliday: I think you heard recently from Steve Cowley on the impact of EU funding and Europe as a whole and what it has done globally to science. I think that is very

apparent if you look at what America has been like regarding major scientific collaborations and what Europe has now come to be like regarding such scientific collaborations. It is a phenomenal story of success of investment in large-scale collaborations where they are not exclusive but they are based in Europe. There is an engagement and the UK plays, as I say, a disproportionate role in that because of the excellence of the science base here. We get a large amount of money back to our research that goes on here in the UK. It has become critical in times of fiscal restraint to have that funding. We also exert a huge amount of influence in being able to set the science agenda not just for Europe but for the world, because Europe is becoming a leader in areas such as particle physics and people are moving to Europe, and less to America, because this is the place to be. It gives us an opportunity to do things that are truly wonderful on a global scale by having, if you like, a disproportionate influence on what can go on.

To go back to what Robert said in his introductory remarks, mobility is very important from the point of view of getting people to work together and communicate. There is funding for that in the European Union and we get a large amount of money for that out of these framework programmes. It is also particularly important for young people who want to be part of something bigger than just the UK, France or Germany. They get a great deal out of spending time in laboratories in other parts of Europe as a result of those framework agreements. Regarding the legacy for future generations of scientists, it is going to be immensely important.

Lord Peston: In my notes it says that the EU funding programmes have a longer time horizon. Could you confirm that?

Professor Ric Parker: Typically, they are seven-year programmes. Framework 7 was a seven-year programme. The new Horizon 2020 is a seven-year programme. They are 10-year programmes, but the grants are allocated for seven years and then burn off over the final three years of the programme, which usually overlaps with the following programme. It is one of the strengths of Europe that the UK could learn from: that we have this consistency of objective and financing and we can plan, both from an industry point of view and an academic point of view, on these programmes being there. We know what the major themes are over this long-term horizon, and it does aid planning, recruiting of staff and other things if you know that there is a programme here that is going to run for 10 years and we are going to take a major part in it.

Lord Peston: I must have misread my notes. I assumed they meant the EU was interested in payoffs in the further distant future rather than the short term.

Professor Ric Parker: There is a balance across the spectrum of what we call the technology-readiness level. The European Research Council is funding stuff with long horizons research for the future. The framework programme, Horizon 2020, tends to concentrate on collaborative research and the pull-through of technology from the research base into European industry, so you have that complete spectrum within the European funding.

Lord Peston: I have one last supplementary specifically to Professor Parker. You said you were connected with Rolls-Royce. Let us carry out a thought experiment and assume that funding from the EU dropped drastically. I take it that the private sector is part of the science base?

Professor Ric Parker: Yes.

Lord Peston: Do you think there is any possibility that the private sector would make up the difference if we lost money from the EU?

Professor Ric Parker: No, I think the private sector is already spending twice what the Government are spending on the R&D base in this country. We are more than footing our share of the bill.

Lord Peston: That is right.

Professor Ric Parker: We certainly do not have any more to put into the pot and, frankly, we have choices about where within Europe we do that research. If we were not going to do it in the UK, we might do it in Germany.

Professor Sir Robert Lechler: I have a couple of supplementary points. The first one is to reinforce what Alex said. EU funding is a big part of our portfolio of funding. In the Russell group, about 13% of our research spend comes from the EU, so it is a very significant fraction. I would highlight two distinctive things about EU funding as opposed to any other funding. The first, as I said earlier, is that framework schemes have catalysed collaboration, because for the framework funding you need to have multiple countries participating in a bid in order to get the funding. One might say that sometimes that was slightly overengineered, but it certainly fostered collaboration.

The second scheme that has been distinctive is the Innovative Medicines Initiative, which is quite a substantial budget, and to win that kind of money you had to have a partnership between an academic institution and industry. The UK has been number one in receiving that money and, again, it has been catalytic in fostering industry/academic partnerships. Those are two particular bits of vitality.

Q32 The Chairman: I will follow up Lord Peston's question to Professor Parker about business spend on research, particularly in the European context. In its written evidence to us, the Royal Academy of Engineering pointed out that the UK has the lowest success rate for business applicants for funding from Europe[608], and it felt that United Kingdom businesses—not SMEs, but larger businesses—are not adequately supported when they apply for European Union research and innovation funding. Would you like to elaborate as to how you think business should be more adequately supported?

Professor Ric Parker: Yes, the proportion of European money that goes to business in the UK is low compared to many others, but the absolute amount of money is second only to France and Germany, so, again, we have to be careful to talk percentages or talk amounts. Regarding the money that flows directly to British business out of the framework programmes, we are tucked in behind France and Germany. In the UK the difference is we are much better at engaging our SME community. Our small to medium-sized enterprises are quite good and effective at getting at European funding. I do worry, for reasons I will come back to, that that may not continue. As I said, only two large companies in the UK, Rolls-Royce and one other, are in the top 50 recipients in Europe. That is well below our batting average or where it should be if we were pulling our weight. I am not sure why that is the case for UK companies, but one of the changes in the support mechanisms in the last five or so years is the removal of the RDAs. The RDAs, through their innovation funds and

[608] compared to France and Germany, with the UK ranking 7th out of all 28 members states, Royal Academy of Engineering written evidence,

their innovation boards, did a lot to stimulate engagement in Europe from the business community. The LEPs that have replaced them no longer have that prime objective and the funding to achieve that, so we are seeing less stimulation of UK industry to engage in the European programmes, which is regrettable.

Lord Hennessy of Nympsfield: When Lord Wilson, as Prime Minister in 1967, was preparing the Labour Party's second application to join the then EEC, he stressed endlessly that what we really could bring to the Community was science and technology as part of our special gifts and accomplishments. Did it turn out that way?

Professor Ric Parker: Yes. We are major participants in collaborative programmes. If you look at European Research Council funding across all three grant types, 20% of all grants come to the UK. In that we are major participants and in that these are collaborative programmes, we are educating and leading the rest of Europe in many of these areas, and bringing our thought leadership and, in our case, our industrial leadership to Europe, so I think it could be said to be true.

Q33 Lord Fox: I should declare my interests at this point as it is the first time I have spoken. I am employed by and have a financial interest in GKN plc, which is a participant in EU funding programmes, including the Clean Sky programme. You mentioned that some countries seem to support businesses better in their endeavours to get this money. Which countries would you highlight and what particularly about what they do is better?

Professor Ric Parker: I think the German system works particularly well. There is an infrastructure at the Länder level. It is largely down to granularity, particularly with smaller companies. We expect them all to come to London to get advice and help and that is not going to happen. When we had the RDAs, they could go to their local regional development agency and get that help and support, particularly if it was the first time they had ever submitted a grant proposal. The other support they need is finding those partnerships across Europe if they do not know their way around. There is a lot that can be done to help. It is part of the formal remit of Innovate UK, if you look at their charter, to help in this way. Again, that is very London-centric and tends to be a website people can go to and it really needs to spill out into the regions a bit more.

Lord Fox: You are not finding that the LEPs are stepping into that role?

Professor Ric Parker: The LEPs are at the wrong granularity. They are too small. They have no consistent blueprint. Some of them do quite a good job of this; others do not. There is no instruction that they must all operate in this way. It is largely down to each individual LEP and how it chooses to engage, and they do not, by and large, have the funding to participate in this sort of activity in the way the RDAs did.

Lord Hunt of Chesterton: Is your response back to the response on question one? On the continent of Europe, you could say the concept of Europe—the political, economic and technical aspects—is very much done at a regional level. Indeed, it is the people in the regions in Europe who understand why they are in Europe and what it is about, whereas, when it is very London-centric, we miss out on this. My question to the academies is: who are you talking to when you are trying to explain Europe and science? Surely the answer is it must be through the regions and the regional elements of the UK, because in those areas people identify industry and technology. I just wonder whether that is possibly part of the way of outreaching your debate. Have you thought about that?

Professor Alex Halliday: I think it is something we can do. As I say, the Royal Society's job is to provide the data and facilitate the debate rather than to actually say what we should do. Communicating with the regions is something we are doing increasingly and holding meetings around the regions of the UK about a variety of things. At various stages, the president of the Royal Society has led that activity and it is something we should definitely consider doing more of. Of course, the universities are also involved increasingly with the LEPs and the local regions, councils and businesses. The universities have engaged increasingly, particularly in places such as Manchester, in seeing how the region develops and helping to inform discussion. There is a lot of feed-through that comes to the higher education sector as well.

Q34 Lord Cameron of Dillington: Does our membership of the EU influence R&D investment by outside businesses into our research and development programmes? Does our EU membership, both in the investment we get from the EU and indeed collaboration, encourage international investment? What would happen if we were an associate country, such as Norway or Switzerland, would we attract similar amounts of money? For that matter, in the case of a Brexit, would we create new international partnerships with the US or the Commonwealth or China? Would we be equally successful in attracting international funding from businesses? How do you see the international business research funding being affected?

Professor Sir Robert Lechler: Shall I start on that because I have already made reference to it in regard to life sciences and the pharmaceutical biotechnology industry and so on? I quoted to you some observations made by the BIA, and the Association of the British Pharmaceutical Industry has made similar observations. They would say that harmonisation of the market and regulation has been a factor in why some major pharmaceutical companies have chosen to put their European headquarters in the UK, along with the UK's research performance of course. It is difficult to answer the question of if we were an affiliate as opposed to a member, because there are a lot of unknowns there. My observation would simply be that there is greater security of our position and our influence, and so on, on regulation harmonisation and all the things that are relevant to industry partnerships that come from our membership. If we withdrew and became an affiliate, then we are moving into slightly unknown territory, although of course there are case studies, as you said, from Switzerland and Norway. The Switzerland case, as I am sure you are all aware, has been a volatile relationship.

Professor Ric Parker: Regarding overall inward investment in the UK by industry, it is quite obvious that many companies have established themselves very successfully here. You only have to look at our car industry. There is little, if any, UK-owned car industry any more, but most of the car industry we have here is not here to address the UK domestic market, it is here because from the UK it has a springboard into Europe that would be denied otherwise. Toyota, particularly in my own home town of Derby, is our second biggest employer now, after Rolls-Royce. We have attracted companies because being in the UK gives them access to Europe. Other companies, such as Sharp, have brought their research bases to the UK. Again, that is stimulated by that access to Europe.

If we look at other collaborations, one of the strengths of Europe is this framework. It is called a framework for the good reason that it has a consistent set of rules and objectives. Sometimes the rules are a little complicated, but they are there, and it allows collaboration

relatively easily across European institutions and between industries in one country and another country. When it comes to Anglo-American collaborations, in my experience it is quite difficult because we have totally different schemes and totally different attitudes to what the Americans call "corporate welfare", and that makes the alignment of any collaborative programmes very difficult indeed.

Professor Alex Halliday: The biomedical industry in particular is concerned about this, partly because the UK is only 3% of the global market whereas Europe gives you the largest single global market you have, so they see the scale-up opportunities as being particularly important. The other thing the European Union has facilitated is not just regulation, but also funding to actually catalyse work with industry and business in the biomedical area. There is an important instrument called the Innovative Medicines Initiative mentioned by Robert. This is a public/private partnership, which works with the pharmaceutical companies across countries, and Robert is of course more of the expert in this than I am. It involves a number of universities in the UK that have been immensely successful at being part of this. It is part of a European-wide effort at a time when drug discovery is desperately in need of collaboration, more working together and less competition. It is immensely important globally as well as being important for Europe and the UK.

Professor Sir Robert Lechler: I referred to Switzerland. When Switzerland fell foul of migration regulations before they readjusted them, they lost their IMI funding as a consequence.

Q35 The Chairman: Sir Robert, you referred to the life sciences, and our previous report was on genetically modified insects. The evidence that we had almost universally, not least from the Minister George Freeman, was that the climate in Europe was not conducive to investment in Europe by international companies. The interference from politicians and lack of inclination to follow the evidence base made this a rather hostile climate, if you had to choose between Europe and other countries. Indeed, in the case of GM crops, there might well be evidence that investment has gone elsewhere because of the lack of application of this technology. Would you like to comment, therefore, as to whether this aspect of Europe is conducive to inward investment in the life sciences?

Professor Alex Halliday: The story of GM has been a tragedy for UK science in many respects, particularly for the plant sciences departments in the UK that were very strong at one stage. I think that debate and discussion needs to be kept going and we need to make sure that the debate is informed by proper robust scientific evidence. That is hugely important across Europe, and if we want to change Europe we think we can help do it. We think we can influence things certainly through the academies. Even though there is massive political baggage associated with the issue, as a society, we believe we can influence the other academies and actually get them on board.

The Chairman: If I could press you a bit on this, do you think that the European Union, or perhaps, to be more specific, the European Parliament, if not the Commission, has led to a lack of inward investment in this area that we might otherwise have been able to attract?

Professor Alex Halliday: I honestly do not know the answer to that, to be fair, but I would say that I see it as a landscape in which we have to engage for the future and we have to change it. It is not going to do us any harm. If anything, it is going to improve our chances of success in this area if we can actually build up GM technologies in the UK, in partnership

with other parts of Europe. That is something we are very keen to do. The Royal Society produced a booklet on questions about climate change, which seems to have been quite successful in communicating to people the main issues so that the public understands the issues and the questions. We are currently doing one on GM, which we hope will have the same successful outcome.

Professor Sir Robert Lechler: It is a mixed picture, but I would like to highlight three areas where the UK in particular and the academies have been influential in a more conducive legislative framework. One is around access to data for epidemiological and large genetic studies, which are increasingly important. Again, that has had a wobbly course, but recently there has been a more conducive set of legislative decisions, which has been very helpful. The second one is the clinical trials directive. Again, the most recent clinical trials directive has been welcomed, and I think it is very relevant to the issue that Alex referred to on the size of the patient populations that pharmaceutical companies are interested in, so that is a positive. The third is the use of animals in research. Again, it has had a chequered history, but most recently the decisions have been rather favourable. I think that all those are indications of the influence that we both have had and would wish to have and that is necessary if we want to make use of our participation in Europe for large-scale research.

Q36 Baroness Neville-Jones: Do you think against that background and history that you need to be more active in the future in the whole area of spreading the understanding of science?

Professor Sir Robert Lechler: I am not sure if I am very well placed to answer that as I am the new boy in this business. All I can say is certainly the Academy of Medical Sciences, and I am sure my colleague academies, is very closely involved with the associations of European academies. My early impression is that works rather well. Whether we should be more involved, maybe. I am not sure.

Baroness Neville-Jones: A lot of these areas of modern science are going to get more and more into the way people live their lives and what they believe, so they become of sociopolitical importance. Does that not indicate a very active role?

Professor Alex Halliday: I fully agree. I think to some extent we should have been doing more in this area in the past. Part of the problem is the European academies are somewhat mixed. They probably think the British ones are too. We have started focusing on certain key collaborations. There are two the Royal Society engages with, which are: the European Academies Science Advisory Council, which does some good work; and ALLEA, the All European Academies. We work with those to discuss how to take forward some of these issues on the European stage. We are thinking increasingly about this and being asked to come forward with suggestions of things that should be discussed within Europe. We are also forming stronger alliances than previously with some of the top academies, such as the German Leopoldina. Many years ago there were three main Germany academies so you did not know which to engage with. Now the German Government have recognised that they need one particular German academy to represent the country, and the Leopoldina has become that. It has considerable funding and is doing considerable interesting work, and we should be working with it closely. The French Academy is also doing some wonderfully exciting new things. We are also in constant discussion with other academies about things that we could do with them. Developing a communication platform for working across Europe is important. It is good anyway, because science is global, and we need to be thinking

about how to address issues with global consensus, but it is particularly important for this issue of societal engagement and influencing policy.

Q37 Lord Hennessy of Nympsfield: Can I ask for your thoughts about the different way in which scientific advice is organised in the UK compared to the EU, and, specifically, the overwhelming need, as we all see it, I am sure, if evidence-based policy is to have any chance at all, for officials, chief scientists and everybody else speaking truth unto power? Could you talk specifically about the new scientific advice mechanism which the EU is proposing? Do you think it needs a chair who will be proactive in all this? Do you think it should have the power to go into areas where the Commission might not invite it to go into? From a British perspective, it strikes us as a pretty neutered outfit compared to the one we are used to here, particularly on the speaking truth unto power point.

Professor Alex Halliday: Many people in the UK feel that the system of chief scientific advisers that has been developed in the UK, and which was expanded under Sir John Beddington in particular, has worked extremely well, and I think there is some level of dismay that it has not worked as well in trying to make things happen with Europe. The Royal Society has been quite vocal on Europe's need to get strong scientific advice feeding into government at the European scale. The Commission has actually been quite responsive to that need. The scientific advice mechanism that has been put in place does offer some strategic advantages for the UK. Apart from anything else, we have Julia Slingo sitting on it as one of the seven members of the Committee. I think the question is really how the national academies are going to feed into this, and at the moment that is very unclear. It is being put together and it is a sort of "watch this space" scenario where we are trying to have a strong influence. There is a certain sense that of course the UK is highly regarded. There is also a certain sense—and I do not want to sound as if people in Europe might be irritated with the UK—

Lord Hunt of Chesterton: Heaven forbid.

Professor Alex Halliday: —that can play into this space as well because we have a sense that, "Oh, we know how to give scientific advice". I think we have to be quite careful about how we evolve that mechanism, and to be diplomatic and helpful rather than too confrontational.

Professor Sir Robert Lechler: It is early days for the scientific advice mechanism. I think the jury is out. My understanding is that they intend to elect a chair from within the seven senior members but, as Alex said, the academies would wish to have a route in that will be influential. Time will tell.

Professor Ric Parker: Europe has tried it one way. They had Dame Anne Glover advising Barroso; more or less a lone voice and very undersupported. She was on a hiding to nothing there, but did an excellent job despite that. To go to this scientific advice mechanism, the academies will have a role in both selecting the advisers and advising the advisers. It is that structure we are all trying to put in place at the moment and work out how it will work. The fundamental difference in Europe compared to the way the UK system works is this great need for consensus. In the UK, scientific advisers are willing to give advice whether it is in line with consensus views or not, and that is a jolly good thing.

Back to your point about whether the advisers should be proactive in advising on areas where they have not been asked questions, yes, we would certainly endorse that, and they

should have some freedom to make their own research into certain areas and give advice even before it is asked for.

Professor Alex Halliday: I want to try and clarify one issue of potential ambiguity. The High-Level Group is tasked with the job of choosing a chair every year and that is supposed to rotate, so there is a sort of chair de facto built into the system already.

Lord Hunt of Chesterton: I would have said one of the differences is that in the UK we have a very strong Civil Service and Executive. These advisers talk to the civil servants and to Ministers, and very occasionally to parliamentarians. You should hear what they really say. It is completely different on the continent, where these substantial changes in regulations on drugs and all sorts of other things have been decided by parliamentarians. That is why it is a totally different position. It will require a scientific body to work in this continental way where parliamentarians have power as opposed to this area, where it is a secret cabal of civil servants and Ministers a lot of the time. I wonder whether this point needs to be explained.

Professor Ric Parker: I think you need both those channels of advice. You need advice to the Commission and the parliamentarians. The Parliament has its own science and technology committee and can seek advice itself. In an ideal world the same panel, the same mechanism, would be able to provide consistent advice to both. Our own MEPs in the UK are very welcome to be advised by the learned academies in the UK should they seek our help.

Lord Hunt of Chesterton: That is important.

Q38 Lord Vallance of Tummel: Can we take a closer look at the regulatory set-up? Is the balance of power between what is done at European Union level and what is done at national UK level about right, or are there areas where some rebalancing might take place? Have you any examples of where the EU regulatory framework works particularly well?

Professor Ric Parker: One area where the framework works especially well is in setting standards across Europe which we can jointly agree and that are then mandatory across Europe for many areas of industrial engineering work and other facilities. Having that common set of standards across Europe and having a common framework is an area where the legislation works well. There are other areas where you need joint legislation. The REACH legislation for chemical hazards is one, which again needs to be done on a European-wide basis, but the way it is implemented can be to the detriment of the competitiveness of some UK companies in that they suddenly find they have to do a lot work to find alternatives for products, with little help from the European Commission. The Commission needs to devote some of its research funds to helping us find these alternatives to some of the products that are now on the proscribed list. I would not like to comment on the overall balance. All I would say from my observations is the UK needs to be more on the front foot and getting involved in setting and defining European legislation rather than it being something that is done to us, which is often what it feels like.

Lord Vallance of Tummel: Would either of your colleagues like to comment on the overall balance? Are there any areas where you think things should be tipped more towards the nation state than they are at the moment?

Professor Alex Halliday: From my perspective—and I am sure Robert will have views on this as well—there are a number of areas where we have to be careful to make sure, while we believe in the importance of European regulation, that things that are introduced do not stop us from being able to do frontier research. Of course, there have been some very

important areas that are affected by that. Data regulation is an important part of this, and we are pleased to say that in December the research side was brought back in as exempt regarding the use of personal data—and I will not go into what "personal" means—so there is a recognition that what we need to do as regards research can still be conducted. It is very important for biomedical research in particular.

The other significant area I would highlight, before passing over to Robert, is copyright reform, which has been a fairly major issue for academics who publish lots and lots of material. In America and Britain, you can do data and text mining, but in Europe they are moving against that, so we are having to work quite closely with the publishing companies to explore how that gets dealt with on a European scale. Again, things are looking fairly positive, but at the moment we are still in a position where there is an issue to sort out.

Professor Sir Robert Lechler: I mentioned three areas where I thought there had been positive progress and benefit from our engagement. I talked about the use of data, to which Alex has just referred, clinical trials regulation and the use of animals. In principle, maybe one can draw a distinction here between research that by its very nature involves access to large populations and datasets, in which case it is necessary that we have harmonised regulation, because it allows access to large datasets. Then there is research that does not. A couple of years ago the academy produced an influential report on the use of animals containing human material. I think that is something we have defined rather well in the UK. I do not see the need necessarily for the same rules to apply across continental Europe and the UK. It is on a case-by-case basis. Increasingly, as we think about things at the population scale, the balance is about right, and I think our influence is palpable and detectable.

Baroness Neville-Jones: The Chairman says that I must be very brief with this question, so if the answer is no just say "no" without feeling the need to elaborate. In the scientific community, do you find that you are affected by any of the decisions of the European Court?

Professor Alex Halliday: I do not know.

Baroness Neville-Jones: The safe haven is the one I am thinking of that affects data transmission. The answer is no, it would appear.

Professor Ric Parker: I am not aware.

Professor Sir Robert Lechler: I think no.

Q39 Baroness Manningham-Buller: I think you have answered most of the question I was going to put to you. All of you have emphasised the importance of mobility of people in Europe and what advantage this has for British science in attracting students, academics and so on into the UK. I am going to focus in on the question of whether this freedom of movement has any deterrent effect on people from outside the EU coming also to join the labs and research bases that we have and of which we are so proud and which have been so successful.

Professor Ric Parker: I do not think mobility within Europe is a deterrent. Our own immigration laws are a significant deterrent and are causing major problems at the moment. We need to look again at that.

Baroness Manningham-Buller: Which this Committee has looked at.

Professor Ric Parker: It would be a particular worry if in the future, if we were not in Europe, those same immigration laws prevented this free flow of people in Europe. It is particularly difficult for companies such as my own, which operate across multiple sites within Europe, where the ability to move our own employees around freely and develop them through different parts of our business is particularly important. Again, if I go back to the figures I gave on engineering doctorates, 47% of all the engineering doctorates in the UK are gained by people from outside the EU and the UK, so we are very dependent on those people coming here. Unfortunately, we do not welcome them to stay on and use those skills and knowledge in the country. We tend to send them back straight afterwards, which is rather regrettable.

Lord Peston: Can I ask one very brief question? Optimality requires equal treatment of equals, and therefore the people doing the recruiting should be able to hire the person they really want. Given that there is free movement from the EU here, but not free movement from, say, India or China, surely that must lead to suboptimality, on any piece of economic analysis?

Professor Alex Halliday: From the point of view of recruiting scientists, it is not a huge problem. To go back to the visa issue, I think the Home Office has been quite responsive in understanding what HEIs need. HEIs sometimes need to understand better what the Home Office can help us with. The fact is that we compete globally within the UK and on a European basis. We benefit from having more EU post-docs coming here as Marie Skłodowska-Curie fellows, for example. I think it is 23% of Marie Skłodowska-Curie fellows choosing to come to the UK, which is a phenomenal success. We are getting all those people here and it is building up the science, it is creating hubs of excellence and a buzz scientifically, and the net result of that is people from around the world want to come to the UK. I do not think it has anything in the way of detrimental effect. It has, if anything, a very positive feedback on what is happening.

Professor Sir Robert Lechler: There are two specifics possibly worth mentioning. One is that if you compare continental Europe with the US as a pool to recruit from—and I am sure we have all been engaged with lots of international recruitment—you get into salary issues more commonly with recruiting from the US than you do from continental Europe. For the clinician scientist cohort in particular, the EU is a big advantage, because getting recognition of equivalence of training for clinicians is much easier in the EU than it is if you are recruiting from outside the EU, so people can get a job both as a clinician and as a scientist.

Q40 The Chairman: At the risk of encroaching on the next session, and I apologise in advance to them, there is one issue I would like to come back to, Professor Parker. You touched on the absolutely critical issue of inward investment in this country. You referred to the great success of the car manufacturing sector, which has indeed been a great success story. You said that this was because it gave multinational companies the ability to have access to Europe. Is access to Europe in this context dependent on EU membership? I seem to have read recently for example that Toyota has announced that if Brexit happens it has no intention of disinvestment in this country.

Professor Ric Parker: I would not like to comment on Toyota's own statements. It has other plants in Poland, for instance, that it has built up substantially, so it has other choices for future investment. I am sure it would not disinvest. It values the domestic market in the UK and there are lots of Toyota cars on the road, as we all see. It is a question of anything that

puts additional barriers in the way. We have seen in the past some of the national practices within Europe, when it comes to imports from outside the EU, that are probably not as open-minded as the UK to some of these things.

The Chairman: Thank you very much. We have run out of time. I am most grateful to our three witnesses for appearing today. We will, of course, be circulating a transcript of today's evidence. Please make any minor corrections that you think are appropriate, and, if there is any further supplementary evidence you would like to submit, please feel free to do that. Thank you very much.

The Royal Society – Supplementary written evidence (EUM0078)

From the Physical Secretary and Vice-President Professor Alex Halliday FRS

Thank you for the opportunity to give evidence to the Committee on 12 January. I am writing to formally submit the Society's report *UK research and the European Union: the role of the EU in funding UK research*[609]*,* published on 18 December 2015, to the Committee as evidence. I would also like to take this opportunity to further clarify a point that was raised during the evidence session about the role of European Structural and Investment Funds in UK research.

The Society's report, *UK research and the European Union: the role of the EU in funding UK research,* aims to show the role of the EU in funding UK research. The UK receives most of its EU research funding through Research and Innovation Framework Programmes and European Structural and Investment funds. Over the period 2007 – 2013, the UK received €6.9 billion of Framework Programme 7 (FP7) funds. The UK was allocated €1.9 billion of structural funds for research and innovation activities over the same period. See Figure 5 of the report.

Structural funds that support research and innovation should therefore be considered when looking at the role of the EU in funding UK research. However it is important to recognise the different nature of this funding to other sources.

Framework Programme funding is intended to support research, development and innovation and is allocated on a competitive basis through calls for applications from researchers/institutions which are peer reviewed by experts. Conversely, the European Structural and Investment Funds (aka 'structural funds' or ESIF) are not allocated on a competitive criteria based on excellence and are not targeted solely at supporting research and innovation. The ESIFs are the European Union's main investment policy tool[610], intended to support job creation get the European economy growing in a sustainable way. They support a wide range of activities and initiatives, including businesses, investment in infrastructure and skills development. As part of achieving this, a proportion of these funds support research and innovation activities. Research and innovation activities funded by the European Structural and Investment Funds include the construction of research infrastructure, support for technology transfer and research intensive businesses, and skills programmes.

ESIF are allocated and implemented by policy decisions at European, national and regional levels. The UK receives ESIF for research and innovation predominantly through the European Regional Development Fund (one of five different funds that make up the ESIF). To access this fund, national governments of EU Member States will outline their priorities and strategy for using structural funds, based on the requirements of specific regions –

[609] Royal Society (2014) UK research and the European Union: the role of the EU in funding UK research https://royalsociety.org/topics-policy/projects/uk-research-and-european-union/
[610] European Commission, http://ec.europa.eu/contracts_grants/funds_en.htm [accessed 19 January 2016]

producing a National Strategic Reference Framework (NSRF). This is used by the European Commission to allocate the budget among Member States. At a regional level the implementation of these funds is then delegated to a managing authority.[611] Each region of the EU must produce an Operational Programme (OP) to detail how funds will be spent. Both NSRFs and OPs are approved by the European Commission.

As shown in Figure 6 of the report[612], the UK receives relatively little in terms of structural funds compared with some other EU countries. When the designation of more/less developed regions within the EU (see map provided by the European Commission[613]) is taken into account, it can be seen that there are relatively few regions within the UK that are designated as 'less developed'. While the total amount of structural funds is not necessarily directly correlated with the number or area of less developed regions within a country, this may at least in part explain the differences in the allocation of ESIF between different EU countries.

The Committee was particularly interested in Figure 8 of the Society's report. This provides the Framework Programme funding and ESIF for research and innovation received by the UK in the period 2007-2013, normalised to each country's GDP during this period. This Figure is intended to be viewed alongside Figure 7, which shows Framework Programme funding only, normalised to each country's GDP over this period. Figure 7 shows that the UK performs very well for the size of its economy in accessing Framework Programme funding, which is allocated competitively on the basis of excellence, reflecting the UK's strong research base. Figure 8 is included for completeness, to illustrate that the picture differs when ESIF for research and innovation, allocated strategically on the basis of perceived need for development, is also taken into account. This again likely reflects the UK's highly developed research base.

Interestingly, Figure 8 shows that the UK performs better than Germany and France, both countries that receive a greater amount of ESIF for research and innovation than the UK. This is due to the UK's strong performance in accessing Framework Programme funding.

When analysing these funding streams, it is important to recognise that the monetary value of a funding stream is not the sole guide to its value for research. Small amounts of funding in areas where little funding is available, or that offer researchers mobility and encourage collaborations, can have a bigger scientific value than their monetary values might suggest.

Thank you again for the opportunity to give evidence to your Committee and please do not hesitate to contact me if the Society can be of further help.

22 January 2016

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611 European Parliamentary Research Service Briefing 2015, Overview of EU funds for research and innovation (http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568327/EPRS_BRI(2015)568327_EN.pdf)
612 The Royal Society (2015) UK research and the European Union: The role of the EU in funding UK research
613 European Commission (2013). Structural Funds (ERDR and ESF) eligibility 2014-2020 (http://ec.europa.eu/regional_policy/sources/what/future/img/eligibility20142020.pdf)

Russell Group – Written evidence (EUM0069)

1. Summary

- Science is a global pursuit and is most effective when ideas and people are mobile across borders. The free movement of talent, the networks, collaborations, critical mass of research activity and the irreplaceable source of funding that we gain from EU membership are important to underpin the competitiveness of our leading universities and the UK economy as a whole.
- The UK should remain at the heart of a modernised, competitive and outward-looking European Union to drive world-leading research and innovation and bring significant returns for the UK economy.
- However, we support calls for reforms to the EU particularly those which enhance our universities' ability to benefit further from forging productive collaborations across Europe. For example: further simplification of some processes in Horizon 2020, changes to VAT rules that currently hamper scientific collaboration and ensuring a sensible Data Protection regime that does not compromise important research.
- The UK's membership of the EU brings a number of advantages for science, research and universities in particular:
    - Membership of the EU allows us to be part of a wider network with a critical mass of excellent researchers working together, making us even more competitive with the likes of the US and others.
    - The ability of universities to recruit staff and to attract students from other EU countries without having to negotiate the UK visa system, with the attendant expense and administrative burden for both parties, is very valuable.
    - The UK leads Europe in the quality of our research and drives excellence across Europe. Our researchers have won many more awards from the European Research Council (ERC) than our nearest competitor – the UK wins 22% of ERC grants (with the Russell Group winning 17% of the total on its own), compared to Germany's 14%.
- Exit from the EU would mean that the UK would lose its seat at the table in Europe, thus minimising the influence we are able to exert. What is more, we may continue to be bound to many EU rules, particularly around trade and those which impact the Single Market, without having a say on their formation.
- Whilst we can only speculate about the impact of withdrawing from the EU, since we have no precedent to guide us, what we know for certain is that, for all the reasons set out in this paper, our membership of the EU to date has been of significant benefit to science, research and innovation in the UK.

2. EU-level collaboration is critical for UK research

2.1. **Science is a global pursuit and is most effective when ideas and people are mobile across borders**. Indeed, international collaboration and researcher mobility have been identified as being core to the maintenance and further development of the

UK's world-leading position as a research nation.[614] Nearly half of all UK academic articles result from international collaboration and these articles typically have a higher impact.[615] The EU provides an essential platform for these important collaborations to take place, which are underpinning the strength of the UK's own science base.

2.2. The UK has considerably higher collaboration with EU research partners than with those in the rest of the world.[616] Indeed, over 80% of the UK's internationally co-authored papers are written with partners from other EU countries.[617] Although not all collaborations will be the direct result of EU-funded projects, the benefits of being able to work with colleagues across Europe, to create networks, travel to other workplaces and share equipment with ease must not be underestimated.

2.3. Under Framework Programme 7 (FP7, 2007-2013), the UK made nearly 100,000 collaborative links with other EU Member States.[618] Networks initially created through EU programmes or initiatives can form the basis of much longer-term collaboration between researchers, institutions and nations and are at the heart of wider international engagement. Furthermore, the partnerships created between institutions through EU programmes can be beneficial for raising the profile and reputation of a UK university abroad.

2.4. EU funding is often targeted at larger, cross-border projects that promote research mobility and thus national funding schemes, even with increased budgets, could not directly replace or compete with EU research programmes. It is important for the UK to be a key participant in these types of projects as one of the leading scientific nations in Europe.

2.5. The EU also invests in key research infrastructures which would not be possible to build at a national level, for example due to the scale of funding needed, the critical mass of usage needed to justify its construction, or because the risk to one nation would be too great. This allows the UK to access and take advantage of large-scale infrastructures and also avoids duplication of efforts. An example of this can be seen in **Annex A**, which describes the University of Southampton's engagement with an EU project to develop an ultra-deep-sea research robot.

2.6. Another pertinent example is that of ELIXIR, the European infrastructure for biological information, which brings together life science organisations across Europe to manage and safeguard the enormous amounts of data being generated every day by publicly-funded research. The ELIXIR hub is based in Hinxton, Cambridge. As Professor Dame Janet Thornton, former Director of EMBL-EBI and coordinator of the preparatory phase of ELIXIR said: 'This funding puts Europe in a

[614] International Comparative Performance of the UK Research Base – 2013 A report prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS).
[615] International Comparative Performance of the UK Research Base – 2013. For further evidence that the best science comes from international collaboration see: 'The fourth age of research', *Nature* 497, 557-560 (2013).
[616] Review of the Balance of Competences between the UK and the EU: Research and Development.
[617] International Comparative Performance of the UK Research Base – 2013.
[618] Seventh FP7 Monitoring Report.

uniquely strong position to solve some of society's most pressing problems, with the UK right in the middle of the action.'[619]

Free movement of people

2.7. The strength of UK higher education internationally lies in its quality and diversity, including the ability to attract the most talented staff and students from within and outside the EU.

Staff

2.8. Russell Group universities employ staff from every EU Member State, totalling over 20,650 employees. These staff members make up 20% of the academic workforce at our universities.[620] In fact, Russell Group universities employ a third more academic staff from EU countries than non-EU countries and prominent European academics are involved in cutting-edge research at our universities, generating the innovation that will create the jobs of the future for the UK.

2.9. Were the UK to leave the EU, the researchers and academics that universities currently recruit from EU nations may become subject to current immigration restrictions through the Tier 2 (Highly Skilled) route, including the annual cap on visas of 20,700, which is already over-subscribed. Whilst PhD level positions are prioritised within the cap, bringing in applications from EU nationals in future would significantly increase the pressure on the cap and may mean that PhD level positions could be negatively affected. Such an outcome may also make it much harder for universities to recruit to highly specialist non-PhD roles, such as project engineers, software developers and technicians, from both the EU and other non-EU countries.

2.10. A recent report produced for the Department of Business, Innovation and Skills (BIS) found that the primary driver of research excellence is excellent researchers. It also identified one of the potential impediments to excellence as the actual or expected time and effort associated with recruiting individuals that need a visa to work in the UK.[621]

2.11. If the numbers of EU researchers were to drop as a result of the UK's withdrawal from the UK, it is not necessarily the case that they could be replaced easily by UK nationals (particularly in the short term), who are unlikely to have the specialist skills, expertise and experience to match those brought to the UK by excellent European academics.

Students

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[619] http://www.elixir-europe.org/news/uk-invests-%C2%A375-million-european-research-infrastructure-support-knowledge-based-economy

[620] HESA staff data 2013/14.

[621] *Growing the best and brightest: The drivers of research excellence*, a report produced for the Department of Business, Innovation and Skills (BIS) by Economic Insight (2014).

2.12. Excellent international students are indispensable for world-class universities, contributing to a diverse student body and a thriving society, culture and economy. If we are to maintain our place as a global leader in higher education and research then the UK must continue to attract the very best students from across Europe. International students make a vital contribution to the success of our universities and are often highly motivated and entrepreneurial.

2.13. Furthermore, an international environment with a diverse mix of people is conducive to delivering the most original and innovative ideas. It promotes cross-cultural dialogue, enriches our communities and enhances the student experience. A recent survey found that 87% of students agree that studying alongside students from other countries will improve their world view and benefit their own education.[622]

Potential impact

2.14. The costs to the higher education sector of Tier 4 student visa compliance in 2012/13 was estimated at over £66.8 million; but these costs have risen even further over the last year due to the significant number of policy changes since this figure was calculated.[623] There are over 55,000 EU students at Russell Group universities, so visa costs would rise substantially if these EU students also had to enter the UK via the Tier 4 route. At the same time, universities would almost certainly need to pick up the costs of Tier 2 visas for EU staff: the cost of a three-year Tier 2 visa for skilled international staff is £564, so if EU staff numbers can be maintained then this would add a further £12 million in visa costs alone, plus associated compliance and administration costs.

2.15. But EU staff and student numbers could fall significantly if the UK were to leave the EU. Of course we do not believe that all recruitment of European staff and students would come to a halt; even without EU membership the UK's leading universities would continue to attract <u>some</u> EU students and staff. However, the extent to which this would have an impact on numbers is not known and would inevitably add significant costs, uncertainty and bureaucracy into the system.

2.16. **The ability of universities to recruit staff and to attract students from other EU countries without having to negotiate the UK visa system, with the attendant expense and administrative burden for both parties, is very valuable**. Requiring EU staff to go through the UK visa system would not only be a potential deterrent for prospective staff, but it would add significant costs, red tape and bureaucracy for universities.

Business collaboration

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[622] 'What do prospective students think about international students?' HEPI report 74 (March 2015).
[623] Final Report: *Cost and benefit analysis project on immigration regulation*, Higher Education Better Regulation Group (July 2013).

2.17. Many EU-funded projects bring together both academic and industry partners from across Europe and the CBI has highlighted that EU funding can support business-university partnerships that might not have been possible otherwise.[624] Eight Russell Group universities are partners in the Graphene Flagship project, for example, alongside a wide range of UK and European businesses. This multi-disciplinary network of scientists and companies will work on a whole series of graphene applications, with the aim of creating new products, ideas and jobs with resultant economic impact. More information on this and other examples are provided in **Annex A**, including Queen's University Belfast's collaboration with Novartis and others.

2.18. The European Institute of Innovation and Technology (EIT) also has as an explicit aim to facilitate collaboration between academic and business partners. Imperial College London is one of the six co-location centres of the EIT's Climate KIC. Working with a network of over 200 European private, public and academic partners the KIC is working to accelerate and stimulate innovation in climate change mitigation and adaptation by integrating innovation, education and entrepreneurship.

Attracting private investment

2.19. The UK is the number one destination for Foreign Direct Investment (FDI) in Europe and is increasingly popular as a location for R&D: FDI projects involving R&D increased by 10% last year. In addition, UK Trade & Investment (UKTI) supported the delivery of 34 R&D collaborations involving UK research institutions and organisations, which in their own words are 'creating the building blocks for future growth.'[625]

2.20. The UK is more reliant on foreign investment in R&D than many of its competitors: in 2013 over 20% of gross expenditure on R&D conducted in the UK was financed from abroad (compared to around 4% in Germany and the US and the OECD average of 6%).[626] On the one hand, this is clearly a reflection of the quality, breadth and depth of the UK science base in being able to attract inward investment. But it also shows how dependent the UK is on the ongoing ability to attract this investment; and our continued membership of the EU may well have a significant impact on investment decisions of foreign companies.

2.21. In fact, uncertainty over the UK's continued membership of the EU may have a negative impact on foreign investment: EY found that 31% of investors will freeze or reduce investment in the UK leading up to the EU referendum.[627]

[624] CBI evidence submitted to Balance of EU Competences Review: Research and Development.
[625] UKTI Inward Investment Report 2014 to 2015: https://www.gov.uk/government/publications/ukti-inward-investment-report-2014-to-2015/ukti-inward-investment-report-2014-to-2015-online-viewing
[626] OECD Main Science and Technology Indicators, 2013 (GERD financed from abroad). OECD average figure quoted is from 2012 as the 2013 figure is not available.
[627] EY 2015 UK attractiveness survey.

2.22. One of the main reasons foreign companies choose to invest in R&D in the UK is of course due to the excellence of our research-intensive universities and the strength and efficiency of the UK's research base. However, for those outside of Europe, being able to access other European countries and markets from the UK is also an important consideration. This is emphasised in a report produced by UKTI, which describes some of the benefits of locating overseas Life Sciences investment in the UK by stressing our close link to Europe and the EU.[628]

2.23. This view has been echoed by the Centre for Economic Reform (CER) who explain that market size is a major determinant of the size of FDI flows, and membership of the EU expands the UK market.[629] Locating business in the UK also gives multinational enterprises a platform from which they can influence EU policy-making, which would no longer be the case if we withdrew our membership.

Collaboration beyond the EU

2.24. We have not found any evidence that collaborations have been inhibited by the UK's membership of the EU. Indeed, the EU facilitates collaboration with non-EU countries; the EU has science and technology agreements with 20 countries and researchers from many of these countries participate in Horizon 2020 and previous programmes.[630] EU collaborations can attract partnerships with other international partners, such as the US, producing a collaborative rather than competitive approach in certain cases.

2.25. The EU can also provide a mechanism for involvement in global initiatives. For example in the African Monsoon Multidisciplinary Analysis project (see details in **Annex A**) allowed Europe to take the lead in an area normally dominated by the US.[631]

2.26. However, it should be noted that whilst UK universities collaborate extensively with partners outside the EU, our institutions are also in competition with those countries. **The UK's membership of the EU allows us to be part of a wider network with a critical mass of excellent researchers working together, making us even more competitive with the likes of the US and others**.

2.27. In 2013 the UK spent about $40 billion on R&D, less than a tenth of the US spend in the same year ($457 billion). The 28 EU Member States together, however, spent $342 billion – still less than the US, but a much more comparable figure.[632] Added to this is the EU's own research funding budget, around €11 billion (roughly $14.5 billion) in 2013. Whilst national research projects and programmes in the

[628] *Unlock Your Global Business Potential: The New UK Life Science Prospectus* – UKTI guide providing an overview of the UK's life science industry including opportunities for investment for overseas organisations (April 2014)
[629] *The economic consequences of leaving the EU* (June 2014).
[630] For example, in the first 18 months of Horizon 2020 US partners submitted 911 eligible proposals, in particular focusing on Marie Skłodowska-Curie Actions.
[631] As noted in the University of Leeds' response to the Balance of Competences Review on R&D.
[632] OECD Main Science and Technology Indicators – Gross Domestic Expenditure on R&D (current PPP $)

different EU Member States boost research capacity and expertise, the EU programme provides an additional mechanism (and funding) to bring together the leading experts from across the continent to collaborate on a scale that is globally competitive.

2.28. In addition, the EU's framework programme, freedom of movement rules and other structures actively promote and facilitate collaboration and mobility of researchers between EU countries, which is not the case for partnerships with the US, for example, where arrangements can be of a more ad hoc nature.[633] There can also be issues of 'double jeopardy', where two different national funders need to agree to support a project (thus requiring some synchronisation in funding cycles), which can be a barrier to international collaboration that is not an issue for collaborations funded by the EU.

2.29. The diversity of Europe is also a major factor for collaborating with our closest neighbours. This diversity takes many forms, such as different approaches to research, ways of working and different types of expertise that can deliver unpredictable outcomes; or the diversity of the populations that allow researchers to make novel discoveries in relation to our health or our societies. This diversity cannot be matched by bilateral collaborations with China or the US, for example.

3. Access to EU-level investment

3.1. Robust UK Government funding for research, development and innovation remains crucial to the health of the UK economy and to our future global competitiveness, but EU funding is complementary to this. EU level funding enables the pooling of Member States' resources to address global challenges such as climate change and food security. The scale and multinational scope of such work could not be funded by the UK alone and EU involvement provides real added value.

3.2. **EU funding is an irreplaceable and increasingly important source of research funding for UK universities**. Russell Group universities won over half a billion pounds (£539 million) in research grants and contracts in 2013/14 from EU sources, an increase of 16% compared to the previous year.[634] EU government research grants and contracts alone now account for 13% of the collective research grant income to Russell Group universities, almost double the proportion compared to 2007/08 (7%).[635]

3.3. The EU is equivalent to an eighth Research Council for Russell Group universities: in 2013/14 they won more in research grants and contracts from EU government bodies (£473 million) than from any of the seven UK Research Councils.[636]

[633] This point is noted by Sir Gareth Roberts in his paper 'International partnerships of research excellence: UK–USA academic collaboration': http://www.immagic.com/eLibrary/ARCHIVES/GENERAL/OXFORD/O060427R.pdf
[634] EU sources includes EU government, EU industry and EU charities where grants have to be won competitively – HESA finance data.
[635] HESA finance data.
[636] HESA finance data.

3.4. The UK has had an outstanding level of success in Framework Programme 7 (FP7) and this has provided significant intellectual and economic value to the UK, on which we can build in Horizon 2020:

- The UK secured €6.94 billion from FP7, second only to Germany.[637]
- The UK hosts the highest number of European Research Council (ERC) grants of all Member States: 22% of all ERC grants (including 17% at Russell Group universities) compared to 14% in Germany, our nearest competitor.[638]

3.5. As well as boosting key areas of research and facilitating activity at a larger scale than might be supported in the UK alone, EU funding can also help to sustain areas of research when funding is not available at a national level. For example, Russell Group universities have received EU funding in areas such as cosmology and anthropology, which has been provided on a level that would not have been possible through UK sources alone. In this way, EU funding allows UK researchers to maintain a core of excellent research capability and capacity in a range of areas even if they may not be national priorities at the time, allowing excellence in particular fields to flourish.

3.6. The approach of the ERC is especially complementary to the UK's national approach as it focuses on excellence and does not prescribe policy-driven outputs. The success of ground-breaking ERC-funded projects has also prompted action by the UK Government, such as investment in graphene. Furthermore, the UK's success in securing these grants, which are only awarded to the absolute best in Europe, gives a clear indication to the rest of the EU of the excellence of the UK's research base. This creates a positive feedback effect since the prestigious nature of the awards attracts the top researchers to the UK, which then further enhances the UK's science base.

3.7. In 2014/15, 17% of the ERC's annual budget was allocated for social sciences and humanities (SSH), equating to approximately €283 million.[639] This is almost the same as the combined budgets of the AHRC (£98 million) and ESRC (£153 million) – which together were only allocated 10% of total UK Research Council funding for that year.[640] The ERC has therefore provided a very valuable platform from which SSH research can excel in the UK. This is the area in which the UK outperforms other European countries to the greatest extent, winning a third of ERC SSH grants between 2007 and 2014 (171 in total, compared to 72 in the Netherlands, our nearest competitor).[641]

3.8. The ERC is also relatively efficient: only around 2.3% of its operational budget was spent on administration in 2013[642]. We have not been able to find evidence of the

[637] Seventh FP7 Monitoring Report (March 2015).
[638] ERC statistics (2007-2014) http://erc.europa.eu/projects-and-results/statistics
[639] ERC Work Programme 2014.
[640] Document produced by BIS: The allocation of science and research funding 2011/12 to 2014/15.
[641] ERC Statistics (2007-2014)
[642] Seventh FP7 Monitoring Report (March 2015).

proportion of the overall Horizon 2020 budget spent on administration to make a broader comparison of efficiency. Whilst the research and innovation framework programmes have been criticised for being overly bureaucratic in the past, the European Commission is striving to simplify the programme. The new structure of Horizon 2020 has simplified the architecture of the programme, as well as the funding rules and the streamlining of application and award administrations has resulted in efficiency savings. **There is still progress to be made in order to simplify further the Horizon 2020 programme and improve the efficiency with which funds are allocated and distributed**, but the European Commission has shown willingness to work on addressing some of the outstanding problems and this is something we are following-up.

4. Regulation

4.1. There are a number of EU regulatory frameworks that adversely affect the science and research community. It is possible that if the UK were to leave the EU the UK may have more flexibility to set its own regulations which may be beneficial for science and research. For example, **the UK is bound by EU rules on VAT which can hamper scientific collaboration**.[643] In theory as a non-EU member the UK could relax some of the rules to better facilitate university-business and university-university collaborations.

4.2. There are also potential threats to UK research from EU regulations in the future, for example **potential changes to data protection rules could have serious consequences for research using personal data, making it at best unworkable and at worst illegal**. Another example concerns the realisation of the European Research Area (ERA). The ERA is currently being achieved through a voluntary approach between Member States, which allows the UK to maintain its high quality research practices and share good practice with other countries; but there has previously been discussion of imposing regulation in this area.[644] **Legislating for the ERA could potentially have negative impacts on the UK's currently world-class research system by adding bureaucracy, burden and unnecessary new rules**.

4.3. However, in many cases, our membership of the EU allows the UK to influence regulations to the benefit of the UK and the rest of Europe. The Russell Group alongside other research organisations such as the Wellcome Trust and Cancer Research UK have worked together to raise awareness of the serious concerns for research in proposed in amendments to the draft Data Protection Regulation and have worked to influence and inform MEPs, European Commission officials and UK representatives in the Council. Although the final agreement on the Regulation has

[643] Interpretation of VAT legislation has hindered equipment sharing between institutions as it requires an institution to levy VAT when charging to another institution's grants, significantly reducing the financial benefits of equipment sharing – unless special arrangements such as cost sharing groups are established. In addition, universities can only benefit from zero-rate VAT on new buildings if 95% of the use is for non-business use, thus deterring collaboration between universities and businesses.

[644] The former Commissioner for Research and Innovation Máire Geoghegan-Quinn said she 'wouldn't rule out the legislative route'.

yet to be reached, we are hopeful for a much more positive outcome for research using personal data as a result of UK engagement and influence, which would benefit not just the UK, but research – and by extension competitiveness – all across Europe. The UK has also been a vocal opponent of legislation on ERA, ensuring this approach has been resisted so far.

4.4. The UK has played a key role in shaping the design and implementation of the EU's research programmes to ensure funding is allocated on the basis of excellence rather than diverted to less research-intensive regions of Europe to build research capacity. We have been able to share existing good practice in the UK to help EU science and research to be as effective as possible. This has helped strengthen the research base across Europe by providing a competitive system that drives excellence. If we were to leave the EU, we would lose the direct ability to influence the way in which science is conducted in Europe and would simply become a 'passenger' for regulation imposed at EU-level, which would nonetheless affect UK researchers and institutions through collaborations with European partners.

4.5. In addition to the framework programme for research and innovation, there are other examples of European regulations which are of direct benefit to science and innovation in the UK. For example, the development of the Unitary Patent means that a university, a spin-out, start-up or a larger company can protect its innovation ideas with a single patent that covers 25 different EU countries. The European Commission estimates this will cost the applicant less than €5,000 in renewal fees over 10 years compared to the previous level of around €30,000, as well as reducing the administrative burden of patent applications.[645]

4.6. UK scientists have actively engaged in informing and influencing EU public policy on a range of issues. For example, they played a key role in ensuring that the budgets for the ERC and Marie Skłodowska-Curie Actions were protected from cuts in the recent negotiations on the establishment of the new European Fund for Strategic Investments (EFSI). In addition to the Russell Group and other UK research organisations raising concerns and engaging with policymakers, UK or UK-based Nobel Laureates and Laureates of other international prizes also fought to protect these budgets and Sir Paul Nurse, President of the Royal Society, had a high-level meeting with President Juncker on the issue.

4.7. **Exit from the EU would mean that the UK would lose its seat at the table in Europe, thus minimising the influence we are able to exert particularly to achieve the reforms we want. What is more, we may continue to be bound by many EU rules, particularly around trade and those which impact the Single Market, without having a say on their formation.**

5. Conclusions on EU membership and research and innovation

[645] Statement by Internal Market and Industry Commissioner Elżbieta Bieńkowska on the Unitary Patent (25 June 2015).

5.1. This paper aims to illustrate some of the benefits to UK research and innovation through our membership of the EU, including:

a) Free movement of people, which allows the UK's research-intensive universities to recruit the very best staff and students from across the continent without having to negotiate the UK visa system, with the attendant expense and administrative burden for both parties
b) Access to the EU networks, infrastructures and the research programme, which provide a platform for international collaboration and an important source of funding
c) The ability to influence research-related policies and decisions by having a seat at the negotiating table and through the mobilisation of UK scientists, research organisations and other groups to ensure UK views are heard and represented in Brussels
d) The opportunity to raise the quality of research across Europe, driving excellence for the benefit of the UK and EU economies and our global competitiveness.

5.2. The question is whether some or all of these benefits could be maintained if the UK were to withdraw membership of the EU. In some cases, it is difficult to know because we do not know what 'out' means for the UK and what the UK Government might be able to negotiate with the EU if we were to leave.

5.3. In this respect, it is in theory possible we could still access Horizon 2020 or future EU research programmes as an Associated Country. However, this cannot be taken for granted and Switzerland provides a fitting example of this. Following Switzerland's referendum in February 2014 on immigration quotas, the EU revoked Swiss access to Horizon 2020 and Erasmus+. The Swiss were able to negotiate partial access to Horizon 2020, but only for 2014-2016 (not for the duration of the programme, which runs until 2020) and they are only eligible to participate on Associated Country terms for one part of the programme (the Excellent Science pillar) – they therefore only have access to less than a third of the total budget. Perhaps more importantly, Swiss researchers cannot access the most collaborative elements of Horizon 2020 on the more favourable Associated Country terms such as the Societal Challenges calls.[646]

5.4. It is possible that the UK could try to maintain some form of free movement with the EU, but again, this cannot be taken for granted and we do not know what terms or conditions could be put in place or what the impact would be on the UK's leading universities in terms of their ability to attract and recruit the best and brightest people from across Europe. It is safe to assume that if EU staff and students had to

[646] Following the result of the Swiss referendum the Head Physician of Basel University Hospital made the following remark about an application for a large EU project on diabetes which would involve 22 European countries and the US: 'This is really the type of work we cannot do without international collaboration because in a country the size of Switzerland we can never enrol enough patients for such a large trial. And there is no other single institution to finance such a large project': http://www.swissinfo.ch/eng/horizon-2020_eu-snub-leaves-swiss-research-community-in-limbo/38369904

go through the current visa system in the same way as non-EU internationals must, it would add considerable cost, time and burden to universities and could well act as a significant deterrent to coming to study or work at a UK university. In turn, this would have real knock-on consequences on the excellence of the UK's research base, on our economy and on our global competitiveness.

5.5. However, one of the most important aspects that we would certainly lose if the UK were to leave the EU is strong UK influence on EU policies and regulations (which may continue to impact us even if we were no longer an EU Member State). Whether we were to operate as part of the European Economic Area, alongside Norway, negotiate bilateral agreements, similar to Switzerland, or agree a bespoke arrangement for the UK, in practice we would not be able to maintain the currently strong influence the UK has in Europe.

5.6. The UK was ranked at the top of a recent soft power index. As explained in the accompanying report, this is because from the G-7 to the UN Security Council to the European Union, Britain has a seat at virtually every table of international consequence.647

5.7. **The EU is not perfect by any means and we would support EU reforms particularly those which enhance our universities' ability to benefit further from forging productive collaborations across Europe**. One of the Prime Minister's key areas of reform is to boost the competitiveness and productivity of the EU; research and innovation should be at the heart of this, as key drivers of growth and jobs. There is also a focus on cutting red tape, which would be welcome, particularly if the regulatory burden on UK universities could be reduced.

5.8. **Whilst we can only speculate about the impact of withdrawing from the EU, since we have no precedent to guide us, what we know for certain is that, for all the reasons set out in this paper, our membership of the EU to date has been of significant benefit to science, research and innovation in the UK.**

5.9. The UK should remain at the heart of a reformed, modernised, competitive and outward looking European Union to drive world-leading research and innovation and bring significant returns for the UK economy.

27 November 2015

Annex A – Examples of Russell Group engagement in EU projects

EU and UK investments are supporting the development and application of graphene

In 2007, Manchester University scientist Konstantin Novoselov received one of the first European Research Council (ERC) starting grants to investigate the 'Physics and Applications of Graphene'. With fellow Manchester professor Andre Geim he went on to win the 2010

[647] Another key component leading to our number one ranking is our ability to attract international students. Index compiled by McGlory, J., *The Soft Power 30: a global ranking of soft power* (July 2015).

Nobel Prize for Physics for his work. The ground-breaking work on graphene at Manchester led to the establishment of the National Graphene Institute at the University, which was officially opened in March 2015 and is part of a wider £90 million UK government investment in graphene. Alongside this, the European Commission has invested €54 million into a Graphene Flagship project and will be investing a further €50 million a year from 2016. The **Universities of Manchester, Cambridge, Nottingham, Oxford, Sheffield, University College London, Queen Mary University London and Imperial College London** are all partners in the Flagship project.

Tackling disease: why cross-border projects are so essential

Health research particularly benefits from large-scale international collaboration facilitated by EU programmes. Here are just three examples why connecting data, research, knowledge and expertise from many sources across Europe is so important:

- **University College London (UCL)** is one of the leading partners in an EU-funded network of European HIV cohorts and collaborations. Using data from over 300,000 HIV-positive people from many different settings in Europe and beyond, the network's multidisciplinary approach has carried out crucial research on improving the management and life of HIV-positive individuals, whilst exploring differences within sub-groups.

- Researchers at **Queen's University Belfast** are leading a €50 million, Europe-wide project to develop new drug treatments that could improve the lives of patients with cystic fibrosis and bronchiectasis. The consortium, which comprises world-leading lung specialists from 20 organisations across eight European countries and includes industry partners Novartis and Basilea, will develop new 'inhaled antibiotics' to manage chronic lung infection. The programme will also establish the first European patient register for bronchiectasis, providing a unique platform to improve the quality of care for patients across Europe, as well as making it easier to develop and trial new drugs.

- The EU is investing €6 million through Horizon 2020 into a new programme aimed at developing better diagnostic tests and treatments for patients with non-alcoholic fatty liver disease. The project will be coordinated by **Newcastle University**, who will work with partners from the **University of Cambridge**, as well as those in France, Italy, Denmark, Finland and Germany. This will be the largest ever study of its kind to connect research from across the continent in liver disease, which is hoped will enable a greater understanding into the genetic and environmental factors linked to the development of the life-threatening illness.

Working together to improve border controls across Europe

The Oxford Internet Institute at the **University of Oxford** is a partner in FASTPASS, a four-year EU-funded project aiming to find a solution to facilitating quick and easy border crossings for travellers, whilst ensuring border guards can use the range of technological identification tools to secure against illegal immigration and other threats. The project brings

together key stakeholders across the supply chain, including research institutions, system component producers, government authorities and end users, with partners from the UK, Austria, Germany, Finland, Poland, Latvia and Greece. As one of the Oxford researchers involved in the project has commented:

> "Each element of this research could be funded separately at a national level, however it is through the direct collaboration and integration of these elements and with these stakeholders, throughout the life of the projects, that accelerates the knowledge and implementation required to develop a global standard."

Developing equipment and expertise for shared European use and understanding

The **University of Southampton**, along with the UK National Oceanography Centre (NOC), universities in Cyprus and Portugal and nine SME partners from the UK and other European countries are working together to develop the continent's first ultra-deep-sea robot glider with an €8 million grant from the European Commission. The sole European underwater glider 'SeaExplorer' will be modified and improved so it can reach at least 75% of the ocean. Its enhanced capabilities will be able to be used for submarine environmental monitoring, as well as in the oil and gas and sea mining industries to conduct environmental impact assessments for potential sea bed mining and exploration. This kind of large-scale project would not be possible without international collaboration drawing on the best specialist knowledge and expertise from across Europe. In addition, developing this kind of technology at European rather than national level is far more cost-effective and resource-efficient, avoiding duplication of efforts.

International university-business collaboration makes the UK a key player in space science

Alongside scientists from across Europe, three Russell Group universities – the **University of Edinburgh**, the **University of Cambridge** and **University College London** – are key project participants in Gaia, the European Space Agency satellite launched in 2013 which will provide the first 6-Dimensional census of the Milky Way. Gaia is funded by the European Space Agency and the EU's FP7 Programme. The UK has major roles in the Gaia satellite mission, both in building the spacecraft and delivering the science. In addition to Russell Group universities, UK industry won some €80 million of industrial contracts to build Gaia. The UK also played a central role in developing the Radial Velocity Spectrometer, engineered at the Mullard Space Science Laboratory, University College London, which measures the speed, temperature, size and age of over a billion stars in our galaxy. It is only through academic-business collaborations all across Europe that we can be competitive with other big players in space technology and research, such as the US, Russia and China.

EU funding delivers global collaboration to study global problems

The African Monsoon Multidisciplinary Analyses project (AMMA), co-funded by the European Commission, was established to improve the predictability of weather and climate in West Africa and Southern Europe. Over 140 European, African and American laboratories gathered data for the better understanding of the reasons behind disturbances of the African monsoon. The **Universities of Leeds, Liverpool, Manchester, Oxford, Cambridge,**

York, Imperial College London and UCL all participated in the project and a large number of African research institutions also benefitted from the EU funding. Thanks to their effort the mechanisms regulating the monsoon and its societal impacts have started to be unravelled. This project allowed Europe to take the lead in an area normally dominated by the US.

Russell Group's EU Advisory Group, Universities UK and Universities Scotland – Oral evidence (QQ 62-68)

Transcript to be found under Universities UK

Science and Technology Facilities Council (STFC), Wellcome Trust and Met Office – Oral evidence (QQ 107-116)

Transcript to be found under Met Office

Scientists for Britain – Written evidence (EUM0075)

Overview

The title of the inquiry is 'Relationship between EU membership and UK science inquiry', so we are deeply concerned that all of the questions and preamble of the inquiry are on matters that are not contingent upon the UK's membership of the EU.

Norway, Switzerland, Turkey, Iceland and Israel are all non-EU nations that participate in and contribute towards the science networks operated via the EU.

Norway, Switzerland and Turkey have all been represented on the governing bodies of the ERA, either in the Scientific Council which currently governs the work of the ERA or its forerunner the European Research Area Board (ERAB). European scientists within the ERA rightly see the benefit of ensuring that scientific cooperation is done openly and is not exclusive to political membership. It is within this environment that the UK's participation in EU science networks would continue if the UK were to leave the EU.

Therefore, it is essential for us to say with regret that the House of Lords inquiry appears to be premised on a fallacy in this respect. The nature of the inquiry's title points to EU membership while the preamble and questions (about the funding, collaboration, regulation and advice) point to a discovery of the merits of science cooperation which is not contingent on membership.

It is clear that the inquiry is written and designed in such a way that an assessment of the UK's science relationship with the EU is intended to inform the currently live debate about whether the UK remains a member of the EU. It would be a serious mistake for anyone to connect the two.

We address the above point in prefix to every answer except one that we provide to the inquiry's official questions (these prefixes are labelled as 'Advisory').

However, we do also provide full answers for the sake of clarity and understanding, as our perspective towards each topics might provide a useful counterbalance to any of the misinformed or politically-motivated views that have so far found their way into the public debate.

We believe that to conflate the relative desirability of UK collaboration with the EU with the UK's membership of the EU amounts to further misinformation and the perpetuation of a miscalculation by observers – that science collaboration depends on EU membership – which is prevalent among the scientific community.

For this reason, we believe that regrettably no conclusions from the inquiry that are based on the original questions and preamble can be considered as valid to the issue of the UK's membership of the EU, regardless of the inquiry's outcome of whether the EU is a favourable or not favourable influence on UK science.

We also feel obliged to point out that if any of the reasoning derived from the inquiry's questions were used intentionally or unintentionally to support a view regarding the UK's decision on whether to remain in or leave the EU, it would have the potential to diminish Parliament's reputation among the public.

However, conclusions from the inquiry may inform a future decision on how the UK might continue its participation in EU science programmes, should the UK choose to withdraw from the political institutions of the EU. For example, regarding the funding questions, the UK is currently a net contributor to overall EU funding; determining the current value to the UK of participation in EU science programs would inform a future decision as to what level of contribution to EU science programmes provides value for money.

Introduction to our methodology

Scientists for Britain arises from an experiment to test the integrity of the EU-UK science hypothesis by taking the alternative viewpoint and challenging established notions, reflecting scientific methodology.

The experiment, a discussion between current professional and former scientists, was so successful at proving an alternative path for UK engagement is not only viable but also more productive that we decided to maintain our activity and attract new members to our group.

The main established wisdom that we wished to test was that the UK-EU science relationship made UK membership of the EU beneficial. To speak against the established wisdom had become a taboo, but a few of us like to challenge taboos.

We had become aware that much of the reports on science benefit relating to EU membership had been based on the questionable dual pillars of 'audience perception' and 'whether funding is beneficial'.

We address both of these in detail in our material below, but the general point to remember in both is that a UK exit from the EU would not exclude or hinder continued participation in EU science frameworks. A common misperception that a UK exit would exclude or hinder participation can create a distorted picture via audience perception studies and any analysis of whether funding can ever be argued to assist a scientific project.

The public debate so far

We are extremely concerned that organisations such as the Campaign for Science and Engineering (CaSE) have made very little effort in asserting the difference between continuing European Union membership and continuing European science participation. Their members and subscribers therefore remain less than clear on this subject and this deficiency is apparent in their survey results which draw no distinction between the two outcomes.

We believe that the high response rate in the CaSE study and others show that the number of scientists who say they “wish to stay in the EU” is likely to be a result of this misunderstanding – scientists have been led to believe EU funding and Europe-wide collaboration are contingent on EU membership.

We’ve recorded several instances where our explanation of why and how our UK-EU collaboration would continue outside the EU has reversed initially hostile correspondents who were incorrectly led to believe that for the UK to adopt the same EU science participation as non-EU science players is somehow “anti-science”. It plainly isn’t.

Also, we’ve found that many scientists including in the private sector scientist are reticent because of the prevailing view among scientists and because private sector companies feel an obligation to stay out of politics. One science company we spoke to said that although they felt EU membership has no tangible benefit for either their company or for UK science as a whole, it was a view they would never openly express as two of their principal clients are universities whose views are known to differ in that respect.

We are concerned at some of the presumptive and bogus statements made by Scientists4EU, an organisation formed by two highly political scientists from the Scientists for Labour group. They have said that the UK would have difficulty ‘re-entering’ the ERA after leaving the EU and would receive less science funding from outside. We strongly disagree with this statement and object to its sentiment. The selection of projects for funding is done on the basis of merit, peer-reviewed excellence and ‘frontier research’. These principles are to be found in the ‘about us’ sections of the ERC, ERA, Scientific Council and Horizon2020.

Scientists4EU are effectively theorising that in a future where the UK is a contributing participant in Horizon2020 the European Commission would choose to intentionally and secretly relegate or dissolve funding applications that featured UK teams specifically because it is outside of the EU. If Scientists4EU are alleging that the European Commission is capable of such underhanded malevolence against a paying participant, they should urgently spell out their reasons for this assessment and any measures for combatting it.

They are suggesting the EU would effectively be willing to dispense with scientific collaboration with Europe’s leading science powerhouse and for political objectives. We believe that is incorrect, particularly since the ERC is governed by the Scientific Council, composed of scientists. It is completely infeasible for the EU to refuse to collaborate with a willing EU science partner that would pay its way, especially one that offers so much. A refusal to cooperate is made even more implausible by the fact that the EU is guided by its own EU Neighbourhood Programme which means it is obliged to pursue policies of cooperation and openness with its immediate neighbours.

It is deeply erroneous and frankly ridiculous that pro-EU groups such as Scientists4EU and UniversitiesUK have cited the European Space Agency, CERN and the European Transonic Windtunnel as examples of why the UK should stay in the EU. These three bodies are international rather than supranational and are not underpinned by the EU as a political project.

We feel that another organisation, UniversitiesUK, has become unsuitably preoccupied with the EU question when there is far more to gain from an emphasis on the UK funding policy debate and theorising on the UK's options as an independent and cooperating nation.

International cooperation between the UK and EU and elsewhere would continue and thrive outside the EU.

Questions

Funding

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

Advisory: As this inquiry is designed to investigate the relationship between EU membership and UK science, it is important for us to state that this question is not relevant to the UK's membership of the EU, but rather it refers to the UK's continuing participation in EU science networks which is not contingent upon continued EU membership, as we stated above.

The EU's financial contribution to UK science is funded by the UK and other member states. The funding that the UK receives back from the EU in the form of science funding is lower as a proportion of total science funding than the UK's financial contribution to the EU (figures below). However, this should not be regarded as a reason for non-participation in EU science after UK exit from the EU, merely a point of negotiation for the future, over which the UK would arguably have greater control from outside.

From 2007 to 2013, the UK received 5.2bn out of 50bn total ERC funds available, i.e. 10.4% of total.

The UK's total EU contribution was between 13bn in 2007 to 17bn in 2013, both of which are about 17% of the EU's total contribution and budget for each year.

The UK's funding of 10.4% of total EU science funding is also less than its relative population size of 12.7% of the EU population.

The money the EU returns to the UK in the form of science funding accounts for about 10% of the UK's total Research and Development expenditure.

The UK government has indicated that science spend will be maintained at its current level, at least, as a proportion of UK government spending. This principle has consensus across the political spectrum.

It would be reasonable and legally justifiable to expect any future UK government that finds itself independent from the EU to be expected to account for EU funds returned to the UK as a legacy of the function of overall UK governance and that therefore the funds initially

contributed or equivalent of funds returned should either continued to be paid into the EU science frameworks by the UK government or paid directly into UK science as a substitute. In short, funds returned to the UK by the EU in the form of science funding can be considered as part of the total funding that future independent UK governments are duty-bound (via previous assurances) to protect.

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

Advisory: As this inquiry is designed to investigate the relationship between EU membership and UK science, it is important for us to state that this question is not relevant to the UK's membership of the EU, but rather it refers to the UK's continuing participation in EU science networks which is not contingent upon continued EU membership, as we stated above.

A crude estimation of the UK's contribution to the EU science frameworks can be calculated as the UK's overall percentage contribution to the EU budget, between 15% and 17% based on recent history. This contribution is already higher than the proportion of the science budget the UK receives back from the EU. However, what might also be included is the funding the UK government contributes in the form of individual project funding, match funding and contribution to UK higher education, training and science infrastructure that allow UK teams to apply successfully, but which are far harder to quantify.

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

Advisory: As this inquiry is designed to investigate the relationship between EU membership and UK science, it is important for us to state that this question is not relevant to the UK's membership of the EU, but rather it refers to the UK's continuing participation in EU science networks which is not contingent upon continued EU membership, as we stated above.

There is no evidence to suggest the EU's model of supranational administration of science funding is more successful in terms of effectiveness and efficiency than the international model of administration as conducted by CERN, the European Space Agency, the International Space Station, the International Council for Science and others.

Decisions by a supranational organisation must inevitably find a generalised set of goals for nations with different scientific agendas and specialisms. The reason the EU seeks to take a supranational approach to an issue that was formerly international is to place a political underpinning to scientific output in a way that seeks to ensure credit for the funds and outcomes is attributed to the EU entity. There is nothing that the EU science structure currently achieves that could not be achieved at an international collaborative level across the same nations. In fact, if funding returns could be entirely proportional with funding contributions then governments that perceived benefits from continent-wide collaboration in science would feasibly be expected to increase their funding and participation to access the assured payback that such a structure, coupled with collaboration, would provide.

There is also a disproportionate amount of box-ticking to be done by applicants for funding, which means only those teams that have access to skilled grant administrators should consider applying regardless of the merits of their project. We feel that if funding were to be organised on an international basis, the propensity for a team to engage directly with their domestic funding agency would bring a more tangibly meritocratic outcome to funding decisions. One of the reasons for this is that the team's proposed research would form part of a national debate in the domestic scientific community about various forthcoming projects and which were most interesting or deserving. This national debate would in turn nurture public interest, political interest and investor interest. At present, where the decision making of the EU science frameworks is centralised, decisions and projects are not part of a single domestic science debate and are thereby taken further from public or domestic industry consciousness.

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

Advisory: As this inquiry is designed to investigate the relationship between EU membership and UK science, it is important for us to state that this question is not relevant to the UK's membership of the EU, but rather it refers to the UK's continuing participation in EU science networks which is not contingent upon continued EU membership, as we stated above.

The opportunity for UK scientists to collaborate with peers in academia and business in other countries can be very useful. It is essential and inevitable that UK teams will continue to enjoy this choice whether the UK is in or out of the EU.

It is worth noting that the propensity to collaborate with domestic-only teams is higher in the UK than any other EU country.

With that in mind, the EU's appetite for projects that are across more than one member state is also higher than the UK teams' appetite or requirement for this. This wouldn't ordinarily be considered a problem but it has two unfortunate repercussions.

A significant portion of EU funding is allocated to the concept that scientists in one part of the EU should be have equal employment opportunities as a scientist who lives in the town where the project is conducted. Mobility funding ensures that travel and accommodation expenses are paid for the travelling scientist, even if that person is on an equal skills footing with a local applicant.

Another significant downside to this effort to fund a single and level marketplace for science personnel is that science teams particularly in the public sector have a tendency to abdicate responsibility for training the next generation of scientists in their 'home patch' when it is so easy to recruit from other EU nations. This is being shown to have detrimental effects on the level of engagement in science among young people in the UK.

We applaud universities with an outreach programme for schools and colleges, such as Surrey University's Brilliant Project which allow particularly disadvantaged youngsters to investigate a route to study science at university.

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

Advisory: As this inquiry is designed to investigate the relationship between EU membership and UK science, it is important for us to state that this question is not relevant to the UK's membership of the EU, but rather it refers to the UK's continuing participation in EU science networks which is not contingent upon continued EU membership, as we stated above.

According to data from the European Commission for every UK team that applied successfully for Horizon2020 funding, another 7 were unsuccessful. The EU has such a strong grip on the more accessible and liquid forms of grant funding (that were previously administered by domestic agencies) that it has a far more prominent and pervasive presence in the psyche of scientists than it deserves, compared to the 10% proportion of UK funds it provides.

For this reason, we believe that the supranational structure of EU funding actually diminishes the level of collaboration and therefore investment that UK teams would otherwise seek with non-EU and non-ERA nations such as the US, Canada, South Korea, Japan, China, India and Australia.

Although leaving the EU would have no detrimental impact on the UK's choices in EU science collaboration, we believe that UK science could benefits from a concerted effort to modify a current unhealthy over-focus on the EU by looking to additional geographies that might in some cases provide a more effective collaboration partner. We believe scientific partnerships should always be formed on their respective merits rather than via a political effort to create EU/ERA-only partnerships.

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

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Science that is done on scientific rather than political merits nurtures far greater confidence among private investors.

When a science funding mechanism is attached to a developing political entity as it is with the EU, it brings enormous uncertainty for the outlook of science in every member state. The

domestic science markets become more dependent on centralised EU funding and when they see their home nation investment dwindling as result, the only apparent certainty is that funding is eventually transitioning to the centre of the EU.

Science is being used as an expression of a developing political entity, akin to a vanity exercise. The EU is a project in cross border nation building. To claim that such cooperation can't be done without a political union is pure deception. In the same way that biillionaires buy football teams to enhance their public persona, the EU is investing member states' money in science programmes that it hopes will lead to the enrichment of its reputation. There is absolutely no reason why European science can't be done on an international basis just like the successful CERN, ESA and International Space Station.

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

Advisory: As this inquiry is designed to investigate the relationship between EU membership and UK science, it is important for us to state that this question is not relevant to the UK's membership of the EU, but rather it refers to the UK's continuing participation in EU science networks which is not contingent upon continued EU membership, as we stated above.

It has been argued that the UK's contributions to the EU and allocations to EU match-funding ventures places a squeeze on UK subscriptions to non-EU or international facilities. EU match funding means that the UK government is incentivised to spend in a way that follow EU's decision making. This means that even money allocated to domestic science agency spending ultimately complies with the supranational decision making.

An example of spending squeeze is the UK's Infra-Red Telescope in Hawaii – the UK withdrew from this and several other facilities to save money while allocation to EU match funding has risen.

The centralising effects of EU decision making are thereby amplified.

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

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EU membership has no bearing whatsoever on this topic. A UK scientist would be met with utter bemusement if he or she tried to persuade science colleagues in Norway, Turkey, Iceland or Israel that the quality of their EU projects would be enhanced by joining the EU.

Ending EU membership does not on its own predicate a change in freedom of movement. There are several non-EU European states that maintain free movement with the EU. Freedom of movement would have to be assessed separately by the UK electorate if voters had chosen to leave the EU.

There are commentators who argue that a UK exit from the EU makes movement limitations more possible or more likely.

Despite the complexities of this issue, we believe through our investigations that none of the possible scenarios necessitate impediment to scientists in any way that would, in consequence, discourage cooperation between the UK and nations that are part of the EU's collaboration and funding networks, whether they are EU or non-EU.

If the current terms of non-EU immigration to the UK are taken as a basis, even leaving the EU's free movement environment is highly unlikely to impede meritorious EU scientists. In other words, if the UK applied its tightest tests for immigration and movement, the deserving scientists and engineers would in any case meet the Tier 1 or 2 qualification for UK work visas.

It is commonly cited by pro-EU campaigners that Switzerland was excluded from EU science collaboration for a short period due to impact a nationwide vote on inward migration had had on the opportunities for EU scientists to work there. It is important to remember that the Swiss referendum proposition on migration went further than restricting movement – they voted to give job preferences to Swiss nationals, which is the part that conflicted with agreements in Switzerland's science cooperation arrangements with the EU.

The Swiss subsequently negotiated their way back into science cooperation projects.

In the UK context, even the strictest possible application of UK border and immigration controls for non-EEA citizens, if applied to EEA citizens, still would not have the effect of the Swiss proposals because of the applicability of Home Office Tier 1 and Tier 2 visa criteria to anyone taking part in research work in the UK as part of UK-EU science projects. The NHS already takes advantage of thousands of these Tier 2 visa applications for non-EU staff and the same would be immediately applicable to EU scientists even without any change of legislation.

Scientists chosen from anywhere in the world who are sufficiently qualified can already be employed by an organisation in the UK without risk that someone says it is a. illegal or b. that someone else should be doing the job.

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

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membership of the EU, but rather it refers to the UK's continuing participation in EU science networks which is not contingent upon continued EU membership, as we stated above.

We would refer you to the answer we gave to Question 7. In brief, the centralising effects of EU decision making are amplified by the incentive for the UK government to match-fund EU funding decisions. This inevitably draws UK science funds towards the EU and away from international collaboration.

It is significant to recall that EU science has been engineered to produce social and industrial gain for the EU. This means that UK projects that aim to reduce suffering for diseases or social problems in developing countries are arguably squeezed. UK science partnerships in developing countries are essential for saving lives. They are also influential over the UK's joined up aid-giving projects and the UK's impact and reputation worldwide.

Regulation

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

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All of the EU's regulatory frameworks have a bearing on UK science. The only part that arguably has a lower benefit for individual UK scientists compared to scientists from other EU/ERA countries is mobility funding – UK scientists are least likely to travel to take advantage of opportunities in another EU state and therefore least likely to take advantage of this funding.

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

Although this is the only question relevant to the UK's membership of the EU, we do not believe there is sufficient appetite for such regulatory changes that the changes themselves create a 'pull' in either direction regarding the UK's membership of the EU.

Therefore, we feel that the inclusion of this question might muddy the waters, especially given the likelihood that the UK would choose to remain as a paying participant in EU science frameworks and adherent to its rules. If in the longer term, the UK chose to exercise its rights to pursue separate legislation that is an entirely separate democratic exercise, which is far more likely to be done in partnership or selective partnership with the ERA member states.

There are firm precedents for this being accepted under ERA auspices. Switzerland operates its own clinical research rules (Swiss Human Research Act) that are different to the EU's

Clinical Trials Regulation. The EU rules in this area are a mixed bag for UK scientists – although some of the rules are welcomed, others are seen as injurious and unwieldy.

12. How is the innovation landscape affected by EU membership?

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As this question overtly relates to EU membership rather than EU science frameworks, it is not necessary to elaborate. EU membership can be discontinued and there is no reason that the UK's science partnerships with the EU would need to be impinged, for the reasons previously stated. Therefore the innovation landscape would in the short to medium term be unchanged. In the longer term, there are strong reasons to believe that a mindset shift towards a national science industry in the context of global science, where responsibility for UK science was ultimately with the British people and governance, would encourage a sense of ownership, increased sectoral and public debate and enhanced domestic buy-in, interest and investment.

Scientific advice

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

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The UK has a deserved reputation as the most sophisticated environment for scientific discussion and policy at least among member states of the European Research Area.

There are differences between the UK and EU. The UK has a chief scientific advisor within government. The EU recently scrapped the post of chief science advisor as a function of cross-disciplinary decision making, but it is seeking to replace the role and has a Scientific Council which in some regards performs the same role.

The EU Scientific Council is appointed partly on merit and partly on geographical origin, to produce a council that is as far as possible representative of the breadth of EU and ERA member states. Although all the members of the council are highly distinguished and qualified senior scientists, the council's composition can be considered to have the effect of spreading the benefits of science funding in a representative manner rather than to the most meritorious projects or those that will produce the greatest results.

A nation that produces great cars or great clothes can expect consumer or investor attention for each of those outputs, but a nation like the UK that produces great science might justifiably expect a greater proportion of attention from consumers and investors in that area goes towards its activity.

In a supranational funding body, where members are not closely acquainted with science developments, debates and landscape of other member states, their deliberations are arguably conducted at a greater administrative ‘distance’ from the subject. Therefore, the involvement of all council members in an active and live science debate can be presumed to be decreased. In turn, it is less easy to see how the simple accountability or effectiveness of decision making can be as readily assessed. Just as decisions by the European Commission are frequently questioned by national parliaments and not adequately answered, it is our contention that the same dynamic could feasibly exist within the supranational Scientific Council. It is arguably considered transcendent of accountability by national scientific agencies. However, this is something the UK would be far better placed to address from outside, for the reasons given in the next answer.

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

Advisory: As this inquiry is designed to investigate the relationship between EU membership and UK science, it is important for us to state that this question is not relevant to the UK’s membership of the EU, but rather it refers to the UK’s continuing participation in EU science networks which is not contingent upon continued EU membership, as we stated above.

We do not believe there is sufficient difference between the UK’s ability to influence the debate as a non-EU member of the ERA compared to an EU member of the ERA that the outcome creates a ‘pull’ in either direction regarding the UK’s membership of the EU.

Therefore the UK could leave the EU, remain in the ERA and have at least comparable levels of influence through its appointed members of the Scientific Council, via dialogue between the UK’s national scientific agencies and the ERA and via dialogue between the UK Government and European Commission.

However, we do believe that in the long term, there could be benefits for the UK’s influence by being a non-EU member of the ERA. The other member states, while acknowledging that the UK’s participation is voluntary, would recognise that the country should not be ignored.

This is in line with a widely reported phenomenon regarding the EU and other supranational organisations, which is that the EU has a tendency to listen more to outside partners than to insiders whom leading figures can engineer to outvote. We expect that this would be the UK’s beneficial experience on leaving the EU but remaining in its science frameworks.

December 2015

Scientists for Britain, Mr Emran Mian, Social Market Foundation Society and Scientists for EU – Oral evidence (QQ 128-135)

Transcript to be found under Scientists for EU

Scientists for EU Campaign – Written evidence (EUM0058)

Lead authors are Dr Mike Galsworthy (Programme Director), Dr Rob Davidson (CTO) and Dr Claire Skentelbery (research team).

Scientists for EU launched as a social media campaign on May 8th 2015. It has since acquired a voluntary research team (http://scientistsforeu.uk/about/who-we-are) and an advisory board featuring leading UK scientists and political cross-party representation (http://scientistsforeu.uk/about/advisory-board). We also thank anonymous contributors to our survey concerning this submission – and Dr Jonathan Adams for providing us with Thomson Reuters Web of Science data, analysed by Evidence Ltd.

Summary

In this submission, we argue and evidence the following ten statements:

1. The EU is the world's biggest hub of scientific activity – and the UK's central position in that hub is a major contributor to the UK's recent rise to first place globally in scientific productivity.

2. To clarify benefits of EU membership to UK science, we must compare extrapolation of the continuing relationship with realistic assessments of the best alternative models on offer for UK science outside EU membership.

3. The promise of extra money for UK science derived from pulling out of the EU, then investing the UK's net contribution to the EU budget into national research and innovation (R&I), is doubtful. Leaving the EU has wider negative economic consequences which, when all is summed, remove rather than provide money for science.

4. A significant amount of the UK's net contribution to the EU budget goes to build R&I capacity in under-competitive member states. This produces more excellent individuals and top science/innovation capacity in the multinational collaborations that UK institutes so often lead. Thus, they strengthen the global hub that positions UK science so dominantly in the world.

5. UK national public investment into science is complemented by an additional >10% of funds (and rising) from the EU. Much of those EU funds are irreplaceable by national money as they pertain to the benefits of multinational frameworks that the UK could not establish alone.

6. Leaving the EU would incur a guaranteed loss of UK democratic representation in the decision-making processes of the European Parliament. This would end our scientific community's influence via UK MEPs on key EU policies relevant to UK science interests. However, UK science advice to the Commission would be retained via newly-established mechanisms.

7. Attempting to 'buy back' into the science programme following a departure would likely result in a partial access model that continues collaboration but protects the interests of the remaining countries. Unlike other non-EU countries which can easily be absorbed by the EU science programme at a charge, the UK is now the largest actor within the programme. Leaving the EU sets up a poor dynamic to re-enter the EU science programme as the leading player.

8. The example of Switzerland, with its recent demotion in Horizon 2020, shows that partial access to the EU programme is a model which the EU can use with external partners. That precedent also established the key role of Freedom of Movement (FoM) from the EU as a pre-requisite for European countries to gain access to core parts of the EU science programme.

9. The consequence of reduction in Horizon 2020 participation, even with full national funding replacement, will be damaging for the UK as a scientific leader. Universities would lose coordination roles and talent to countries where full Horizon 2020 access is possible.

10. Remaining in the EU secures a robust future for UK science. The EU programme is growing, improving and highly responsive to UK demands. All the dynamics are moving in the right direction for EU membership to establish UK science an ever-more prominent position in the global R&I ecosystem.

Scientists for EU

Scientists for EU was initiated on May 8th, the day of the Conservative election victory, when it became clear that there would be a referendum on the UK's membership of the EU.

Scientists for EU began as a social media campaign by Dr Mike Galsworthy & Dr Rob Davidson[648]. The campaign quickly amassed thousands of followers on Facebook and Twitter. On October 9th, Scientists for EU launched the official campaign, with an advisory board comprising representatives from the Conservatives, Labour and Liberal Democrats alongside leading science figures such as Lord Martin Rees, Sir Tom Blundell and Dame Anne Glover[649].

The mission of Scientists for EU is to play a vocal role in the referendum debate, highlighting the importance of EU membership to UK science. It also presents the opportunity to educate on why science is critical for the UK's future economy, global standing and citizens' quality of life.

Scientists for EU has no intention to instruct the British public which way to vote in the referendum. Rather, we wish to raise the profile of science and the achievements of the EU in science in the referendum debate, encouraging voters to become informed on the

[648] http://scientistsforeu.uk/about/who-we-are/
[649] http://scientistsforeu.uk/about/advisory-board/

matters and factor that knowledge into their decision making. As such, the campaign wholeheartedly welcomes all voices concerning science into the debate.

Ultimately, with primary loyalty to the UK and the UK science community, it is important that the relationship between UK science and the EU is understood. Should the public vote to stay, we must have good understandings of what limitations the EU brings to bear upon science and how best to remedy those, whilst taking advantage of benefits. Should the UK public vote to leave, we must be in possession of an understanding of the consequences, taking advantage of opportunities and mitigating damage. Either way, fuller information and considered debate is in the interests of all.

Section 1: Context of UK science and EU membership referendum

1.1 The position of EU and UK science in the world

*"…**Europe's productivity continues to increase** while the US's growth has slowed somewhat in recent years. In 2011, **Europe produced 33.4% of the world's research outputs**, while the US accounted for 23.4%."*
Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility - 2013
A report prepared in collaboration between Science Europe and Elsevier's SciVal Analytics[650] (page 6)
"Europe" was defined as the 27 European Union (EU) member states and 14 associated countries contributing to the framework programme budget under FP7.

*"…**the UK has overtaken the US** to rank 1st by field-weighted citation impact… It is likely that **recent increases in UK research productivity have, at least to some extent, been driven by the increase in UK international research collaboration**, which is also associated with greater citation impact…"*
International Comparative Performance of the UK Research Base – 2013
A report by Elsevier for the UK's Department of Business, Innovation and Skills (BIS)[651] (page 2)

1.1.1. Collectively, the countries of the EU produce approximately 20% more scientific academic output that the US, by the last data-points available[652]. This would be a fairly moot bragging point, were it not for how the EU science programme has managed to network the European countries into a collaborative engine which serves as a hub of science in the wider world. This, in turn, has benefited UK science prowess demonstrably.

1.1.2. The EU is now a community of scientific talent which can flow between countries without visas or points systems and which can assemble bespoke constellations of cutting-edge labs, industry and small businesses to tackle challenges local and global. Across the

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[650] http://www.scienceeurope.org/uploads/PublicDocumentsAndSpeeches/SE_and_Elsevier_Report_Final.pdf
[651] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf
[652] http://data.worldbank.org/indicator/IP.JRN.ARTC.SC/countries/EU-US?display=graph

500m populace of the EU (plus the Associated Countries which buy into the EU science program), there is a capacity to pick n' mix the best labs to do the job – and apply for funding from a single source. Given that the European Research Area produces a third of the world's research outputs (see quote and reference above), this communal spirit provides a powerful environment to combine leading players across borders to common advantage. So large is the programme that top teams in 170 other countries[653] in the world are easily taken on board as secondary participants. This, in a nutshell, is how a collection of countries converts its critical mass into a critical research advantage, globally.

1.1.3. Twenty-first century science often has to go big to go small and increase the resolution of our understandings and capacity. Developing new nano-materials or discovering ever-rarer particles often requires more expensive machinery to establish more extreme conditions. In health, identifying ever-smaller contributory effects (e.g. multiple interacting genes in disease development) requires ever larger sample sizes of patients. Increasingly complex models require larger collections of expertise and shared resources. This is more than an appealing narrative: The drive to big networked science is also borne out in the data on the rising internationalisation of science and the associated impact. Below we demonstrate how the international networks uniquely supported by EU funding have driven the UK into global pole position for productivity.

Increasing internationalisation

1.1.4. Since the 1980s, global research has become rapidly more international. The prevalence of scientific research papers co-authored by researchers from more than one country has risen sharply. However, some countries have seen this increase more than others. Since 1981, the UK has risen from 15% of its papers being international (and 85% domestic authors only) to over 50% international today. In fact, almost all the growth in UK output is in the form of international collaborations.

653 https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report_draft.pdf

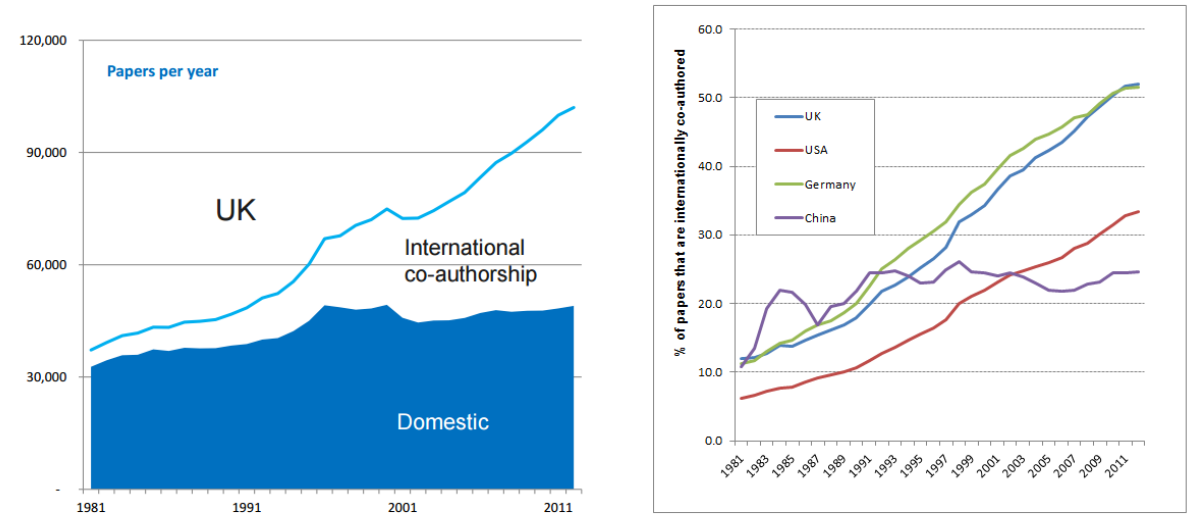

Figure 1: a) The UK's increasing output is largely driven by an increase in internationally co-authored papers and b) UK rise in international papers compared with other countries.

1a Reproduced with kind permission from Dr Jonathan Adams. From: 'The Fourth Age of Research' (2014)[654] , 1b generated for this report using data: Thomson Reuters Web of Science data, analysed by Evidence Ltd

1.1.5. This rate of increase can be compared to the US, which has seen a rise in internationally co-authored papers from 6% in the 1980s to 33% currently. [655]

Internationalisation and impact

1.1.6. Multiple sources have identified international co-authored papers as having substantially higher impact than domestic-only papers[656].

[654] https://www.britishcouncil.jp/sites/default/files/pro-he-international_collaboration_and_research_strength-presentation_mr_jonathan_adams-feb17.pdf
[655] ibid
[656] ibid.

Figure 2: Correlation of international co-authorship share and field-weighted citation
Reproduced with kind permission from Dr Jonathan Adams. From: 'The Fourth Age of Research' (2014)

1.1.7. The UK's strong lead over the US on proportion of international output interacts with the added impact of international output – resulting in the UK science base now measuring as more productive than that of the US. This is despite the US's domestic-only papers showing more citation impact than UK domestic-only papers. International collaborations give the UK the research quality edge.

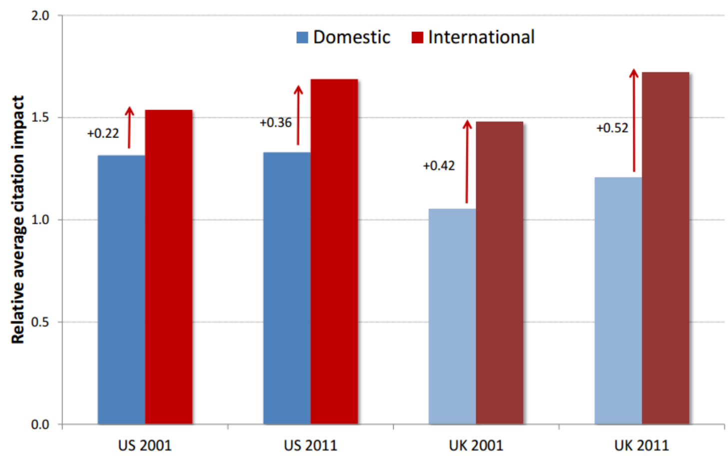

Figure 3: How the UK's rise in high-impact international collaborations has helped the UK push ahead of the US recently in science productivity
Reproduced with kind permission from Dr Jonathan Adams. From: 'The Fourth Age of Research' (2014)

1.1.8. How much of this increase in internationality can be attributed to participation in the EU science programme? Approximately 10% of UK public funding for science came from the EU during 2007-2014 (see answer to Q1 in Section 2), this amount has been rising sharply recently (Q1 in Section 2) and, pertinently, Horizon 2020 funds are predominantly for international collaborations. Of the UK's international collaborations, 80% include an EU partner. Therefore, it is not too adventurous a conclusion to state that participation in the EU science programme looks highly likely to have helped the UK science base become more productive than the US.

Other benefits of a pan-European science programme to EU and UK productivity

1.1.9. Beyond the cross-border collaborations themselves providing more impact than domestic-only work, there are multiple additional properties of a pan-European science programme that confer increased science capacity and productivity to its members:

- The presence of a pan-European fund helps prevent duplication of activity.

- The spread of good practice is facilitated 1) by collaboration and researcher interactions and 2) by adoption of successful policies from one country (e.g. open access, open data) into a funding body present in multiple countries.

- Such a large comprehensive programme covering the gamut of research and innovation areas sets a common framework for funding categorisation and comparisons; a spine against which national funding schemes can be benchmarked.

- A single one-stop shop for international collaborations removes a vast amount of bureaucracy that would be incurred otherwise. Without the EU common pot of funds and common administration, a UK lab looking to partner with, for example, teams in four other countries would encounter serious trouble in finding full funding. The UK government (or any other) would be unlikely to fund a five-way collaboration on which the UK partner undertook 20% of the work. Similarly, all five partners attempting to obtain matched funds from their governments means five times the administrative loads, aligning five timelines of funding applications and work, and five times the jeopardy in getting the monies through. If each of the five applications had a 20% chance of success, then the overall chance of getting funding for all five partners would be $0.2^5 = 0.00032$. The EU, however, regularly funds teams of many partners. This is because the governments of the EU members and associated countries have committed money to a common administration that can choose to fund constellations of labs, regardless of team composition, based solely on competitiveness of the proposal.

1.2 "Brexit"[657] and free money for science

"Our current assessment is that leaving the EU would be likely to impose substantial costs on the UK economy and would be a very risky gamble."
Analysis by economists at the Centre for Economic Performance (CEP)

1.2.1. Stocktaking the current benefits of EU membership to UK science is not enough. Content from this House of Lords inquiry will be used to inform the debate on whether to stay in the EU or leave. To adequately address the role of UK science in the debate, we must

[657] "Brexit" is the shorthand for a British exit from EU membership.

compare realistic models of UK science continuing within the EU against realistic models of UK science moving to a position outside the EU.

1.2.2. As an analogy: When evaluating the utility of any new drug or treatment, the medicine at hand must be compared not only with a placebo, but also with the best competing medicines on the market. In the case of EU membership, we must compare the current trajectory within the EU against more than flat-cash reimbursement of EU funds through UK funding mechanisms (placebo). We must compare UK science in continued EU membership with the most seductive alternatives being offered on the market.

1.2.3. To summarise those alternatives; we, have widely encountered two notions:

Firstly, that because the UK is a net contributor to the EU budget, then the UK could leave the EU and the surplus money gained from the transition could be channelled into research and innovation. In short, leaving the EU frees up money for UK science.

Secondly, that because non-EU countries such as Norway and Israel can have full participation in EU science programmes such as Framework 7 and Horizon 2020, therefore there is no threat to the UK's relationship to the EU science programmes continuing as is. On leaving, we simply buy back into EU science programme participation as the other countries do.

Combined, the claims amount to an appealing package: On leaving the EU, the UK could continue reaping all the benefits of full membership on the EU science programme whilst having significant extra cash-in-hand to boost public investment in R&I at the national level.

Both these notions are dangerously – and demonstrably – misinformed.

1.2.4. In this section, we deal with the first claim of free money for science. In the next section, we utilise the clear precedent of Switzerland to explain why full membership is not an entitlement, why the UK is a special case, and why negotiations following a Brexit would result in a much diminished role for the UK on the EU science programme.

The availability of money on a departure from the EU

1.2.5. There is a claim by the campaign ***Vote Leave*** (which use the slogan "Vote Leave – take control") that a Brexit will free up money for R&I investment[658]. This claim is based on the UK being a "net contributor" to the EU budget as a whole.

1.2.6. The size of that net contribution varies, but according to analysis by economist Roger Bootle in his 2014 book "The trouble with Europe" (which, incidentally, contains no analysis of EU research and innovation in its 201 pages), the UK paid a net £9.6bn into the EU in 2012, about 0.6% of nominal GDP.

[658] https://www.youtube.com/watch?v=0tItgGcWVHw

1.2.7. Models of impact to the UK economy on Brexit vary. The Centre for Economic Performance (CEP), calculated the UK could suffer income falls of between 6.3% to 9.5% of GDP under a pessimistic scenario. CEP calculate loses of 2.2% GDP under an "optimistic scenario" (a free trade agreement with the EU). The think tank Open Europe calculate UK GDP could be 2.2% lower in 2030 if Britain leaves the EU and fails to strike a deal with the EU. In a best-case scenario (liberal trade arrangements with EU and globally, with large-scale deregulation at home), Britain could be better off by 1.6% of GDP in 2030.

1.2.8. Importantly, even the more optimistic assessments of the UK's economic performance following a Brexit (such as the "best case" +1.6% GDP increase by 2030 by Open Europe) all analyses model an immediate loss in GDP for the transition years following a Brexit. The size of that loss is substantially larger than the current net contribution of the UK to the EU budget.

1.2.9. The triviality of the UK net contribution relative to the greater economic forces around transitioning out of EU membership have been noted by Eurosceptic economist Roger Bootle: "These are not the sort of sums on which the fate of great nations depends – nor on which momentous decisions about EU membership should be made."[659]

1.2.10. Therefore the attempt to financially gain in the short term via a Brexit is akin to killing the goose that lays the golden egg. It is a sure-fire short term loss, wiping any free money for R&I investment until at least a decade down the line – according to the most optimistic scenarios. This strongly counters any claim that voting to leave the EU provides immediate funds for a shot in the arm of national science. The extra money simply will not be there for science as the UK economy is hit by huge transition costs.

1.2.11. Even if it were the case that there were free cash-in-hand on a Brexit, the individuals offering this money to science (as part of their campaign) would have no power over its allocation. None of them have any track record in science policy or impact on national science budget allocations. They are simply in no position to offer money to national R&I – even if that money were available.

1.2.12. It is worth taking a moment to consider where the UK's net contribution actually goes. The UK net contribution (and similarly, the net contributions of the other wealthier countries in the EU, such as Germany – which contributes the most) has risen in recent years due to the EU's expansion eastwards, taking in new member states that are less developed than western Europe. Regional development funds are being used to support their development.

1.2.13. A huge transition from the FP7 to the Horizon 2020 timeframes concerns the use of regional development funds alongside the science programmes to support research and innovation capacity building. So while eastern (and southern) Europe's under-competitiveness does not interfere with the EU's criterion of funding "excellence" in science (a decision which benefits the UK greatly), nevertheless, it is important that those EU countries which came into the competitive funding environment late receive adequate

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[659] The Trouble with Europe (2014). http://www.amazon.co.uk/The-Trouble-Europe-Working-Reformed/dp/1857886305

support to be competitive. Otherwise brain drain and disillusionment will drop capacity in those regions and for the EU overall.[660]

1.2.14. Therefore, the new focus of the Commission to dedicate regional development funds to R&I means that the whole EU ecosystem of science is strengthened in all parts. The UK, as the EU science programme's leading player – benefits strongly in the long run when it can participate in and lead (more than any other country) ever more capable teams from an ever stronger region.

1.2.15. Much of the "net contribution" being promised by ***Vote Leave*** to UK R&I is currently deployed to strengthen the pan-EU science hub that boosts the UK's global leadership in science. Therefore those monies are already being strategically invested in the UK's R&I future. Ultimately, we see further by standing on the shoulders of a giant.

1.3 A case study of Switzerland as a model for UK science outside the EU

1.3.1. The contention that the UK can leave the EU and then re-join (or continue full member participation on) the EU science programme without notable difference from the current situation is addressed here.

1.3.2. Fortunately, this discussion is not purely hypothetical, but rather based largely on the precedent of Switzerland's relationship with the EU science programme. Given Switzerland's high competence in science, geographical location in Europe, non-EU status and political difficulties with issues of EU immigration – Switzerland is a helpful model for the UK's re-negotiation of science programme membership following a Brexit:

1.3.3. Synopsis of the Swiss-EU science story:

1. Switzerland is not a member of the EU but since 1992 has obtained full access to Framework Programmes, as part of agreements that also guarantee free movement of persons, contributing to the FP budget alongside other EU members.
2. In 2014, a popular vote to limit mass migration was passed by a margin of 50.3 to 49.7%
3. The Swiss government was then unable to commit to ratification of a free movement accord with Croatia.
4. Switzerland was suspended from access to Horizon 2020.
5. The Swiss government was forced to replicate at national level a temporary programme to replace immediate access to the ERC programme and subsequently negotiated limited access to H2020, with much reduced access to programmes, exclusion from the new SME Instrument and loss of ability to coordinate collaborative research within H2020. This is reliant on continued freedom of movement. Switzerland also funds Swiss participants in EU collaborative programmes directly at national level, requiring parallel domestic administration and an agreement to accept all funding decisions made in Brussels, effectively losing control of its national science budget.

660 http://www.researchresearch.com/index.php?option=com_news&template=rr_2col&view=article&articleId=1341729

6. The Swiss were also not included on Erasmus+. They chose to ensure continuation of the scheme by paying nationally both for students leaving and for those coming in (i.e. paying double what they would as a member of the international programme).
7. Negotiated access to H2020 will end in 2016, when Switzerland must either ratify the Croatia treaty or lose access to H2020 plus risk its bilateral trade agreements with the EU.
8. Switzerland must contribute to H2020 based on GDP and population and has no role in developing funding topics.

1.3.4. This case study of Switzerland represents an instructive set of circumstances for the UK with regard to Horizon 2020 access post-Brexit. Switzerland's current participation is dependent on free movement. Should the UK leave the EU and restrict freedom of movement, it will have no access to Horizon 2020 beyond third country status (Afghanistan, Argentina etc.). However, as detailed further on, the sheer size of the UK causes problems for re-joining the EU programme after rejecting the EU.

1.3.5. The UK must consider that a withdrawal from the EU, followed by Horizon 2020 'buy in' such as that of the Swiss model, will require continued EU budget contribution. Switzerland makes a contribution to the Horizon 2020 budget based on its GDP and its population, but the UK may have to pay more than its current contribution and/or accept limited involvement, due to its size, so as not to be so overtly disruptive (without the counter-balance of net contribution investment into less competitive regions).

1.3.6. It will also have to follow Switzerland in creating domestic administration structures for programmes where it will fund UK participation in Horizon 2020 collaboration from domestic budgets. This has the double disadvantage of replicating a complete administration structure in the UK that operates on EU financial and legal rules without any role in creating those rules, and it must agree to a single evaluation decision made in Brussels to avoid damaging the partner-worthiness of UK participants with an additional UK level of evaluation.

1.3.7. The requirement to agree to implement funding decisions made in Brussels will ensure that the UK cannot control budget allocated to such collaborations. This creates a scenario in conflict with claims by anti-EU groups. The UK will still be contributing to EU science financially, it will have no control over domestic budget for collaborative research and it will have to sustain a parallel administration structure. This combination of factors means that the UK cannot make a simple financial calculation on financial contribution to EU science nor estimate how much it would retain to find UK research post-Brexit.

What is each Member State's share of signed grant agreements?

Share of participations in signed grant agreements per EU Member State: Horizon 2020 compared with FP7

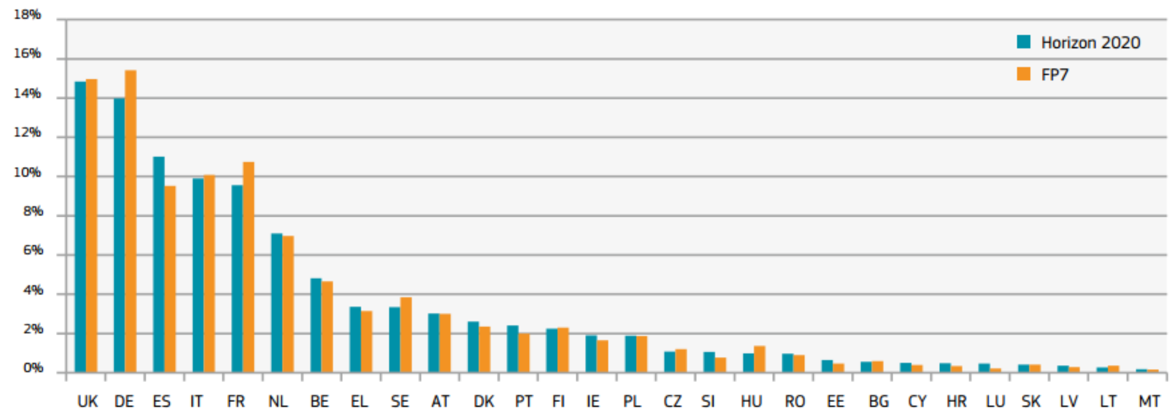

Figure 4: The UK is now the leading country in terms of number of projects won from Horizon 2020

1.3.8. Important considerations pertaining exclusively to the UK's relationship with the science programmes must be addressed upfront. Unlike Switzerland, Norway, Turkey or any of the non-EU countries that hope to become full Associated Countries on the EU science programme – the UK has a lot more to lose.

1.3.9. The UK is currently a full member of the EU, meaning that it has a political say in the development of the science programme. It is also the leading player on the EU science programme, winning more grants than any other country during Horizon 2020 so far. That means it has overtaken Germany, which was the leading country on FP7 (see Figure 4 above).

1.3.10. This combination of the political input (and the UK has, due to its population size, the third largest delegation to the European Parliament), and the UK's science prowess means that the UK has the kind of status and power on the programme that no non-EU participating country has. These other countries are easily absorbed into the overall programme at a cost. Whether they are EU members or not, they would not command much of a political say on overarching science direction and management.

1.3.11. This commanding position for the UK means that, on Brexit, a buy-back into the programme as a full Associated Member would have several major flaws:

- The largest player on the programme would have no political say about its formation.
- Playing by the same rules as others means a 12% contribution of funds for 16% gain of competitive funds – a very damaging ratio to the other countries given the UK's

size, given also that it is no longer a net contributor to an EU budget and therefore not supporting the R&I of other EU countries.

- The threat of the UK changing its immigration policies at any stage offers major disruption to the programme, which must respond according to the precedent with Switzerland.

1.3.11. In conclusion, the UK acquiring full Associated Country status on Brexit is not an option. The EU has already introduced and used the concept of Partial Association with Switzerland and would do the same with the UK, tailoring a deal to maximise its own interests.

The impact on Swiss science of a partial access deal

1.3.12. Although it is early days in Horizon 2020, nevertheless, data available clearly show the disruption caused to Swiss science performance on the EU program (Figure 5)[661]. The uncertainty and renegotiations, despite clawing back participation on areas of the program critical to Switzerland's interests, has taken a marked toll.

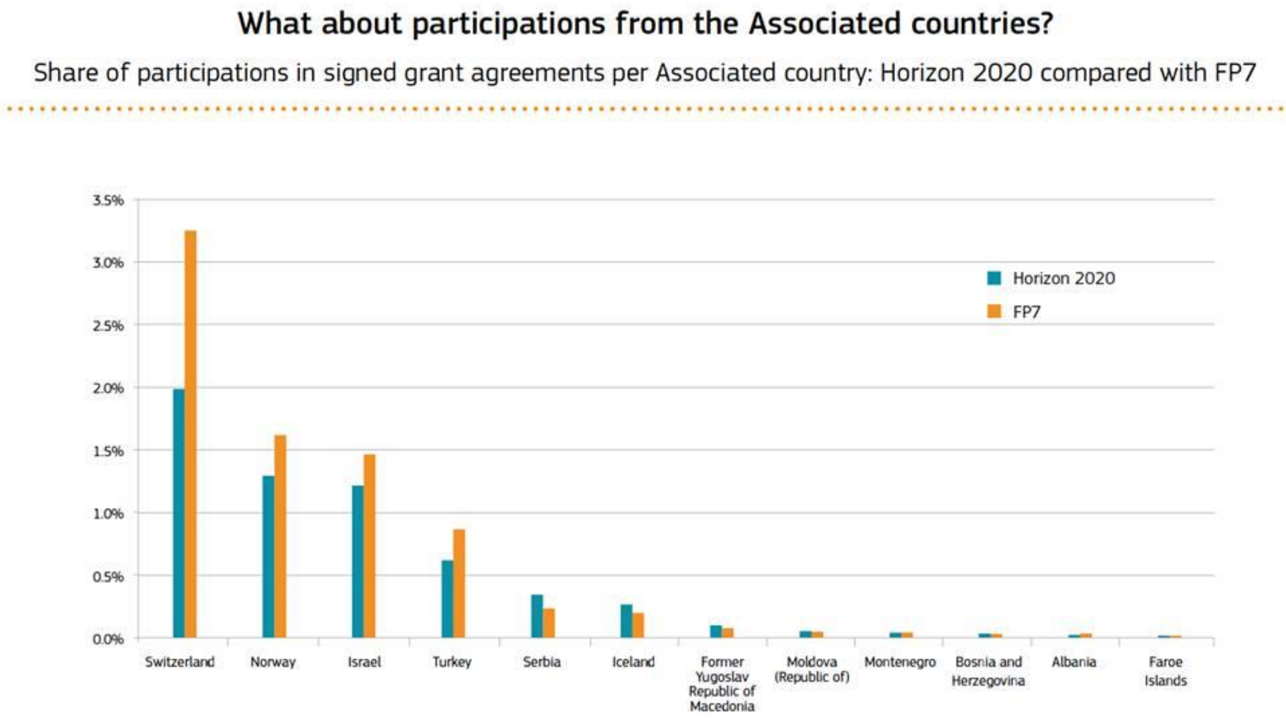

Figure 5: Comparison of participation levels during FP7 and the latest figures from H2020. Switzerland indicates a 40% drop in participation.

1.3.13. Swiss participation in H2020 and financial benefit has declined significantly, despite negotiated access. The above graph suggests a drop in participation by over 40% for

[661] https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results.pdf

Switzerland – highlighting the cost of renegotiation confusion even for a highly-competitive scientific community.

1.3.14. Swiss sources (private communication) report a declined trust in Swiss research partners and rapid reduction in their engagement in collaboration – the Swiss science sector is reliant on immigration and its innovative performance is likely to decline, particularly if it must completely exit Horizon 2020 membership in 2016.

1.4. Retaining EU membership: Is the EU headed in the right direction for UK science?

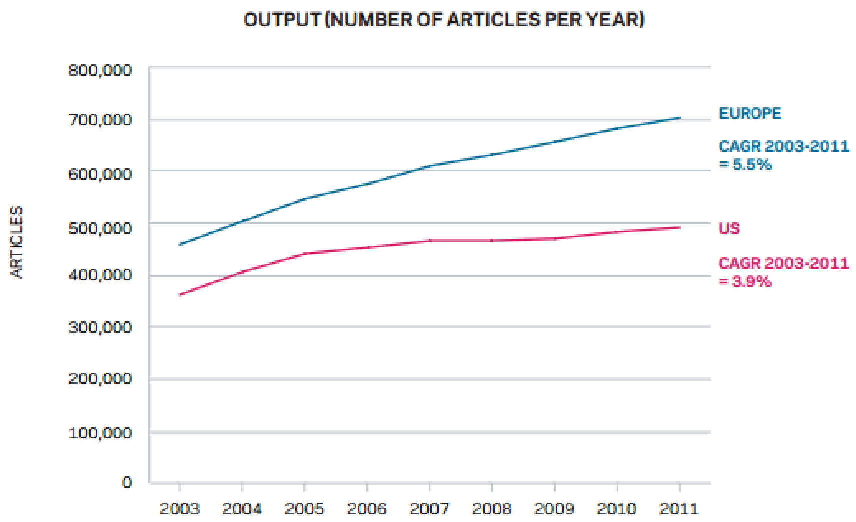

Figure 1 — *European and US output per year, 2003–11, with compound annual growth rate (CAGR).*

Outputs included are articles, reviews and conference papers indexed in sources covered by Scopus, primarily journals, conference proceedings, book series, and trade publications.

Figure 6: Retaining EU membership: Is the EU headed in the right direction for UK science?
Figure copied from Science Europe & SciVal report (2013). "Europe" denotes all countries that paid into the FP7 science programme (ie. 27 member states plus 14 associated countries)

1.4.1. The UK is currently in the driving seat of a global hub of research excellence that is larger than the US in output size, growing faster than the US (see diagram above), and with a far higher rate of international collaborations at a time when the impact of international collaborations are bringing increasingly high impact.

From Eurocracy to leadership

1.4.2. However, the benefits of the UK remaining within the structure of the EU go beyond the clear internationalisation-impact dynamic. The increasing competence of the EU in science management is beginning to be felt.

1.4.3. Whether one considers the bold commitment to increasing science investment despite shrinking overall budgets, a holistic and well-articulated vision for science, closer democratic accountability for the budgeting and priority-setting within science, success in linking universities with small businesses, open data, bold infrastructure, the European Research Council and plans for a similar innovation council, or newfound transparency around its science programme outputs – it is clear the EU has discovered an appetite for science leadership. The body has transitioned from a painful bureaucratic funder[662] poorly copying a US lead into a true leader confidently setting its own agenda.

1.4.4. UK politicians even act as a barrier to UK science's capacity to fully harness the benefits of the EU. The low participation rate of UK SMEs on Horizon 2020 relative to our universities is directly attributable to very poor advertising through channels such as BIS and Innovate UK.[663]

1.4.5. Any pride that British politicians may feel about the quality of British science in comparison to other countries in the EU should have their mood strongly tempered by the realisation that in the eyes of many British scientists, the EU is stealing a march on the UK in science policy leadership. New directions and capacities that our UK scientists argue for are now rapidly adopted within EU thinking, whilst in the UK, common knowledge about core needs (e.g. a funding increase to a 3% target) often circulates perennially with inaction by the parties in power and their appointees.

Section 2: Direct answers to the questions set by the inquiry

2.1 Funding

Q1: What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

2.1.1. The UK receives funding for R&D from the EU primarily in two ways: EU frameworks such as FP7 and Horizon 2020 provide direct funding for international research and Cohesion Funding may optionally be spent on R&D by the UK government.

2.1.2. Over the course of FP7 the UK obtained the second highest level of funding of €3.9bn.[664] Of the €10.6bn Cohesion Funding, €4.5bn was spent on R&I.[665] Not accounting for the vagaries of changing exchange rates, that equates to £5.88bn (today's rates) over the

[662] Galsworthy, M.J. & McKee, M. (2013). Europe's "Horizon 2020" science funding programme: How is it shaping up? Journal of Health Services Research and Policy. doi: 10.1177/1355819613476017

[663] http://www.theguardian.com/science/political-science/2014/feb/18/eurosceptics-could-damage-british-science-and-innovation

[664] http://ec.europa.eu/euraxess/pdf/research_policies/country_files/United_Kingdom_Country_Profile_RR2014_FINAL.pdf

[665] ibid.

2007-2013 term of FP7. ***This is equivalent to 10% of the total spend on R&I (in all sectors) of UK government, RC's, HEFC's and HEIs for the full period of 2007-2013***.

2.1.3. The scale of the EU financial contribution to UK science is also increasing. This is particularly salient against a backdrop of under-funding from our own government. The EU expenditure on research and innovation under the Framework Programmes and their successor, Horizon 2020 has risen sharply recently, more than tripling over the last 10 years.

Table 1: The EU Science Programmes from Framework Programme 5 (FP5) onwards.

Programme	Years	Budget (€B)	Av spend/year (€B)
FP5	1998-2002	15.0	3.0
FP6	2002-2006	17.9	3.6
FP7	2007-2013	53.2	7.6
Horizon 2020	2014-2020	80.0	11.4

2.1.4. The impact of this recent surge can best be seen in funding profiles provided by the most recent Research Excellence Framework (REF) documents. The REF 2014 analysed the research of 154 UK universities with 1,911 submissions covering 52,061 academic staff, 191,150 research outputs and 6,975 impact case studies.[666] The panel overview reports from the REF (published in Jan 2015) contain figures showing the sources of funding for UK university research from 2001 up to the year 2013 (the last year of FP7). We have compiled those graphs into a single diagram (see on next page).

Extrapolating the REF funding diagrams to now and the future

2.1.5. Given the increased funding for Horizon 2020 from FP7 – and given the increasing proportion of money won by the UK, it would be fair to continue the extrapolation of the "EU government" funding line upwards in all four panels. That means that by now, in the year 2015, "EU government" is the second largest single funding source in 3 out of the 4 REF panels. Only Panel A (Life and medical sciences) shows a relatively low projected influence of EU funding.

[666] http://www.ref.ac.uk/

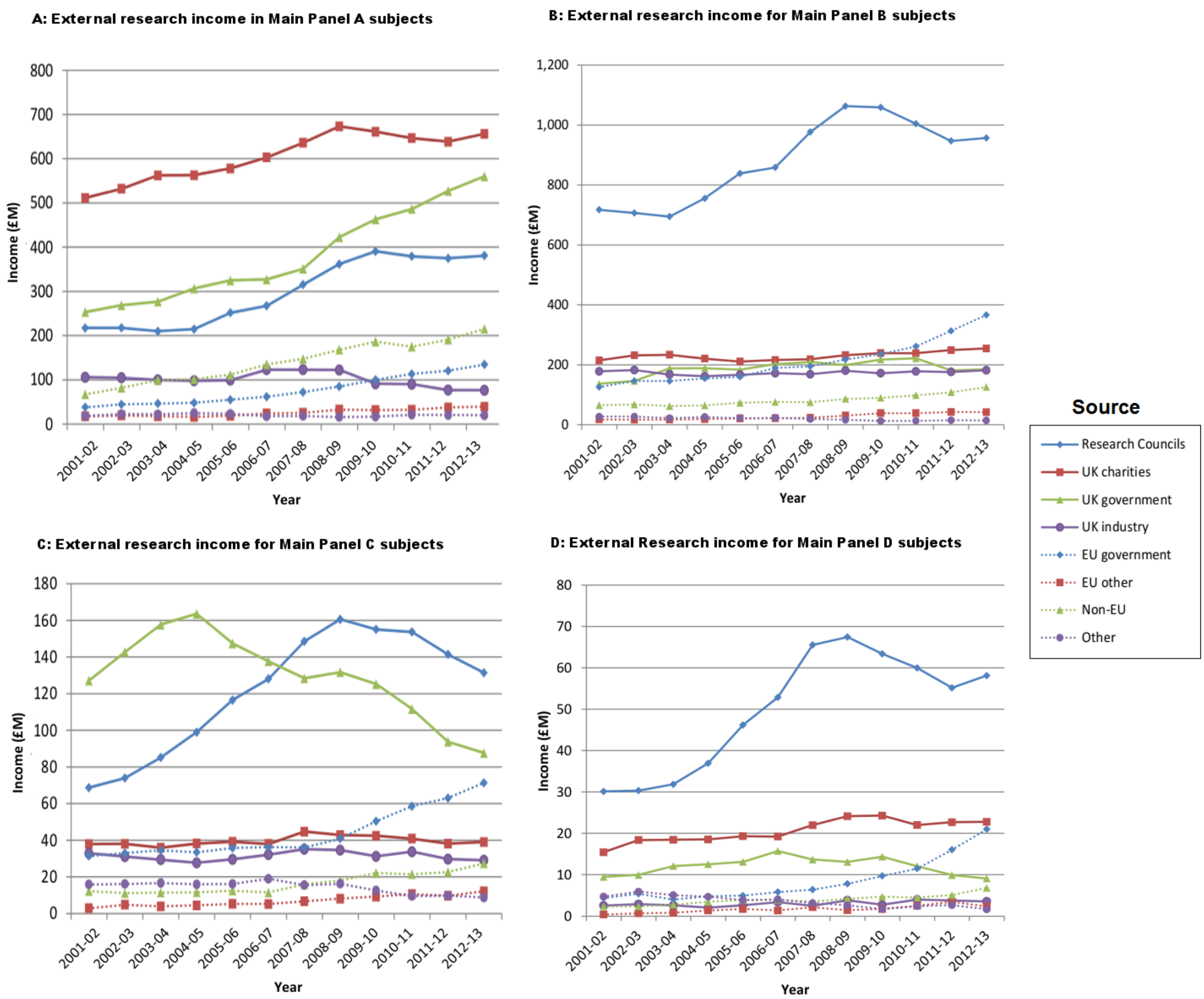

Figure 7: Graphs copied from REF Panel overviews and compiled into a single diagram. Explaining the panels: Panel A: Life sciences. Panel B: Engineering and Physical sciences. Panel C: Social sciences. Panel D: Arts & humanities.

Comparison of UK with other countries for EU funds, participation and coordination won

2.1.6. The UK is the lead performer within EC funding programmes across the spectrum when it comes to applications and participation rate. As noted earlier in this submission, although Germany won the most projects during FP7 overall, the UK has overtaken Germany to pole position on Horizon 2020 so far (incidentally, the UK overtook Germany in the last 2 years of FP7, according to a speech by Commissioner Moedas to the Royal Society[667] in March 2015). Nevertheless, Germany remains in the lead (and extends the lead in Horizon 2020) with actual amount of funding won.[668]

667 http://europa.eu/rapid/press-release_SPEECH-15-4658_en.htm
668 https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results.pdf

2.1.7. The Horizon 2020 First Results report[669] shows UK in 10th place for success rate of applications (a measure of quality of applications). Although it should be noted that the range of success rates is narrow for the 28 EU member states (11-17%), unlike under FP7 where there was greater variation (14-26.5%). The same report shows the UK in 16th place for application rate per capita and 21st place out of 28 for SME instrument participation per capita (although Germany was 23rd and France 24th indicating probable disconnect of small business awareness of EU funds in larger countries).

2.1.8. The UK is particularly dominant in two areas; winning European Research Council grants and playing the coordinator role on multinational health projects.

2.1.9. Within the European Research Council grants allocated from 2007 to 2014[670] the UK obtained over 30% more grants than the nearest competitor, Germany (1225 vs 808) across the five grant types (Figure 8).

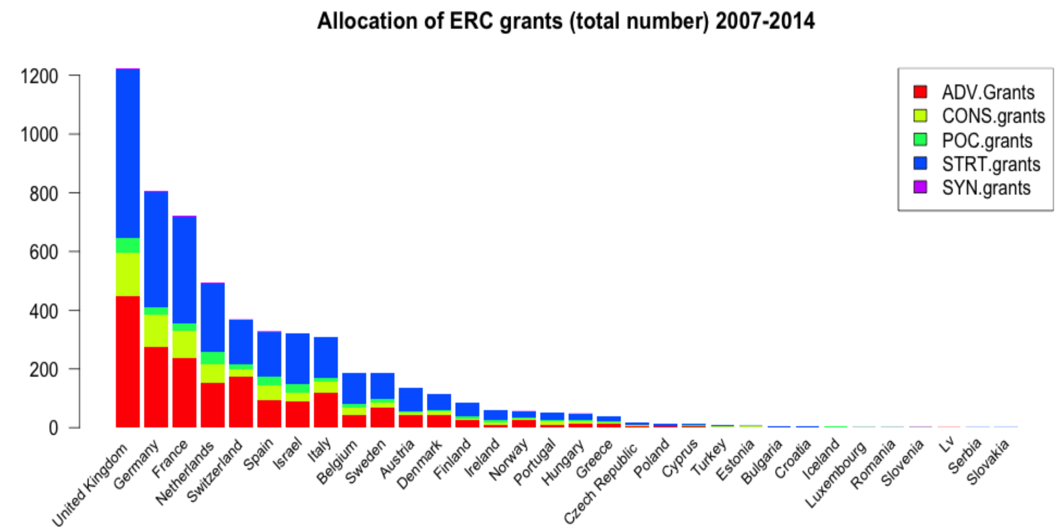

Figure 8: Numbers of grants allocated by the ERC to individual countries. Grant types are: ADV, advanced; CONS, consolidator; POC, proof of concept; STRT, starting; SYN, synergy.

2.1.10. ERC grants are particularly important because they are 1) generous in funds, 2) are awarded by a panel of leading scientists, 3) investigator-driven, 4) highly-competitive, 5) attract top talent from anywhere in the world to work in the EU and the science programme's Associated Countries. Therefore, it is a global brand of excellence facilitating the attraction of world-leading talent.

Health Project Coordination

2.1.11. UK researchers have particular expertise in health. Under FP5 and FP6 combined, UK institutions coordinated just over 20% of all health-related projects.[671] Under FP7, that coordination rate rose to 23% and under Horizon 2020 it stands so far at 34%[672]

[669] https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results.pdf
[670] https://erc.europa.eu/projects-and-results/statistics
[671] Galsworthy, M.J. et al (2013) An analysis of subject areas and country participation for all health-related projects in the EU's FP5 and FP6 programmes. Eur J Public Health. doi: 10.1093/eurpub/ckt075

Q2: What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

2.1.12. The UK economy regularly makes payments of around 1% GDP to the EU budget. This is very similar for all EU member states. The overall EU budget therefore stands at around 1% of EU GDP, although a system of additional "own resources" and special considerations/ corrections (including the UK rebate) make the finances more complex[673].

2.1.13. To understand the proportion of the funds that support R&I activities, one needs to look at the EU budget itself – or more specifically, the multiannual financial framework (MFF). It is not just Horizon 2020 that supports current science and research activities.

2.1.14. Outside the €79bn Horizon 2020 are also: Copernicus (€4.3bn; a European system for monitoring the Earth), COSME (€2.3bn; Competitiveness of Enterprises and SMEs), Erasmus+ (€14.8bn; professional development and cooperation between universities, schools, enterprises, NGOs), Galileo (€7bn; state-of-the-art global satellite navigation system), ITER (€3bn; nuclear fusion project in collaboration with US, China, Japan, India, Russia & South Korea), and other programmes that overtly or indirectly support science and technology. The programmes of the 2014-2020 MFF and their allocations are listed on the Commission website[674].

[672] http://www.scripintelligence.com/home/The-Brexit-Effect-A-Blow-To-UK-Life-Science-Leadership-361337
[673] http://ec.europa.eu/budget/mff/resources/index_en.cfm
[674] http://ec.europa.eu/budget/mff/programmes/index_en.cfm

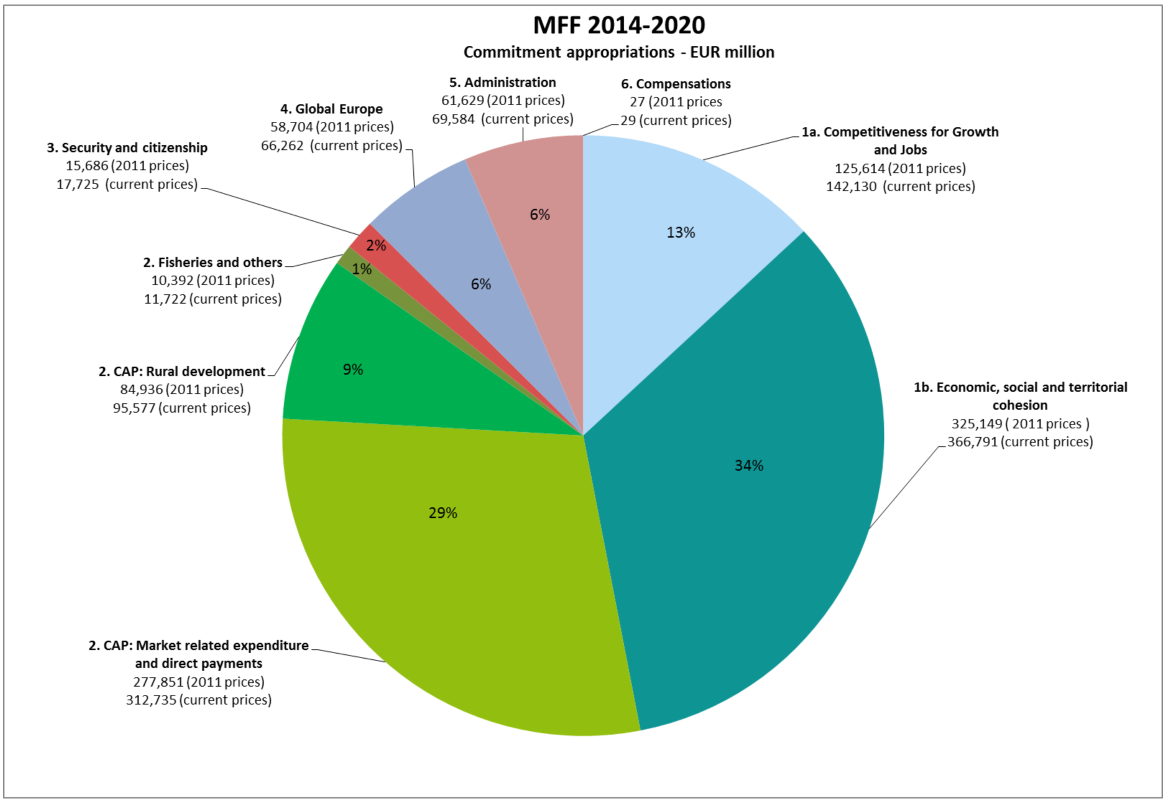

Figure 9: The EU's multiannual financial framework (taken from EC website). Collectively, 1a and 1b are called "Smart and inclusive growth" and the parts labeled 2 are called "sustainable growth: Natural resources"

2.1.15. All of the MFF programmes listed as science and research activities above, including Horizon 2020, fall into the 1a heading of the pie chart above ("Competitiveness for growth and jobs"), that collectively accounts for 13% of the budget spend. Very importantly, however, Heading 1b ("Economic, social and territorial cohesion") is filled with programmes like the €185bn "Less developed regions", the €55bn "More developed regions" and the €75bn "Cohesion fund" – all of which aim to drive economic growth primarily through capacity building of research and innovation.[675]

2.1.16. Yet even headings like "Security and citizenship" contain programmes such as the €449m Health programme which aims to "promote health, reduce health inequalities, protect people from serious cross-border health threats, encourage innovation in health and increase the sustainability of their health systems." A mission that clearly has a health research focus.

2.1.17. Therefore it would take painstaking classification work to go through the entire set of programmes and designate whether they support "science and research activities" and to what degree. However, as a crude rule of thumb, we can say that Heading 1 (entitled "smart and inclusive growth" and comprising 1a and 1b from the pie chart) is targeted at driving stable economic advancement primarily through capacity-building in research and innovation activities. That means that 47% of the EU budget has a clear emphasis on supporting science and research activities.

675 http://ec.europa.eu/regional_policy/archive/what/future/index_en.cfm

2.1.18. This is a shift away from Regional Development Funding during the FP7 timeframe where R&I activity was recommended, but not directly supported, leading to expenditure on physical (eg transportation) infrastructure. The current 2014-2020 MFF is clearly geared to research, innovation and small businesses through regional specialisation. Thus it will strengthen the EU's capacity in this area.

Q3: What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

2.1.19. Management of large scale collaborative research from multiple countries, using taxpayers' money, is inevitably complex and leads to complaints of slowness (often justified) in processing reporting and finances. This is more a challenge for SME participation where cashflow is critical, than for universities, which can manage cashflow over longer periods. The European Commission budget for such management has declined (under pressure from countries such as the UK) to reduce costs and project administration is increasingly carried out through external agencies to the EC.

2.1.20. UK project administration is on a different scale to EU administration – projects are smaller, with fewer partners and primarily within domestic institutions, bound by the same legal and financial laws. They cannot easily be compared to administration of EU programmes. However, the experiences of applicants can be fairly compared.

2.1.21. Previous incarnations of the EU science programme came in for many complaints concerning complexities, pointless timesheets and unduly long time-to-grant processing periods.[676] The Commission's interest in bringing increased numbers of SMEs into Horizon 2020 meant that the programme absolutely had to drop bureaucracies in order to make the programme attractive to the desired audience.[677] For Horizon 2020, the widely-hated timesheets for full-time employees on projects were dropped and strong emphasis placed on time-to-grant targets, despite a huge surge of applications. The Commission now claim that they have met their 8 month time-to-grant target in 95% of cases.[678]

2.2 Collaboration

Q4: What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

2.2.1. The UK achieves a huge benefit from access to collaborative research programmes and the ERC funds. This submission has already fully documented the huge reputational and

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[676] Galsworthy, M.J. & McKee, M. (2013). Europe's "Horizon 2020" science funding programme: How is it shaping up? *Journal of Health Services Research and Policy*. doi: 10.1177/1355819613476017
[677] http://www.publications.parliament.uk/pa/ld201213/ldselect/ldeucom/162/162.pdf
[678] https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results.pdf

impact advantage that such multinational projects confer. The size and increasing brand of the ERC grants also ensures the UK has an attractive mechanism to bring to its labs the world's leading talent. However, maybe the largest advantage the Horizon 2020 framework confers is the leadership/coordination role on multinational projects.

2.2.2. Probably the most detrimental impact to UK science following a Brexit would be the loss of coordination roles. It is hard to tell if this would occur per se or only in response to immigration quotas. Of the projects in which the UK participated in the FP7 Health program, it coordinated almost 23%. In H2020, the coordination percentage is 34%, ahead of Germany (29%)[679]. The UK is an extremely good project coordinator, with a keen market drive and an entrepreneurial ecosystem. These coordination roles are almost always taken by universities, which have developed experienced and sophisticated management teams that not only deliver a solid project but also apply their expanded skills into business planning and a more strategic development of university key strengths.

2.2.3. There are fundamental advantages to coordinating international collaborations, and such a loss would reshape the UK research landscape. Inevitably, there will be a loss of revenue. Coordinating an international partnership brings significant additional income and can fund management, business development or technology transfer posts, enabling universities to scale up their professionalism in research management and exploitation.

2.2.4. The coordinator also invariably drives the science in a project – they are the ones that initiate the project idea, develop the consortium and undertake most of the proposal development. This loss of coordination will also damage the UK's ability to develop, attract or retain leading researchers, whether established group leaders or ambitious young scientists. The world of academic research is driven by striving to lead your field. Coordinating large teams of labs is a clear path to establishing leadership. Losing a mechanism to coordinate international projects will reduce the quality of research leaders in the UK, with the inevitable slide in global research rankings as a direct result.

2.2.5. EU membership also brings access to a scale of international collaboration that the UK cannot replicate, in terms of scale or access to skills. The emergence of public private partnerships within the EU, with the Innovative Medicines Initiative (IMI) being the most significant example, This funding programme engages major pharma companies and the European Commission to target bottlenecks in drug discovery. This programme funds projects worth hundreds of millions of euros and engages all the pharma companies currently in the UK. These companies are not going to disengage from IMI in the event of a Brexit in order to replicate programmes at a national level. Switzerland currently has access to IMI through its negotiated Horizon 2020 access but it will lose that access if it restricts freedom of movement.

Q5: What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

[679] Analysis by Claire Skentelbery utilising data from: http://cordis.europa.eu/projects/home_en.html

2.2.6. The question focuses on bilateral collaboration, suggesting a mechanism beyond the broad multinational research projects of Horizon 2020 where two countries work together. There are already mechanisms such as the Eureka programme and ERANets within Horizon 2020 which provide a platform for bilateral research, primarily between SMEs, utilizing local or national funding sources and managed at funding provider level. EU countries also undertake bilateral research outside Horizon 2020, particularly in research areas of specific interest e.g. regenerative medicine. These are often driven at cluster or regional level, making use of local funds, rather than national sources. Bilateral collaboration within the EU is not hindered by EU membership, indeed there are no differences between EU or non-EU collaboration beyond national legal requirements.

2.2.7. Bilateral collaborations beyond the EU are also undertaken regularly, both as a mechanism to access novel innovation and also to open access into new markets – the US and Canada are particularly strong targets for market access and investment reasons. Bilateral agreements are normally on an industrial basis, for SME collaboration primarily. Israel has a number of collaborations with Europe.

2.2.8. Non-EU partnerships are often more effectively created through EU mechanisms as many non-EU countries have defined access to Horizon 2020 projects. For example, US organisations in Horizon 2020 are funded directly by Brussels, rather than through their own US funds. The structure of NIH funding does not encourage collaboration and this Horizon 2020 is a more powerful mechanism for building partnerships.

2.2.9. It must be confirmed here that the level of regional or national funds allocated to bilateral agreements is usually low, both inside and outside Europe and the agreements short term. The presence of Horizon 2020 as a substantial collaborative funding programme negates the need for smaller scale collaboration and is considered a strong tool for effective collaboration. If the UK were to leave the EU and Horizon 2020, its ability to create bilateral agreements would be limited by the willingness of other EU countries to invest in such agreements to the detriment of their participation in Horizon 2020.

2.2.10. The ease of collaboration both legally and physically is represented in the UK's success with research outputs. An investigation[680] of the publications recorded in the online index PubMed shows that outputs where the UK is partnered with at least one of the other 27 full EU member states more than doubles the number of collaborative outputs with the United States (Table 2). Collaborations with China are a quarter the number of those with the USA and collaborations with India are around a third of those with China.

2.2.11. Of special importance is the observation that of those collaborations with either the USA, China or India, about a third also include another EU member state (nearing a half for USA). It has been stated recently by several countries that the UK is their access point to the EU but it is also true that the EU is the UK's access point to wider international collaboration.

[680] By Rob Davidson, using: http://www.ncbi.nlm.nih.gov/pubmed

Table 2: Collaborative research outputs as recorded in PubMed for year 01/01/2014 - 01/01/2015

UK partner	Number of publications (2014)	Number of publications where at least one other EU member was also listed as author (2014)	% of collaborative papers that include an EU partner.
EU*	13,336		
USA	6,242	2,850	46%
China	1,432	468	33%
India	563	202	36%

* (at least one of the 27 non-UK, EU members)

Q6: How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

2.2.12. The UK attracts a significant amount of private investment into its life sciences sector. A July 2015 report from the BIA and Evaluate[681] recorded IPOs valuing a total of over £340 million in 2014 and private investments of $430 million. This investment is based on a diverse number of factors:

- Strong science base with knowledge transfer into start-ups and spin offs
- Development of a sustainable commercial lifescience base during the 1990s which reached maturity in a number of clusters across the UK
- Creation of a critical mass of business skills in scientific company management, avoiding many of the issues in emerging regions
- Association with strong legal and financial centres such as London
- Seen as a friendly point at which to enter the EU.

2.2.13. All of these points are linked to EU membership. The UK will still be a strong target for investment outside Europe but it will be considerably diminished as all of the points above become diminished outside EU membership:

- Strong science base and knowledge transfer: Loss of collaborative leadership will be a significant blow to the UK research base, with associated loss of knowledge transfer capability as management budgets decline alongside scientific budgets. The loss of international project leadership will also reduce the production of patentable research outcomes in the UK
- Sustainable life science base: As the patentable outcomes decline from universities through loss of research leadership, start-ups and spin offs will start to decline and this will feed into the pipeline. This will result in fewer service providers and a general decline in the cluster landscape. Companies in the UK are likely to create EU research bases in order to access H2020 and this will lead to movement of skills and resources away from UK bases.

[681] BIA and evaluate report: UK Biotech A 10 year horizon: http://www.bioindustry.org/document-library/uk-biotech-a-10-year-horizon/

- Business and research skills: The loss of international collaborative leadership will result in the reduction of senior researchers developing in universities and also moving to the UK (although immigration restrictions will also achieve this). Within the business community, fewer start-ups will start to reduce the population of skilled managers and also reduce the skills within the service community. This is a trend that is very hard to reverse.
- Association with strong financial and legal centres: Lack of access to Europe will reduce the value of the UK as a financial or legal centre, particularly as these centres will not be directly engaged in the EU
- Point of access to the EU: This will be a strong dis-incentive to investment because the market options are restricted and it is no longer an entry point to the EU.

2.2.14. In UK expenditure it can be seen that the UK Research Councils have been increasing their spend on Knowledge Transfer (KT) since 2008 despite a stagnant or falling overall budget at constant prices (Table 3). Whether this is linked to EU policy or simply coincidence is unclear but the existence of the EU recommendations in this area is very welcome.

Table 3: UK Research Council budget and expenditure on Knowledge Transfer (Constant prices)

	2008	2009	2010	2011	2012	2013
UK RC expenditure on KT[682] (£millions)	44	51	83	95	195	184
UK public funding of RCs [683] (£millions	3,079	3,157	3,125	3,053	2,722	2,899

2.2.15. In terms of more general private investment aided by EU membership, a recent article discussed the case of the ~2,500 German companies that employ 500,000 people in the UK and their spokesperson highlighted the benefits that came from ease of movement of talent as well as the stability and facility of the current EU-wide trade agreements[684].

Q7: How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

2.2.16. The UK has been a major actor in the hosting and development of international infrastructures, such as the European Molecular Biology Laboratory (EMBL), based in Cambridge and The European Medicines Agency[685] is also based in London. This attracts relevant knowledge and industry into the vicinity. A loss of EU membership would most probably move such institutions outside the UK.

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[682] http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-370739
[683] http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-353643
[684] http://www.independent.co.uk/news/uk/politics/eu-referendum-german-companies-issue-a-please-stay-appeal-ahead-of-membership-vote-10375103.html
[685] http://www.ema.europa.eu/ema/

2.2.17. The UK is also an integral partner in facilities open across Europe, giving access to facilities and skills that would be hard to replicate in the UK alone, even if funding was ploughed into new facilities at a scale never seen in the UK. Facilities such as CERN, European Space Agency, European Southern Observatory, European Synchrotron Radiation Facility and the Institut Laue are all connected into the UK and represent decades of partnership.

2.2.18. The loss of EU membership will make access to such facilities significantly more complex, as benefit of EU membership will have to be replicated, if possible, as an external partner, rather than an EU partner. It would be likely that greater direct costs for access to facilities would be incurred, no ongoing relationships for research through channels such as H2020. The UK could no doubt recreate partial access from outside the EU but it will be a partnership more in line with non-European partners such as the US.

2.2.19. In terms of hosting academic or business meetings, the current Freedom of Movement arrangement of EU membership means that the UK is an attractive place to host meetings. Very few participants (especially for Europe-based work) need visas. This would change dynamics should the UK leave and negate FoM arrangements with the EU.

Q8: What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

2.2.20. According to the report "International Comparative Performance of the UK Research Base – 2013", prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS), 71.6% of UK researchers were internationally mobile between 1996-2012. The UK currently has a significant percentage of non-UK scientists (15% from the EU) within its universities and companies and a strong performance for UK scientists internationally also. The freedom of movement of people within the EU has underpinned economic and scientific development in all countries. Science is international by its very nature and if universities cannot attract the best researchers globally, they will not compete.

2.2.21. Of the last 10 UK Nobel Prize winners within scientific fields, five held non-UK passports and eight had worked outside the UK before their Nobel Prize. It would be reasonable to ask how many would have been in the UK at all if there were restrictions on movement. Not only because they may have not been able to take up a post in the UK but also because they would not be able to lead international research projects (funded through the EU) or recruit the best researchers to their laboratories.

2.2.22. Cluster development is also linked to mobility of skilled personnel and not just the researchers themselves. People don't move to places where their families will not have a good quality of life – if the partner of a researcher cannot work, there are short term visa restrictions, or there are constraints on access to schooling or social benefits, then the researcher will not move there.

Q9: Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

2.2.23. The UK does produce many collaborative research outputs with non-EU participants. What has also been stated in relation to that table is that international collaborations with non-EU states often involves EU member states (45% in the case of UK/USA collaborative publications). This shows that EU membership does not inhibit collaborations with countries outside the EU. In fact, there is demonstrated facilitation through the Horizon 2020 framework.

2.2.24. It is true that the UK collaborates most with other EU members but this is far from an imposition. The EU is, after all, the most productive research bloc in the world and so it is natural that the UK should want to engage most with EU members, especially given its frequent leadership role in these successful projects.

2.2.25. The 'GlobSci' survey[686] studied international flow of researchers and noted that "For many countries, 'neighbors' are the most likely source of immigrants". This is observed in the frequent exchange of researchers amongst EU member states. The UK bucks this trend somewhat by sending most of its own scientists to far away Anglophone countries like USA, Canada and Australia. The UK still receives most scientists from relative neighbours Germany and Italy. The point being that it should be expected that the UK would do most collaboration with other EU members due to the geographic proximity, cultural similarity and human nature which ultimately prefers to stay close to home – in the survey, the primary reasons for researchers to leave a country were to join family, highlighting the importance of being close to family in general.

2.2.26. The only way for EU migration policy to restrict the UK's ability to attract talent is when the UK itself puts restrictions on total net migration.

2.2.27. The UK has enforced such restrictions despite widespread reporting that international students are a boon to the economy and take out little from public services due to their low age and lack of dependents. A detailed report from Sheffield University claimed that their 8,200 international students would bring £136.8 million to the local economy[687], a figure that when extrapolated to the successful reduction in student immigrants approaches £1 billion per annum lost. It can be surmised that if the UK were to leave the freedom of movement agreement it would not be to allow larger scale immigration from the rest of the world even where the economy, public purse, public services or science desperately required it.

2.2.28. There have been several high profile calls for the UK to adopt an Australian-style points based system to help the UK to select only 'good' migrants. However, the UK has had a points-based system for non-EU migrants since 2008. The number of 'exceptional talent'

[686] http://www.nature.com/nbt/journal/v30/n12/pdf/nbt.2449.pdf
[687] http://www.shef.ac.uk/polopoly_fs/1.259052!/file/sheffield-international-students-report.pdf

scientists allowed into the UK is capped at 700[688]. More than 700 scientists will arrive in the UK each year but the UK persistently fails to improve its international perception by setting salary thresholds for Tier 2 visas that are beyond most post-doctoral researcher wages and rather than creating a 'science visa', instead providing an ad hoc exemption for PhD level jobs.

2.2.29. The government has copied the Australian model by providing these ad hoc exemptions via the 'skills shortages list'[689]. The Australian system shows is that not only does it often produce greater net migration than the UK's current mixed systems but also that skills shortage lists may include traditional skilled working class roles[690]. Rather than allow market forces to determine who is likely to come and stay, such systems are slow and bureaucratic with endless micro-management.

2.2.30. In conclusion, enhanced collaboration with the EU does not inhibit collaboration with non-EU members and in fact appears to be a positive feature for global science collaboration. The unrestricted immigration from EU member states only impacts the UK's ability to attract talent from elsewhere when the UK puts limits on net migration figures. Researchers are willing more to cross borders for employment when their access to their home countries or their ability to take family with them is less of a concern.

2.3 Regulation

Q10: What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

2.3.1. There are key regulatory frameworks that directly affect science within the UK. The UK was involved in the development of all EU legislation and, as an advanced scientific nation, the UK was able to make a highly positive contribution to their development.

2.3.2. Examples of regulatory frameworks that commonly influence UK research include:
- Clinical trials Directive 2001/20/EC
- Protection of personal data Directive 95/46/EC
- Protection of animals used for scientific purposes Directive 2010/63/EU
- Medical device Directive 2007/47/EC

2.3.3. The Commission will only develop new regulations when 1) it is asked to do so, 2) the treaties agree that the EU has competence to set regulation in the area, 3) there is sufficient agreement from the member states (not always the case, as with certain alcohol policies). Therefore the notion of Brussels pushing its own rules undemocratically on member states is plain misleading. Oftentimes the governments and societies within the EU take credit for pushing through successful legislation, but blame "the EU" when the interests of other parties in the negotiations have trumped their own interests in an outcome.

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[688] http://www.nature.com/news/uk-visa-problems-worry-scientists-1.14665
[689] https://www.gov.uk/government/publications/tier-2-shortage-occupation-list
[690] http://www.telegraph.co.uk/news/general-election-2015/politics-blog/11577295/What-should-Britain-copy-from-Australias-points-based-immigration-system.html

2.3.4. Data protection and copyright are two key areas critical to the future of UK research and also to the research of other countries in the EU. In such cases, the battle is not against “the EU” per se, but other interest groups/ stakeholders within the EU. Such examples highlight the importance of UK research community maintaining influence in the EU institutions.

Q11: If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

2.3.5. If the UK were not a member of the EU, in theory it would be able to create beneficial regulatory positions for research and science e.g. within the field of clinical trials. However, deviating from regulatory positions held within the EU would make market access substantially harder, with the burden of additional research required to satisfy EU requirements, in addition to UK requirements.

2.3.6. The same would be applied to data regulation, particularly within the fast growing field of ‘big data’ for research. Different data regulatory requirements would make it harder to access EU data sources and also add UK data into EU-wide efforts.

2.3.7. It must be emphasized that the EU and other major agencies, such as those in the US, work closely together to harmonise regulatory requirements in target fields, research being a key area. The UK outside the EU would have little choice but to follow decisions made by non-UK entities in order to maintain competitive environment for its companies, decisions in which it would have no part in making.

Q12: How is the innovation landscape affected by EU membership?

2.3.10. The innovation landscape is affected in its entirety by EU membership, from the first principles of research through innovation delivery to value creation. It is particularly impacted by changes at the beginning of the chain.

2.3.11. The following stages in the innovation landscape are impacted by EU membership:

Basic research: Researchers access the European Research Council as a major source of funding (highest recipient in Europe) plus ability to recruit the most talented researchers across the world. Access also to world class facilities and integration into later stages of the value chain.
Applied research: Access to diverse international funding programmes that enable collaborative research with SMEs, large companies, end users etc. Increased access to knowledge transfer and exploitation skills and routes plus opportunities to create SMEs supported at EU level. Access to talented researchers from across the EU.
SMEs: Access to research funds plus international business and research collaborations. Access to EIB investments to bridge the funding gap to exploitation requiring large scale

investment. Access to skilled researchers and business managers through freedom of movement.
Large companies: Ability to access funding and drive collaborative research through programmes such as the Innovative Medicines Initiative. Ability to operate across multiple EU sites and access a single market from any point. Access to skilled researchers from any country within the EU to build centres of excellence with critical mass.

2.3.12. There are many more aspects of the innovation landscape that are affected by EU membership. We now consider the above in the circumstance of the UK leaving the EU.

2.3.13. The responses of the innovation landscape are predictable in the case of EU exit, partly substantiated by activities already taking place in Switzerland in response to its changed H2020 access and threat of exclusion from the EU singe market in 2016.

2.3.14. The earliest points in the innovation landscape are the least able to proactively compensate for the loss of benefits should the UK leave the EU. Universities, following what is already happening in Switzerland, will face an immediate shortfall in funding, even if the UK secures access to H2020. In the best case scenario for access to EC funds, which include no research leadership, universities will rapidly see a loss of skilled and ambitious research leaders, followed by a decline in exploitable outcomes.

2.3.15. A proportion of the SME community may seek to gain access to the single market and EU funds. They could do this by creating additional sites within the EU where there are also no issues with recruitment. EU countries such as Ireland, the Netherlands, Germany, France and Belgium would work hard to attract UK SMEs. Should Scotland split from the UK, it may also provide a home for SMEs inside the EU in the longer term.

2.3.16. Many larger companies would shift work outside the UK. This is already taking place in Switzerland, primarily as a result of uncertainty over access to the EU market. Research programmes will move to EU-based sites and current expansion within the UK would likely decline at least in the short term.

2.4 Scientific advice

Q13: How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

2.4.1 The EU gathers advice on science from a broader spectrum than the UK. The EU regularly seeks a range of voices, including young researchers, and their input to panels and groups – or as advisors, rapporteurs, evaluation observers and consultants over a wide area of science and policy. This is notably different from the "great and good" advisors so often favoured in the UK. We prefer the model of broader and more inclusive science community engagement in policy matters.

2.4.2. The appointment of the Chief Scientific Adviser (CSA) to the European Commission President Jose Manuel Barroso in 2012 was a welcome step, as it moved towards a clearer structure of high-level advice by a scientist to the EU leadership. The position was under-resourced, but clear progress was made. Although some fair criticisms were raised about the single-person role, nevertheless, the abrupt abolition of the new position without due consultation or explanation was a notable error of judgement.

2.4.3. The response to the science community outcry concerning the abolition of the CSA role was competent, however. Appropriate experts were rapidly called in for consultation on science advice structure. The Commission has now established a new Scientific Advice Mechanism (SAM), with well-designed structure and a seven-member panel of recognised experts from the science community to provide scientific advice on policy. SAM is better designed and resourced than the CSA role, with links to Europe's national academies of science and €6 million available to the academies' networks consortium for the purpose of in-depth studies on issues that require additional evidence. This networking of pan-European academies and learned bodies with a common purpose to provision advice to the top levels of the EU looks to be a very competent structure. However, its functioning remains as yet untested.

Q14: To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

2.4.5. UK scientists are fully engaged in EU policy development, as are scientists from many other countries. Types of input include: Positions on expert advisory committees and scientific panels, contribution to reports for policy development, panel discussions with policy officials, and assessment of research impacts and programme objectives. In particular, this broad diversity of input trains our young scientists to be policy engagers much more effectively than in the UK alone. It allows them to engage with international counterparts and think bigger on issues of global science direction and international policy engagement.

2.4.6. UK scientists have also taken top roles in advising EU scientific policy. The first Chief Scientific Advisor to the European Commission President was Professor Dame Anne Glover (British). When this role was cancelled, causing uproar in the EU science community, scientists including Sir Paul Nurse (British) were called in to advise on the structure of scientific advice in the EU. This led to the development of the Scientific Advice Mechanism and the seven-member panel of advisors which includes Professor Dame Julia Slingo (British) in the ranks. The presence of British advisors at the highest levels has been and will be, if we remain, fairly constant.

2.4.7. The structure of the Scientific Advice Mechanism (SAM) is such that it will draw its own input broadly from the academies and learned societies of Europe, not just the EU. Fortunately for the UK, this means that even if we do leave the EU, our leading scientists and our communities will still likely have relevance and influence on the Commissioner for Research, the President of the Commission and the Commission itself through the SAM.

Possibly in future, this may include the Parliament also. However, this connection is indirect and it would be unlikely that new appointees to the SAM would be British.

2.4.8. The largest loss of influence of our scientific communities and learned bodies on the EU would be the channel that we now have into the decision-making of the European Parliament via our MEPs. Currently the UK has 73 MEPs; the third largest delegation. Losing their roles on Committees cuts out a deep level of engagement that is currently possible.

18 November 2015

Scientists for EU, Scientists for Britain and Mr Emran Mian, Social Market Foundation Society – Oral evidence (QQ 128-135)

Evidence Session No. 12 *Heard in Public* *Questions 128 - 135*

TUESDAY 1 MARCH 2016

Members present

Earl of Selborne (Chairman)
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Kakkar
Baroness Manningham-Buller
Lord Maxton
Duke of Montrose
Baroness Morgan of Huyton
Baroness Neville-Jones
Viscount Ridley
Lord Vallance of Tummel

Examination of Witnesses

Dr Mike Galsworthy, Scientists for EU, **Professor Angus Dalgleish**, Scientists for Britain, and **Mr Emran Mian**, Director, Social Market Foundation

Q128 The Chairman: Welcome to this session. As you will know, we are getting near the end of our inquiry into the relationship between EU membership and the effectiveness of science, research and innovation in the UK. I hasten to add, as I am sure you realise, that in science, research and innovation we include engineering and technology, so it is a wide church. We are most grateful to the three of you for joining us today, and I am going to ask first Dr Mike Galsworthy, then Professor Dalgleish and then Mr Mian if they would like to introduce themselves for the record. We are being broadcast. If you would like to make a short opening statement, please feel free to do so.

Dr Mike Galsworthy: My name is Dr Mike Galsworthy. I am programme director for Scientists for EU. As a brief opening statement, I would like to say that Scientists for EU started on 8 May when it became clear that there was going to be a referendum on EU membership. Our concerns at that stage were twofold: first, a lack of clarity and cohesion within the community on EU benefits and Brexit risks; and, secondly, a lack of public understanding on the UK/EU relationship in science. Since that time, we believe we have accurately conveyed a majority sentiment from the UK science community to the public,

bringing in new evidence and stimulating debate. We think this is a benefit to the science community and the public alike. As a final point, we would like to note that we believe this referendum is not about a dozen leading political and business voices, rather, it should be about the communities within the UK who have experience of the EU communicating those experiences to the wider public to ensure a richer picture.

Professor Angus Dalgleish: I am Angus Dalgleish and I am a professor of oncology at St George's Hospital and I am both a scientist and a clinician. I got involved in this when I became a victim, I would say, of the European Union clinical trials directive which basically stopped me in my tracks doing a programme which was very successful, leading to cell-based vaccines and dendritic cell-based technology. Without the injection of millions of pounds to bring the facilities up to this very high level of standards, which were basically for pharmaceutical companies and not for clinical academics like myself, I was unable to proceed. This is an area which has continued to proceed elsewhere. You have all heard from America recently that a logical conclusion of this work is leading to tremendous cures for leukaemia using this cell-based technology, which I felt was completely blocked by an over-zealous interpretation of the European clinical trials directive. I am here to point out that the European Union has some good components for science, but it also has had some terrible, negative, devastatingly dreadful effects. I do not feel that we would lose any of the benefits of being in science by leaving the EU. The nature of science collaboration means we do not need a supranational imposition of how we collaborate internationally.

The Chairman: Thank you very much. Finally, Mr Mian?

Emran Mian: My name is Emran Mian. I am the director of a think tank called the Social Market Foundation, and I was formerly responsible for higher education funding in the Department for Business, Innovation and Skills. By way of opening statement, the only thing I would like to add to the points already made is the wider economic environment in which the future envelope for science and research spending might be set. When I look at the arguments for leaving or remaining in the EU in the context of science and research specifically, I think there probably are arguments on both sides. When you look at the wider economic environment in which the future of the science and research budget may be set, all the risks are if we leave the EU, and I think those probably constitute the most significant arguments in this context against leaving.

Q129 The Chairman: Thank you very much. Let me note, first of all, that we have had quite a lot of evidence, as you will have seen, that the United Kingdom is one of the strongest performers in the European Union when competing for research funding on the basis of excellence; we have a good record. We have also seen evidence that the United Kingdom is one of the weaker performers when overall funding for research and development, which of course includes structural funds, is taken into account. Of course, there is a qualification there because we, quite frankly, had some difficulty in determining how much of these structural funds are really relevant to science, engineering, technology, research, innovation and the like. Nevertheless, the figures do seem to suggest that, if you put the two together, the position is not quite so advantageous as it might be if structural funds were excluded. Do you agree with this analysis?

Dr Mike Galsworthy: I do not agree with the analysis. I think that attempting to put the two together gets into a bit of a mess. Essentially, the two are negatively correlated because they have very different purposes. The competitive funds that come through something such as

Horizon 2020 are the ones that we should be focusing on, and the structural funds are part of the broader system in order to bring struggling regions up to scratch so that there can be diversity. Certainly, within this country, there have been accusations that funding tends to go top heavy and leaves many regions starved out. The European Union has a long-standing mechanism for trying to ensure that those regions that are struggling can be more economically competitive, and that avoids certain social tensions.

It used to be the case that this money was spent largely on infrastructure, such as roads and airports. However, it became clear, and this came to a head in the Competitiveness Council of October 2012, that, when it came to the science programme, the western and northern ends of the EU were sucking up all the funds and winning all the projects and leaving the newer member states very much starved out.

There was also the issue of the researchers on EU projects there being paid at local rates and causing something of a brain-drain. There was some alarm at seeing that balance slipping, so there have been various measures put in to try and redress the balance so that eastern Europe can be brought into full play. One of those is to strongly re-purpose the regional development funds to be more research and innovation intensive. There is a policy desk within the European Commission to give advice to governments on that. There is a demand that these regions should engage in smart specialisation programmes in order to clarify what their strengths will be, and then there is an effort to bring some cohesion between those funds and their involvement in Horizon 2020. It is clear that the two funding streams have very different purposes. One is excellence, and that allows us to network with Europe and the rest of the world and engage in projects on a scale that we could not do without such collaborative mechanisms. The other is to ensure that, over time, we can more broadly have all parts of the EU playing that game. By conflating the two, you merely look at the finances of it rather than the value of the whole system, and I believe the value of the whole system is clearly beneficial because it is well structured.

The Chairman: Could I read to you a bit of your written evidence, in paragraph 1.2.14, where your organisation says, "the new focus of the Commission to dedicate regional development funds to R&I means that the whole EU ecosystem of science is strengthened in all parts. The UK, as the EU science programme's leading player, benefits strongly in the long run when it can participate in and lead (more than any other country) ever more capable teams from an ever stronger region". Would you stand by that statement?

Dr Mike Galsworthy: Yes.

The Chairman: Would either of you like to speak? Yes, Professor.

Professor Angus Dalgleish: I would like to point out first of all that the framework programme 2007 to 2013 only accounted for 3% of all the funding of science in the country, so we are talking a very small amount of money with an enormous amount of weight put on it. When we look at the competitive funding for the EU, and these are all formal government-approved figures, we received £6.9 billion out of a total of £54 billion, which is very good indeed. When you look at the structural funding, this is absolutely catastrophically small; we received approximately £2 billion-plus out of £53 billion. I think we need to look at the bigger picture, that we are paying far, far more into this than we are ever going to get out.

With regard to the idea that we would not collaborate without EU funding and then telling us where to go, I have been on these FP7 framework programmes as a referee/adjudicator et cetera, and it is a programme that I do not feel happy with any more. Initially it encouraged collaboration among European scientists with money for meetings and that was very good. Now, it wants to dictate what we research, where the money goes.

I would make it very clear that I have been horrified to see the waste when I have been to Brussels; nobody will sign off the accounts for 20-odd years and the money that is being spent there. When I went there for a three-day programme, it was very clear that they had already made up their minds where they wanted the money to go and that we were going to be bullied until we agreed so that they could have peer review. I found that was something really rotten at the core which I was very unhappy with. If we leave the EU, we do not leave Europe and we do not leave collaborating with the rest of the world, whether it be America or Australia. I think there is too much wrapped up in the fact that we need to be in the EU in order to do the science. No, we do not. If you look at the number of fantastic organisations, which are nothing to do with the EU and in which we play major roles—EMBO, CERN, EMBL, the European Space Agency, the European Observatory, the cyclotron, XFEL, and it goes on and on—we have fantastic collaboration. We do not need to be in the EU. We are the fifth largest economy in the world and we lead in a lot of these areas.

With regard to this enormous disparity in the sum of money that we pay in and never see anything back from, which on another set of figures is over £30 billion over a five-year period, we would have no trouble at all leading in research and taking our formal position if, when we get out of the EU, some of the deficiency in funding from the Government is made up. We still get less than our colleagues in Germany and France in total, and I think that would need to be re-addressed and, when that is done, I think we would still be the leaders of science in Europe.

The Chairman: We will come back to some of those points. Thank you. Mr Mian, did you want to add anything on this?

Emran Mian: I would make a couple of small points. One would be that, whilst it is true, given the UK is such a big player in science, that it would still be competitive and continue to collaborate with lots of other European institutions, one of the factors that contributes to our competitiveness is researcher mobility. It is very difficult for me to see a scenario of Brexit in which researcher mobility is not in some way impaired. Researcher mobility is important not only to the structure of collaboration but to our competitiveness for some of these funds, by which I mean that, if researchers from other EU countries come and work in research in the UK, they bring a set of networks already with them and we then take advantage of those networks in making our universities and research projects more competitive in funding. With all of that, it is very difficult to see a scenario whereby that is not impaired if the UK were to leave the EU.

On the other argument of the balance between the two different sorts of funding that you mentioned, my understanding, and these things are always quite difficult to evidence, is that the UK is one of the important voices within the EU, ensuring that a larger proportion of funding is competed for rather than being on the structural side. In that balance between science funding being competitive versus being used for structural purposes, I think the UK is an important voice for more of it being competed.

The Chairman: I think Professor Dalgleish wants to come back briefly on that.

Professor Angus Dalgleish: As a very brief bit of information, in my own institution half of everybody is from outside of the UK and half of those are from the EU and the other half from outside the EU, so I do not see how the EU is going to change that; people are still going to come from outside the EU and work in British universities for the research and I really do not see how that is going to impact on it.

Lord Hunt of Chesterton: You said that the accounts were not approved. I have heard other people saying something rather different, so it is a canard that is often floated. For the record, since it was a public statement about the EU, I think it would be useful to know what the facts of the case are. The second point I want to ask you about, Professor Dalgleish, is that with many of these big European projects, and I agree with you that some of them were there before the UK joined, and there have been Parliamentary Questions on this, there has been quite considerable EU involvement in the running and the programmes of big ones such as ESER, CERN or whatever, and the view of many people is that that is quite a valuable component to bringing and applying these projects. Would you deny that, or do you think that the EU contribution to these European-wide organisations is actually not valuable?

Professor Angus Dalgleish: With the way the EU has taken larger chunks of the money, it was inevitable that they would then want to get involved with things which are set up and successful. Again, I do not see any problem if we left, as we would also be involved in taking part in those things in the way that we have. I think that outside we have a much larger and more important voice in these organisations than we do as part of the EU; I think we get drowned out in the EU.

Lord Hunt of Chesterton: That is not what the PQ said.

Lord Kakkar: I want to focus a bit longer on this question of the competitive funding rather than the structural funds, to be clear about what the witnesses feel would be the appropriate balance between the Horizon 2020 competitive research funding and structural funding for Europe generally first of all.

Emran Mian: I am not sure I could express it by way of a formula, but I think the broad approach, and this is similar to the way in which we have deployed the portion of research funding given by HEFCE in the UK, is to strengthen institutions that might begin from a weaker position or might be based in regions of the UK or the EU that are in a weaker position, so you use structural funds to begin to level the playing field. Then, as soon as possible and wherever it is possible, you want to use competitive funding, not only as a way of funding the best research but as a way of encouraging everybody to continue to raise their game. Over time, what I would probably want to see is a balance, just as has happened in UK funding, so the same thing happening in EU funding where we rely less on structural funding for science and more on competitive funding.

The Chairman: Dr Galsworthy?

Dr Mike Galsworthy: I think that is an excellent question and exactly what we should be thinking about and I fully agree with what has just been said. I think it is in the long-term interests of the EU and us if there is a shift towards more of that funding which goes into regional development going into a competitive scheme because we know that the value returned on that is large. Also there is a need to ensure that the eastern European countries and southern European countries, which have been particularly hit recently by global financial circumstances, are able to play fairly so that they are not constantly struggling.

I think the best mechanism for doing this is not necessarily giving money directly to regional authorities for them to spend as they will but, rather, to have competitive programmes, such as within the widening participation mechanism of the Horizon 2020 programme where you pair up leading institutions, such as we have in this country, with those in regions that are struggling. The benefits of that are twofold. Those regions get to work directly with the very best that we have within the EU and the transfer of technology in skills and capacity will have much more rapid benefit. Also it benefits us in that, when we have those pairings, we develop skills in boosting the effectiveness of science, technology, research and innovation and that is a global, marketable service which we then can take elsewhere. This is the thinking now within the Commission, certainly there are bodies that are advocating this kind of thinking because then, with issues such as accounting, you do not have to rely so much on regional authorities feeding back to the Commission and, with our net contribution, there is then a clear direction as to how that can be reduced so that is less of a bone of contention. Regarding collaboration, this is a very clear way to start bringing struggling regions into direct contact with the rest of us and into networks. This is actually where the thinking is going and, therefore, I believe that the future of the programme is dynamic and headed in the right direction and will bring significantly more benefits than it even does now.

Professor Angus Dalgleish: I would say that sounds very nice, but I do not believe a word of it in practice. We give far too much to Europe to spend on infrastructure. Anybody who travels around Europe, as I do a lot fortunately, sees how much European Union infrastructure money is completely and utterly wasted, and we are contributing to it. The dreadful parlous state of southern Europe is all due to the euro and the euro crisis, and it was not only a financial crisis. By being part of the European Union, we are contributing to what is a gross instability between the north and the south of the EU. I would say again that I disagree. I think that the structural fund difference, which is well over £30 billion, if not more, is far too high a price for us to pay for what is basically nirvana and that there are many other ways of doing it.

In my own lab, I have just realised that half of them are from EU countries and that is not going to change if we do Brexit and leave Europe; we have already cemented these relationships with laboratories and institutions abroad. The other thing is that a lot of our science is actually a very close collaboration with the US and they are not in the EU.

Baroness Morgan of Huyton: That is why you do not think that will change. I do not really understand what you are saying. One of the obvious implications of Brexit would be a change in the movement of people within Europe and the ability of people to work in different countries within the EU, so I do not really understand how you can think that your laboratories would stay staffed in exactly the same way.

Professor Angus Dalgleish: With science, it has never been a problem taking people across borders. The whole time I have been in science, laboratories have always been international and people have always had approval to come and work in different laboratories.

Baroness Morgan of Huyton: That is not the position at the moment in a lot of universities. As this Committee has discussed before, there is a real problem for people coming in from outside the EU at the moment, and one would only expect that would increase across the piece if part of the reason for doing this was to reduce immigration. I do not really understand the rationale.

Lord Kakkar: To focus again on the success of the application of structural funds to date, is there evidence that the investment of structural funds over the past years has resulted in that movement of institutions from requiring structural funding to being truly competitive regarding the competitive research stream funding of the European Union, or is that still anticipated to happen in the future?

Emran Mian: I have not seen any compelling evidence that it has worked, and that is a gap in the evidence base for sure.

Lord Kakkar: So the United Kingdom's position here, if I have understood it correctly, is it would serve our science interests best if the move were away from structural funding and were to focus more and more on competitive funding, but those competitive funding streams would facilitate the participation of institutions that were potentially on a trajectory towards becoming true science competitors across Europe?

Emran Mian: I think it is certainly true that competitive funding favours our universities simply because of the strength of our science and research base. The observation I was making was that, if over time there continues to be a shift in the balance of EU science funding towards more of it being competed for, and we are a strong voice within the European Union for that end, then that will play to the advantage of the UK science base and indeed to the universities across Europe with whom we collaborate.

The Chairman: Dr Galsworthy, do you want to come in on that same point?

Dr Mike Galsworthy: I would say that we have two interests. One is increasing competitive funding because we do well at winning it, but we also have an interest in strengthening the pan-European ecosystem around us. Whether we are getting impact from the structural funds is, I think, a great question. I think that the move to deliberately put structural funds into research and innovation is too new to see that yet. It used to be quite woeful how much the Commission actually analysed where the money went and what impact was happening. I think it is getting much better at that now. The interesting comparison would be between the widening participation scheme, which does all those twinning and pairing mechanisms that I was talking about, with the direct structural funding—and getting some feedback on which of those people believe is more effective overall. There is nothing yet on that because it is all too new, but I think that will be coming through at some point and that certainly should be a major focus of the entire research and innovation vision of the European Union.

Lord Kakkar: To be absolutely clear, as far as anyone is able to say at this moment, we do not have evidence from previously invested funds that the structural funds which have been used so far for the purpose of bringing up the broader science game have made institutions more competitive for competitive funding?

Dr Mike Galsworthy: We do have some great examples, but we do not have quantitative evidence. To give one lovely example, Ulster is, shall we say, an under-competitive region by classification and there was some money from the European structural funds given to Ulster University to help set up an independent research institute, called NIBEC, which develops medical technologies. That has now spun out various companies to a value of some millions, which I can look up for you, but, importantly, the medical technology that was developed there is now found in the White House and on Air Force One. It is strongly felt by that department that they would not have had the capacity to be world-leading in the way that

they are without this funding from the European Union to build up. In some cases, it clearly has been a productive mechanism, but we need to get this in quantitative terms of course.

Baroness Neville-Jones: Professor, am I right in concluding from what you have said that your objections to UK membership of the EU go rather beyond what you regard as being the damaging, deleterious or irrelevant participation of the UK in the science area, that you have a broader objection as well as your personal experience, which obviously you did not enjoy, in the case of scientific collaboration with the EU?

Professor Angus Dalgleish: The short answer is absolutely yes. I was impacted and have done so much research and reading and prodding away at the whole history of the European Union, and I have a much broader resentment for what they have done to the British Parliament.

Duke of Montrose: To my mind, the structural funds, certainly up in Scotland, where I come from, were based on regional need, and in Europe the amount of money available is based on regional need. Is there a differential between what is available for research and investment and what is available for physical structure? Are they now trying to lay down more of a distinction?

Emran Mian: My understanding is that the qualifying criterion is the same for all structural funds, which is that they can only go, I believe, to regions which have—I think it is—less than 70% of average EU GDP.

Q130 Baroness Morgan of Huyton: Can we talk about the associated country status, because this is an issue that we have talked about a lot with previous witnesses? We have heard a lot of arguments that associated country status would mean that the UK would lose influence over EU decisions. I can probably guess what your answer is going to be, in all honesty, but we need to know whether you agree with this assertion because, although we have had relatively clear-cut answers on both sides, it would be useful to get that on the record. In particular, we really want to explore how much our influence would be cut back if we were not a member of the EU and to what extent you believe, if we were an associated country, we would still be able to exert significant influence over EU decisions relating to science funding and research.

Emran Mian: I think the level of our influence will depend almost entirely on the nature of the deal we get in the event of an exit. I imagine it is likely that the single biggest factor will be how much of a contribution we continue to make to the EU budget. If, for example, we were making 80% of the contribution that we make at the moment, then you would expect that we would retain quite significant influence in how those funds are then invested. Obviously, the flipside of that is that, if we were continuing to make 80% of the contribution that we make now, then some of the economic arguments about withdrawing and the savings that might bring become much weaker. I think how much funding we continue to contribute would be very much a function of the nature of the deal that we get. If we contribute a very small chunk of funding, then you would expect that the level of influence and the amount of that which is returned to us is very small. I think the other issue would be around mobility, and the nature of the deal we agree on mobility. In order to maintain the competitiveness of the UK science base, we would want something very comparable to the level of mobility that we have now across the EU. Again, the flipside of that is that it undermines some of the arguments for wanting to leave. I think it is very difficult to see a

world in which you can have both. You either have to give up some of the mobility, if you believe that is important, but then you also lose competitiveness in science and research, or you retain the mobility, so you retain your competitiveness, but you have not got what feels like one of the qualifying conditions for wanting to leave. My sense, both on the funding side and on the mobility side, is that you can mitigate some of the risks of Brexit, but at the cost of undermining some of the arguments for it.

Viscount Ridley: There are 13 associated countries in Horizon 2020, I believe, i.e. non-EU countries that can participate, and I have to say parenthetically that came as a surprise to me. I am ignorant of these things and, until we started our inquiry, I did not realise this was a programme that applied across Europe and not across the EU; I thought it was an EU programme. Those countries pay in money and get grants out and, presumably, sometimes sit on the committees that decide research funding priorities. In what sense do they get any differential influence over how those funds are allocated within an EU country? We have been told by the Royal Society that the difference is that they are not on the European Council or the European Parliament, but surely research funding priorities are not set at that high level; they are set much further down within Horizon 2020, are they not? Can somebody clarify that for me?

The Chairman: Dr Galsworthy, would you like to start on that one?

Dr Mike Galsworthy: Certainly. If we were to pull out, then we would no longer have our Government representing us in the Council nor our 73 MEPs. In decision-making, two things are important. One is the legislation around science, which is rapidly changing, and the second is actually the nature and the priorities of the science programme itself. In both of those, there are priorities set initially at the Commission level, listening to all the interests of those around them, which will be prioritised for their members over any external parties. That filters down through the Parliament, which would have to agree to it, in which we would have no representation. If we want to influence those processes, to a degree we have to lobby the lot from outside.

Viscount Ridley: Are you saying that Norway has no influence, for example, in exchange for its contribution?

Dr Mike Galsworthy: It would have less influence outside than it would inside. Either way, for Norway, being mindful that the population is something like 6 million, it is trivial to a degree whether they are in or out.

Viscount Ridley: Forgive me, but there are 12 others—Turkey, Israel and others.

Dr Mike Galsworthy: Yes, and all of them have participation rates on Horizon 2020 of less than 2%, whereas our participation rate is 15-16% and we are very structurally part of it.

Viscount Ridley: So we would have more influence?

Dr Mike Galsworthy: We have a colossal voice at the moment on legislation around science, research and innovation, which is very important, because 62% of our papers produced now are international collaborations, so having cohesive policy with other entities with which we work is very important. Also, in the science programme, because we are such a leading force, we have a very strong say in how things are shaped. The Government itself was bragging about how in Horizon 2020 they helped drive a lot more funds towards small businesses, and then they neglected to have this actually communicated to the small business community, hence our very low levels of participation there. The interests of the

remaining countries, should we leave, are going to be towards their own research institutions and their own scientists primarily. We will not be part and parcel of that, so it will cause some awkward dynamics, because of course they will want to work with us, but it is their job to prioritise their own countries and their own research framework over benefiting us, and we would no longer have the protection of being in there.

Viscount Ridley: Who is "they" in this? Is it at the Commission level, the Council level, the Parliament level? Surely, there is a degree of the Haldane principle that goes on in Europe, i.e. scientists set their own priorities for research, and that is where the decisions are mainly taken, and that involves the 13 associated countries.

Dr Mike Galsworthy: I think it would be interesting to investigate further how much influence those 13 countries have, but essentially the degree to which this would be relevant to our scenario is questionable.

The Chairman: We have an opportunity later this morning to ask an associated participant how much influence it has, and we will follow that up.

Lord Maxton: Are those 13 associated countries divided between those who wish to be members of the EU and are applying for membership, and those who do not wish to be members? Is there a division there? I do not know.

Dr Mike Galsworthy: There is an important division because, before the scenario with Switzerland, it was the case that you were either out as a third country or you were in as an associated member. The scenario of Switzerland is the most pertinent to our situation because they had a step-down from an involvement as full as they could, to a lesser scenario. That was based on their referendum where they decided that they were going to have controls on immigration and that put them foul of many deals with the EU. I have here page 8 of a report called *Swiss Participation in European Research Framework Programmes* by the State Secretariat for Education, Research and Innovation. What has happened with Swiss participation from FP7 to Horizon 2020 is a drop in the proportion of Swiss participations from 3.2% to 1.8%, a drop in the proportion of contributions received from 4.2% to 2.2% and, most significantly of all, a drop in the proportion of Swiss co-ordinations from 3.9% to 0.3%. Given that, on Brexit, we would most likely adopt a model that goes back on, or cancels, our freedom of movement arrangements with the EU, the real risk is that Switzerland is a strong precedent for the model that would be used for us. Specifically, the co-ordination of projects, which we are particularly good at, is something that they may wish to retain for themselves, because it then strengthens the hand of their own researchers and research institutions and, when you are a co-ordinator, you are more likely to control the IP, you are more likely to be the lead author on papers and—I believe, but this needs to be checked—you are more likely to call in small businesses from your local environment to participate. There is a strong threat at not only the policy-setting level, but also the leadership level on the ground when we are actually engaging. It is not only about participation. We may be allowed participation, but we might be restricted on co-ordination, which is what happened with Switzerland.

The Chairman: Did Professor Dalgleish or Mr Mian want to come back on this associated membership? Otherwise, we will move on?

Emran Mian: Because our research base is so strong, I think we would still expect to exert a lot of influence when it comes to the peer review of projects and deciding what gets funded

through competition. As an associated country, we would still have a large amount of influence on the scientific decision-making, if you like, and that will be a function not only of the strength of our institutions, but the fact that some of our scientists are amongst the leading experts in those fields. I am sceptical that we would lose much influence in that respect, because we are such a big player. I think where we would lose influence undoubtedly is in the wider context in which those decisions get made. For example, when it comes to legislation, medical research, for example, takes place and there is quite a lot of regulation which pertains to medical research, some of which is UK and some of which is at the EU level. I think Professor Dalgleish alluded to some of it in his opening statement.

The reality of being outside the EU may be that, for a project based in the UK to benefit from EU research money, it would have to comply with the EU legislation on medical research, but the UK would not have had any influence on the making of that legislation, so we would still be bound by the rules as an associated country, but we would have much reduced and possibly no influence on the making of them. I think the same would be true when it comes to setting programme priorities within the next framework. Again, within the area of medical research, it may be that the UK has a particular strength, but that strength is perhaps unique to the UK within the EU and we would not expect that particular area then to become a priority in the framework because we would not be around the table negotiating it. You would expect the countries which do have research bases that pertain to other areas of the programme to exert their priorities and for future EU money to be focused on those. I expect we would lose quite a lot of influence on legislation and priority setting, but not when it comes to peer review and the application, if you like, of the Haldane principle.

The Chairman: Professor, did you want to add anything on associated country status?

Professor Dalgleish: I think we would have far more influence if we were outside the EU. We are in a situation of majority voting now, where we are the same as 28 others, and we do not really have that much influence anymore; it has been diluted out and diluted out. If we, the fifth largest nation and a member of NATO, were to be separate from the EU, we would have even more influence on the European Union because they would need us; we would actually end up being more of a leader than the European Union, which I think is going into disarray. I would like to press that point. I think that our impact at the moment is far, far less than it should be and it would be much more if we left.

Q131 Lord Fox: In the event of Brexit, how clearly will there be a difference in the amount of money coming into UK research institutions in that there was money going out from the Exchequer to Europe and then coming back to our institutions? How likely is it that UK Government expenditure on research would compensate for that?

Professor Dalgleish: I personally do not know, but I think they would be under a very strong moral obligation to make up that gap because they would be so much better off overall having so much more money which they are not sending to Europe and never seeing again. I think there will be a tremendous pressure for them to make up that gap and more. On the example given of that institute in Northern Ireland, which I know is really excellent, I do not think you need the EU to do that. That is the British Parliament's job to say that we should actually fund this in Northern Ireland, the way the MRC has funded good units in Glasgow, Edinburgh et cetera, and distributed it around the country. I do not think we need the EU to do that.

Lord Fox: That was not the question really. It was how likely, and you suspect it might be but there is a risk that it will not.

Professor Angus Dalgleish: I cannot possibly say how likely it is, but I think that it would be for a scientist to lobby so that money came back from the Government, because the Government would have more than enough to be able to do it without having to lose elsewhere. I think that would have to make it very likely.

Emran Mian: That is a very hopeful position. In principle, there is no reason why the gap would not be made up. It is a very hopeful position, not least because in the event of Brexit there would be quite significant economic pressure not only on sterling—and the depreciation of sterling has direct impacts on how research moneys are spent or allocated—but, equally, there would be other economic risks to the UK. It might be that over time those risks would be smoothed out, so if you looked at it over 20 or 30 years the UK might be fine, but the immediate impact would be negative. It is very difficult to see in that negative scenario why science and research would be a priority for the UK.

The Chairman: Dr Galsworthy, do you want to add anything on this one?

Dr Mike Galsworthy: I would concur with the other two that there will be huge pressure to plug the gap financially. Whether that will be taken up, I do not know. It depends entirely on economic circumstances. As has been pointed out, there will likely be lots of other economic fires to put out. The concern would be that the gap is plugged financially, but the overall value of our investments is diminished because our role within this whole ecosystem, which benefits us so well, is hugely reduced. The fear would be that we would be given some compensatory money for the damage done, but the end value would be hugely reduced, and politicians' minds would be elsewhere. I do not believe that we would have money to spare on leaving the EU because, on pulling the plug, there are wider impacts than the 0.5% of GDP, which we count as a net contribution, an amount which might be demanded anyway by the Commission in order for us to continue to play on the science programme, given the fact that it now goes increasingly to shoring up the research and innovation in those other countries that we partner with. The dynamics are complex and very difficult to predict.

The Chairman: Lord Hennessy, Lord Hunt and Lord Ridley all wish to come in on this. I would point out to my colleagues that we are only halfway through the questions, so there is a hint there for you.

Lord Hennessy of Nympsfield: Professor Dalgleish, you used the words "moral obligation". Her Majesty's Treasury, though admirable in so many ways, does not do moral obligation. I think we can all agree on that. It simply cannot abide any notion of hypothecation. If there is a Brexit dividend, there is going to be tremendous competition to grab it. I suspect on the Brexit side of the argument they have spent it at least 10 times already. I think your faith in the moral obligation of Her Majesty's Treasury is touching, but probably deluded.

The Chairman: Shall we take that as a comment rather than a question?

Lord Hunt of Chesterton: Let us carry on.

The Chairman: Thank you for your self-denying ordinance on that. Can we move on to Lord Ridley?

Q132 Viscount Ridley: We have heard a lot about international collaboration. I think Dr Galsworthy cited a figure of 60% of British research being done with international co-

authors, or something like that. I believe our biggest co-author/collaborator is the United States of America. How do we square that with the view that European collaboration is vital to continuing international collaboration? Is there not inevitably an opportunity cost in having programmes that specifically discriminate against non-EU countries and in favour of EU ones, so, for example, a scientist might end up spending time at a second-rate conference that happens to be in Europe rather than working with a first-rate colleague who happens to be from Japan, India or America? Is it not inevitable that there is an opportunity cost if you make it much easier to collaborate with one group of countries than with another?

Dr Mike Galsworthy: Not really, for various reasons. First, I think it is hugely useful that within the EU we have a common programme that allows for multinational collaborations and there is a legislative framework to make those easier. In turn, this serves as a catalyst for our capacity to reach around the globe. The size of the programme means that it is comprehensive in subject areas and well-known as a brand—ensuring a certain quality—and therefore, should other countries, such as the US, want to collaborate with the UK, there is a huge channel of potential for doing that through the EU programme, because of all these factors and because you can bring in other partners. I do not believe the expenditure on our participation in the EU, and our closeness with the EU, would be better spent in forging something with America, for example. I think the latter should be encouraged anyway and the EU programme can facilitate any further work that we do with the Anglosphere, or anywhere. I think we should be reaching out to America more and America should be reaching out to us more. However, I do not think doing well with the EU is an opportunity cost in working with anyone else. That does not make any natural sense to me.

Viscount Ridley: So we can have our cake and eat it.

Lord Maxton: What does the USA think about Brexit from Europe?

Dr Mike Galsworthy: From the Americans I have talked to, they think it is pretty nuts.

The Chairman: Did Mr Mian or Professor Dalgleish want to add anything on that? Shall we move on then?

Q133 Baroness Manningham-Buller: I want to talk about the training of the next generation of scientists, which I am sure you all agree is a really important part of the role of the scientist. In particular, Professor Dalgleish, I want to pick up on your statement that the freedom of movement within the EU that we currently enjoy causes British scientists or researchers to abdicate their responsibilities for developing the next generation of scientists, which is quite an interesting observation. What is your evidence for that?

Professor Angus Dalgleish: I think the arguments there were probably due to the fact that when you have people coming from Europe into a laboratory, they come in with European funding and a budget et cetera, and that has a potential negative impact on the mentorship that you would give for somebody who was from your own university.

Baroness Manningham-Buller: Sorry, can I stop you there? You said in your own lab you have a chunk of people from Europe, a chunk of people from other countries and, presumably, a chunk of Brits as well.

Professor Angus Dalgleish: Yes.

Baroness Manningham-Buller: Do you differentiate, according to how they are funded, in how you train and develop them?

Professor Angus Dalgleish: No, we do not.

Baroness Manningham-Buller: So why do you think other people would? I thought you just said it would depend on how they were funded.

Professor Angus Dalgleish: It depends a bit on how they are funded. I have quite a small laboratory, but people with large laboratories are very impacted with regards to the funding, and that dictates how they run their affairs.

Baroness Manningham-Buller: If those foreign students were not getting training and development in British labs, they would not stay; they would not come. I want to have a feel for what the evidence is, because my observation is that in most universities they are being treated as part of the team and equally.

Professor Angus Dalgleish: Yes, I think that is very much the case. In my own laboratory, I do not see any difference between the way that I or the post-docs treat people who have come from Europe and those from home. I do not have this package of funding from the European Union attached to one person who brings it in which has the knock-on effect that is being suggested, so I have no real experience.

Baroness Manningham-Buller: You are not supporting the submission in your statement that the freedom of movement in the EU encourages British science teams to "abdicate responsibility for training the next generation of scientists in their 'home patch'"? You do not stand by that now?

Professor Angus Dalgleish: It has been suggested by some of my colleagues, but I do not feel strongly about that.

Baroness Manningham-Buller: The Committee is trying to gather evidence to make our judgments, but you do not have that evidence?

Professor Angus Dalgleish: No.

Lord Hennessy of Nympsfield: Professor Dalgleish, I have always felt the one thing we can all sign up to, wherever we are on the great European debate, is a belief in intellectual freedom of trade and that the benefits of it are extraordinary. I am an arts and humanities person, but the British students in arts and humanities only benefit from the presence of people from overseas; it raises everybody's game. I thought this is a consensus we could all leap upon and I invite you to do so. You have.

Professor Angus Dalgleish: With regard to having the freedom of movement of people coming to the laboratory?

Lord Hennessy of Nympsfield: This rather mitigates against this statement we have in your colleagues' evidence that it is somehow denying the intellectual base of Brits to have all this collaboration. I think it is quite the reverse, wherever you look, whatever the subject.

Professor Angus Dalgleish: I do not think it denies the Brits. I think that is a misinterpretation of that.

Lord Hennessy of Nympsfield: That is the way I read it, I am afraid to say.

Baroness Manningham-Buller: And I.

The Chairman: Let us move on. Baroness Neville-Jones.

Q134 Baroness Neville-Jones: Could I return to the question of regulation that was touched on in earlier discussion, where I think the statement was made by you, Professor, that the UK might find itself in the event of Brexit not necessarily not having access, but having to obey the regulations under which that research was carried out without having had a voice in them. We have had a lot of evidence that suggests that, on balance, the regulatory harmonisation of the EU has been beneficial to the UK. That does not mean to say that particular regulatory frameworks have not posed problems—they have—but would you agree with the thesis, quite apart from the question of whether we would be obliged to obey rules that we have not have had a voice in, that the regulatory environment the EU is developing has been broadly beneficial to science? Or do you think it is a mixed picture? I do not know who would like to tackle that. Does it depend on the science? Where does the picture lie?

The Chairman: I see Dr Galsworthy is going to volunteer for that one.

Dr Mike Galsworthy: Very broadly speaking, it is clearly of benefit to common endeavour. There are some areas where there will be tensions—for example, stem cell research—because there are different religious tendencies in different countries. Also, there are some aspects of public health regulation that want to be science driven, such as alcohol, but, because there are very different interests in different countries, even if you asked the Commission to go and legislate on it, it cannot come back with anything coherent so it gives up on it in some areas.

There is other regulation, and I am sure Professor Dalgleish has things to say about this, such as the clinical trials directive, where it is clear that it would be beneficial to have common regulation across a set of many countries so that we can all participate in science and medical research in the same way. However, when that regulation comes in, there can be flaws in the balance of interests. Clearly, we wanted the clinical trials directive to be very heavy on patient protection, for very good reasons, but the impacts of that were felt quite rapidly. It has now been fixed, as far as many people are concerned, by the new version in 2014, which has been praised by various sources, including AllTrials, which liked the transparency that it ushers in, but it had an impact for several years.

Overall, this is clearly the direction that we need to move in. There will be some areas where it is more difficult and some where it is easier, but, as a broad capacity, it is hugely valuable to us all that it is there. If we want common regulation across a vast number of countries, we have a permanent standing mechanism by which we can engage that and then revise it should it need to be revised. I think that is clearly a benefit.

Baroness Neville-Jones: What precisely is the value of having single regulation?

Dr Mike Galsworthy: Efficiency in being able to collaborate and to pool data and effort, so harnessing economies of scale and capacity to involve all countries within the EU.

Baroness Neville-Jones: It is only efficient if it is right though, is it not?

Dr Mike Galsworthy: Yes.

The Chairman: Professor Dalgleish, would you like to comment on this one?

Professor Angus Dalgleish: Yes, I would. My views on the clinical trials directive have already been made known to the Committee. I think it is important to understand the damage that is being done is very largely due to the way it was implemented—like so many directives from the EU—by the British Parliament and Department of Health, without them thinking about its impact. It is yet another EU law of unintended consequences. It has destroyed clinical academic research in this country. My colleague, Professor Morris Brown, has been even more effusive about the impacts of this. The corrections were only after mega, mega lobbying, and it was far too little, far too late.

When I gave evidence to the All-Party Group on Cancer in relation to pancreatic cancer, I pointed out that if you really want to improve the outlook of patients with pancreatic cancer in the United Kingdom, the most important thing you could do was get rid of the constraints on academic research due to the clinical trials directive, at which point it was suggested by somebody else that perhaps the barriers to entry of the clinical trials directive were at the behest of the big pharmaceutical companies, to keep out the smaller generics. From the reaction, it would appear to be an accepted explanation of why we have been subject to such draconian rules and regulations. At this committee meeting, someone from the audience stood up and said they were Dr So-and-so from a very big Swiss pharmaceutical organisation and that the barriers had been raised so high that even they could not afford to do the trials they would like to do these days. I rest my case with an example of a piece of legislation that has been applied and has done unbelievable damage, which people did not think through.

There is a second one that is terribly relevant, not necessarily for all science but one aspect of science—health sciences—and that is the European working time directive, where they lumped being on call with working. That is an indirect cause of why the doctors are going on strike and why you could never stretch the current workforce to a seven-day week.

Lord Fox: To be clear, your bugbear on the clinical trials is not with the existence of the initial European assertions; it is the way in which those assertions have been applied by the domestic Parliament of the United Kingdom.

Professor Angus Dalgleish: There is an awful lot of truth in that because many of my colleagues have not suffered like I have, because they have mixed and matched and adapted the regulations to the environment appropriately and proportionately. Clinical researchers involved in cell therapy, this, that and the other, were told, “You’ve started so you can finish”, and given a grandfather clause, as it were, and told they could renegotiate when they went in to do other things. We were not even given that. I was told on 1 April, “If you carry on, you will be a criminal”. I think that was totally and utterly wrong.

Lord Fox: Thank you. I think that answers my question.

Viscount Ridley: We have heard previously that biotech crops, i.e. genetic modification in agriculture, is one of the areas where a huge amount of beneficial research was stifled by harmonised European regulation and, effectively, something Europe had a lead on vanished and it all went to America. I know it is not any of your specialties, but do any of you want to comment on that particular topic?

Dr Mike Galsworthy: I do. I think that is a particular issue of democracy. In the United States, with genetically modified organisms in foods, you clearly see that the wider public has had huge suspicions about this, but has had little or no opportunity to have its say. There was

one stage at which 90% of the American population wanted labelling on foods that contained genetic modification merely for its information. That had been squashed through various mechanisms at various points. Whereas what you have in Europe is large public objection to genetically modified foods finding its way through the European Parliament in order to put restrictions on our science. That is regrettable for the progress of that scientific field, but I do not believe that science should march on, leaving its public behind. I think the real deficit here is in our outreach to, and education of, the public about the real risks and benefits around genetic modification. I do not think that has been done, and that is where the rub lies. I believe that in one of your sessions Kurt Deketelaere was discussing these kinds of issues on the matter of health data and so forth, and the fact that it is not that the Commission itself is seeking to squash science; it is that regulation goes through this democratic mechanism of the European Parliament, and so the other parties who are interested in the matters being discussed have capacity to make their voices heard. What you are left with at the end of the day is a product of the scientific base engaging with other parts of society when forming regulation.

The Chairman: A final question from Lord Hunt.

Q135 Lord Hunt of Chesterton: From your understanding of the evidence we have received and the wider debate, do you think there are any areas that remain underdeveloped? I would like to add my own tuppenceworth. Having been a scientist and worked on many European projects, I can tell you that as we got more into Europe, what was remarkable about Europe was the efficacy of networks, much more so than with the United States, for example, and the business of handling, storing and making use of data. We have had evidence here in this Committee that, providing there is good organisation, small companies in Britain, and indeed even bigger ones, can make use of the technology and engineering stimulated by the EU programmes. There was some regret that under current arrangements we were not able to make as much use of them as we could. Do you have any comments on those points?

Emran Mian: For me, the most underdeveloped area of the evidence is around researcher mobility. On research funding, there is at least an argument in principle that in the event of an exit the funding gap could be made up. I think it would be very hard to get a commitment to that effect, but, conceptually, you can see it happening. I find it much more difficult to imagine a scenario after exit where researcher mobility is maintained. Some of the arguments have suggested that we already have very good networks across Europe and elsewhere and hence we will be fine. That risks missing the fact that some of these relationships change very quickly, and, of course, the frontier of knowledge changes very quickly, and the researchers who will be important in 10 years' time are not the researchers who might currently be in the UK or currently have associations with UK universities.

The real question is how we would maintain mobility and the making of connections. That feels to me very much like a leap in the dark in the event of exit. For me, the biggest area of hesitation is what would happen to researcher mobility and what impacts that would have.

The Chairman: I think at this point I must draw this session to a conclusion. We have covered a lot of ground. We are most grateful to our three witnesses, Dr Mike Galsworthy, Professor Angus Dalgleish and Mr Emran Mian. Thank you for your help this morning. It has been very enlightening. There will be a transcript circulated. Please make any minor corrections. If there is any further evidence you want to send as a follow-up, feel free to so do, although I

would point out that we will be drafting our report fairly rapidly now, so there is not much time. Thank you very much.

Scientists for Labour – Written evidence (EUM0055)

Scientists for Labour (http://www.scientistsforlabour.org.uk/en/) is the Labour science and technology network and is affiliated to the Labour Party. We believe that science and technology offer the potential to unlock a better future for everyone and seek to engage with politicians, party members and scientists to promote evidence-based policies that foster innovation and discovery in science, technology, engineering and mathematics (STEM)

Based on our collective experience, we consider that UK STEM activities benefit significantly from membership of the European Union, and by far more than the simple sum of the constituent parts. Scientific development and innovation are critically dependent on collaborative ideas and contributions, and it is here that the EU provides value over and above the cost of the subscription, as evidenced in section 3.0 below. The EU has structured its research organisation to harness this additional value in a flexible, insightful way, and the UK is able to exercise an equal voice in EU science policy making along with the other member states. The scale and intellectual challenge of the many, big issues being tackled in the modern world require pooling of resources across the European Union to make significant progress. As a result the capacity of our UK STEM base would be much diminished by loss of EU membership, resulting in many missed opportunities for improvements in our quality of life and for the associated innovative businesses that enable them.

The only realistic alternative to EU membership for the UK STEM base is closer alignment to the US, but the UK has no *de facto* or *de jure* voice in US science policy making. It is an over-simplistic assumption to expect the US to see increased focus on the UK STEM base as the best strategic option for their global science strategy: the UK would have to succeed against fierce competition from others to achieve any special status. Furthermore it is a naïve assumption to contemplate that any such status is even on offer.

1.0 Scope of the inquiry
The House of Lords Science & Technology Select Committee is conducting an inquiry into the relationship between EU Membership and the effectiveness of science, research and innovation in the UK. The UK's membership of the EU has wide ranging influence on the vitality of UK science, research and innovation. Understanding this influence, however, is complex and multifaceted. Its exact nature is uncatalogued in a number of key areas and this inquiry aims to try and understand and characterise these interactions with particular regard to four major themes; funding, collaboration, regulation and scientific advice.

2.0 Introduction

2.1 The EU research and innovation policy framework is entitled Horizon 2020 - the successor of seven “Framework Programmes”. Horizon 2020 is administered by the Directorate General for Research and Innovation (DGRI), embraces both the natural and social sciences and comprises nine sections[691] :

1. Excellent Science
   - European Research Council

[691] http://ec.europa.eu/programmes/horizon2020/en/h2020-sections

- Marie Skłodowska-Curie actions
- European Research Infrastructures, including e-Infrastructures
- Future and Emerging Technologies

2. Industrial Leadership
   - Leadership in Enabling and Industrial Technologies
     - Information and Communication Technologies
     - Space
     - Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology
   - Access to risk finance
   - Innovation in SMEs

3. Societal Challenges
   - Health, Demographic Change and Wellbeing
   - Secure, Clean and Efficient Energy
   - Climate Action, Environment, Resource Efficiency and Raw Materials
   - Secure societies – Protecting freedom and security of Europe and its citizens
   - Smart, Green and Integrated Transport
   - Europe in a changing world - Inclusive, innovative and reflective societies
   - Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy

4. Spreading Excellence and Widening Participation

5. Euratom

6. European Institute of Innovation and Technology (EIT)

7. Science with and for Society

8. Fast Track to Innovation Pilot

9. Cross-cutting activities (focus areas)

2.2 This reasonably comprehensive agenda and structure for research provides a template for individual Member States. Such a template assists Member States where existing national agendas and structures require reform, especially where reform is resisted. Clearly, the value of the template is much reduced for non EU states. As a consequence, reform in the UK would be impeded by leaving the EU. Harmonising the UK agenda with the Commission's agenda would maximise scientific, economic and social benefits to the UK. Such harmonisation would facilitate UK efforts to improve our fragmented research structure. Among the economic benefits of harmonisation are bilateral scientific links between the UK and other countries: whether the UK is an EU Member State or an Associated State, greater harmonisation is needed to persuade third parties of the value of bilateral links with a country – the UK – that would otherwise appear idiosyncratic, maverick

and hence unreliable. Members of Scientists for Labour have individual experience of this.

2.3 To assess the benefits and risks to the UK of this Horizon 2020 framework requires a detailed analysis of the evolution and implementation of the nine sections of the policy. Such a detailed analysis is critical when the issue at stake is continued UK membership of the EU. However, it is not readily apparent where the necessary expertise for this lies within the civil service. We have been unable to locate pertinent government publications. An evidence-based approach to engagement with the EU appears to be missing.

2.4 Note that implementation research is supported by a range of other DGs. For example

- DG Health and Food Safety has responsibility for grants for public and private projects relating to public health, consumers, food safety, plant health and animal welfare. These are awarded by the Commission and the EU Consumers, Health, Agriculture and Food Executive Agency (Chafea). Each year, the Commission publishes work programmes in the field of health and consumer policies fixing the broad outlines of the grants envisaged over the year. The current Health Programme (2014-2020 budget of €449.4 million) supports projects that 1) Promote health, prevent disease and foster supportive environments for healthy lifestyles; 2) Protect citizens from serious cross-border health threats 3) Contribute to innovative, efficient and sustainable health systems 4) Facilitate access to better and safer healthcare for Union citizens.
- DG Sante has activity on rare diseases, cancer and anti-microbials, with new scientific committees on consumer safety and on health, environmental and emerging risks.
- DG Communications Networks, Content and Technology funds high-quality ICT research and innovation that delivers imaginative and practical solutions to both technological and societal challenges through the EU research and innovation strategy.
- DG Climate Action: A number of different contracts and grants are regularly made available for companies or organisations who want to work with the DG-CLIMA or apply for funding. It gives the opportunity to organisations to get some grants through calls for proposals. These are invitations for suppliers to submit a proposal on a specific commodity or service. A grant or a subvention is a direct financial contribution from the European Commission to support a specific action or project of a non-commercial nature, to cover eligible costs directly incurred by the beneficiaries.

2.5 Note, further, that the Joint Research Centre (JRC) is treated as a DG. JRC is the Commission's in-house science service which employs scientists to carry out research in order to provide independent scientific advice and support to EU policy. It has centres in Brussels (BE), Ispra (IT), Geel (BE), Petten (NL), Karlsruhe (DE) and Seville (ES) with institutes for the protection and security of the citizen; environment and sustainability; health and consumer protection; reference materials and

measurements; energy and transport; transuranium elements; and prospective technological studies. It is a pity that UK engagement with EU has been such as to result in no centre being located here.

2.6 Any considered view of the importance of EU membership to the UK needs to take account of all these activities. In each case, there is a need to drill down and ask the question: “Is this activity being undertaken independently in the UK?” Where the answer is “Yes”, then the question arises whether greater efficiencies could be realised by the UK working closer with the relevant non-UK researchers. Where the answer is “No”, then the question arises whether the UK is maximising its benefit from the work being undertaken. Given the breadth of UK ambitions in research, there will be very few activities where a considered view would countenance the UK walking away.

2.7 In this submission we address the four major themes (funding, collaboration, regulation, scientific advice) identified by the House of Lords Science & Technology Select Committee. However, we consider those themes in a different order. We first consider collaboration since this is the real world activity in which scientists engage. On that basis we can then consider regulation and scientific advice because our views on this are based on that real world activity. Finally we consider funding because it is the past activities of scientists that justify future funding. In other words, our views are based on experience, not mere opinion.

3.0 Collaboration

3.1 Research has progressed from “Collaboration 1.0” (based typically on chance meetings of two researchers who agree to combine resources for a short period so as to investigate a single topic) to “Collaboration 2.0” (a systematic approach to the construction and maintenance of networks of people and things addressing a field of research). Collaboration between researchers – both academic and industrial researchers – lies at the heart of EU research policy. This collaboration policy reflects recognition by DGRI (the Directorate General for Research and Innovation) of the nature of research today and it reflects EU strategy in undertaking the construction of the European Research Area (ERA).

3.2 Research increasingly requires ever-larger scale collaboration. The prime (and oldest) example is that of CERN, set up in 1954, so that European particle physicists could share the benefits and costs of high energy particle accelerators that no one country could afford. This increase in scale is not some consequence of bureaucracy but rather of the absolute growth of knowledge and developments in technology. This growth inevitably identifies links between topics that had previously appeared to be unrelated. Experts in such topics had been able to work independently of each other. But now they cannot: they are increasingly obliged to work together if they are to maintain their ambitions to increase knowledge and use it. The requirement for networks of people and things is incontrovertible where research is seeking solutions to societal and global challenges such as health or climate change.

3.3 A large population of researchers in EU Member States and high quality research training are essential to the construction of the ERA so that it can ensure that research topics have the critical mass required for the EU to be globally successful, matching the US today and China tomorrow. This critical mass cannot be realised by any EU Member State on its own across the range of research topics. Nor can it be realised by any Associated State of the EU. Furthermore, it could not be realised by the UK outside of the EU. It is therefore essential for the UK to play an active – and pro-active – role in the planning construction and development of ERA to ensure success in research and innovation for the UK and other Member States.

3.4 Collaboration between UK and other EU researchers is addressing some of the most important challenges facing humanity and is motivating new generations of scientists:

- On climate change, research on discovering and using new sources of energy are critical: the EU is itself a member of ITER (the International Thermonuclear Experimental Reactor) alongside China, India, Japan, Russia and the U.S.A., which is a global project to harness fusion energy, and was launched in 1985.
- The European Space Agency (ESA) is a separate organisation from the EU, but the two are working increasingly closely together, and ESA now receives about 20% of its funding from the EU. UK membership helps underpin our flourishing satellite industry.
- The European Molecular Biology Organisation (EMBO) has a membership that is almost coterminous with the EU. EMBO’s UK out-station (the European Bioinformatics Institute) is located on the Cambridge Genome Campus and it supports a global biological data management system (with additional UK government support) that matches its US sister organisation.
- The UK has a leadership role in these projects in part because it is in the EU.
- On addressing the obesity epidemic (and related diseases such as Type 2 Diabetes, cardiovascular disease, kidney failure, retinopathy (blindness)), the UK cannot go it alone: it needs access to the 500m people of the EU to be able to understand the diseases and to test new interventions. Private industry may be able to find such large populations in China. But EU scientists need to work across borders. Access to 500m people requires extensive networks that can reliably and safely identify people with very specific disease features that make them suitable for clinical and other trials of the new personalised (or “precision”) medicine, that can reliably and safely assemble and share data and human biological samples.
- Better husbanding of food sources requires a scientific consensus on risks to fishery or on emerging new pests or environmental poisons.

3.5 These exciting research projects that are funded at scale by the EU not only address human needs but, at the same time, assert values that are British and European. Assertion of these values is the hallmark of civilisation, and it is this that then inspires the next generations of scientists to commit themselves to the hard life of being a STEM researcher. If the UK distanced itself from all this, it would lose some of its ability to address human need, would deny its values, would diminish its civilisation and would risk the loss of new British talent.

3.6 Of the 106,349 projects in 68 research activity areas funded by the EU, 55,899 (52.6%) involve the UK. This is more than any of the other 197 countries receiving support[692]. UK dependencies such as the Falkland Islands are among the 197 countries receiving funding.

Country Projects	Projects
United Kingdom	55899
Germany	51040
France	45526
Italy	36122
Spain	30374
Netherlands	25833
Belgium	19104
Greece	14150
Sweden	13342
Denmark	11261
Switzerland	9601

In general, all EU projects involve voluntary collaboration between researchers in at least three countries. Thus the EU provides a powerful means enabling UK researchers to collaborate with the people they want to work with from around the globe. To initiate these collaborations generally requires EU membership.

3.7 The EU provides an efficient means of establishing these essential connections. It is driven to do this as a matter of policy to ensure that research funding reaches all Member States. While the UK government may seek to promote bilateral international collaborations, such policies tend to come and go as dictated by diplomacy – not as dictated by the needs of research. UK bilateral collaborations cannot hope in general to have the impact of EU bilateral collaborations. There is even less prospect of UK multilateral collaborations having the lifespan that research requires.

3.8 The high level of UK participation in EU research provides strong evidence that EU research priorities align with UK research priorities. A continued high level of UK participation indicates that EU policymakers are sensitive to UK priorities. Thus the "Brussels bureaucrats" are working for us – not the other way round. They are working more for us than for any other country in helping our researchers do the work they want to do with the people they want to do it with.

3.9 EU-funded projects have budgets that pay not only for staff, consumables, services and equipment, but that also contribute to the overheads of UK research institutions (as "indirect costs"). There is scope for reform on this matter (should this contribution be higher?). There is also scope for simplifying the administration and

[692] http://cordis.europa.eu/projects/home_en.html accessed 26 October 2015

enhancing the oversight of EU funds. Clearly, continued EU membership will help ensure that future reforms meet UK policy objectives.

3.10 The global character of collaboration is exemplified by 22,916 projects with collaborators in countries such as United States, Russia, China, Brazil, India, Switzerland and Norway. In each project however, it is EU research policy that gives the lead in specifying the research topic and it is EU researchers – often from the UK – who frame the proposal and seek out the non-EU researchers who are needed. Thus non-EU researchers are, for EU funding purposes, second class researchers. That would be the fate of all UK researchers with the UK outside the EU.

3.11 Collaboration between academic and industrial researchers (Public Private Partnership – PPP) is an important matter. This is implemented in various ways. We give two examples:

- In Horizon 2020, one of the nine pillars is “Societal Challenges”. One of these challenges is Health, Demographic Change and Wellbeing. Within this challenge sits an activity called the Innovative Medicines Initiative (IMI)[693]. This is an independent multi-billion funding agency (tasked to speed up the development of better and safer medicines). The IMI research agenda is implemented with 50% funding by the European Commission and 50% by relevant private companies (AZ and GSK are major players). Individual companies in a specific project each provide in-kind funding such that the total industrial contribution is 50% of the cost of the project. Thus all the funding is spent on collaboration between academic and industrial researchers. It is important to note that the industrial researchers in any one project are often drawn from a substantial number of pharmaceutical companies and SMEs. Thus IMI promotes pre-competitive collaboration within the private sector as much as it promotes such collaboration between public and private sectors. This has obvious financial benefits: private sector collaboration reduces duplication of effort and promotes adoption of industry standards. The benefits are so attractive to companies that we are aware of numbers of US pharmaceutical companies that have sought to join existing projects as latecomers. If the UK left the EU, the ability of major pharma to engage in this PPP would not be substantially affected since they are multinational in character. However, UK public researchers would be demoted from their current highly active roles.
- In Horizon 2020, one of the nine pillars is “Industrial Leadership”. One of the leadership areas is “Leadership in Enabling and Industrial Technologies” and within this sits an activity on “Information and Communication Technologies”. DGRI regularly issues a list of research topics that have been drawn up in consultation with a wide range of stakeholders. It solicits research proposals that address those topics from groups of public and private researchers i.e. from prospective PPPs i.e. from prospective collaborators. In the list of 39 topics for 2016-17, a budget of €1bn will be allocated to winning proposals from PPPs. The topics are divided into the following eight themes: A new generation of components and systems;

[693] http://www.imi.europa.eu/

Advanced Computing and Cloud Computing; Future Internet; Content; Robotics and Autonomous Systems; Innovation and Entrepreneurship support; Responsibility and Creativity; International Cooperation Activities.

Thus whereas collaboration is supported via IMI between any relevant public organisation and a restricted list of private organisations in the medicines industry, in ICT collaboration is supported between any relevant public and any relevant private organisation.

3.12 When a specified set of industrial partners undertake to work jointly with DGRI to support PPPs – as is the case with IMI – a Joint Undertaking is agreed between the two sides. In addition to IMI addressing the Societal Challenges pillar, there are JU's called "Clean Sky" and "Fuel Cells and Hydrogen". Two further JU's are located within the Industrial Leadership pillar: one for Embedded Computing Systems (acronym: ARTEMIS) and one for nanoelectronics technologies. UK companies are active in these JU's and UK research institutions participate in projects. Companies considered British both large and small are involved in one or other of the five JU's. We may highlight household names such as AstraZeneca, GlaxoSmithKline, Westlands, Rolls-Royce, e-On, Air products, Shell, Johnson Matthey, Ford Motor Company, IBM UK, QinetiQ, Thales (UK) Research & Technology.

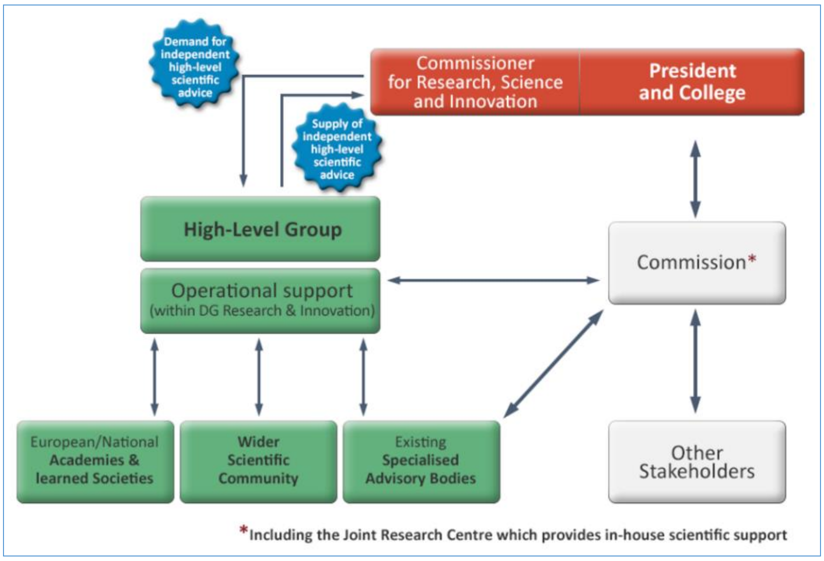
New JU's are planned. For the UK to step back from all this would be catastrophic for future jobs and prosperity and for young researchers who would be driven to emigrate.

We note also that EU programmes give specific encouragement and financial support to the involvement of SMEs, and also to technology transfer – a crucial activity where the UK has well-known and historical weakness.

3.13 Collaboration is increasingly relevant in the area of education and training. As academic research becomes as international as industrial research by multinationals already is, the need for training in more than one country grows, as does the need for the recognition of qualifications across national borders. The UK (including Scientists for Labour members) currently benefits from EU support for mobility: we recruit brilliant and talented young minds from the continent to train here. These people contribute both to our economy and to the quality of our research. There can be little doubt that leaving the EU would be a disincentive to this talent coming to the UK. The pharmaceutical industry has invested in increasing the mobility of its trainee and experienced researchers across the EU because its operations occur across the EU and beyond. To reduce mobility to and from the UK of these researchers by leaving the EU is tantamount to asking the pharmaceutical industry to leave the UK.

4.0 Regulation and Scientific advice

4.1



A new means of providing scientific advice in the EU is being set up based on OECD guidelines. This Scientific Advice Mechanism (SAM) is sketched above. Major appointments are due in November 2015. The Commission notes[694] that extensive use of scientific advice is made today in specific policy areas from the JRC, from external experts and from some Horizon 2020 research projects. This has been summarised by the European Parliament[695].

4.2 Clearly no assessment of the effectiveness of SAM can be made at this time. However, we may note the speed with which the Commission has been able to move on this matter once the need for change was recognised: a speed which contrasts with the sluggishness of change in the UK's system of obtaining scientific advice. CERN head Rolf-Dieter Heuer, Fields medal winner Cédric Villani and UK Met Office chief scientist Julia Slingo have been announced in a timely fashion as members of the High Level Group.

4.3 We may ask whether the structure of SAM is appropriate. While broadly the structure looks promising, a feature that appears to be lacking is the ability of the European Parliament directly to request independent high-level scientific advice through SAM. As a political body, such advice is especially valuable in order that different political traditions can better adapt to a changing world. MEPs should be able directly to request scientific advice from SAM.

4.4 SfL cannot advise the HoL Science & Technology Select Committee inquiry on specific EU legal issues affecting the regulation of science. However, it would be unconscionable for the UK to adopt lower standards of its own, especially in regard to ethical issues around clinical trials or data privacy. Much of the pharmaceutical and biotechnology industries would avoid the UK if that were to happen: the UK would become a pariah state for the sake of saving on some red tape. If standards were significantly more stringent in the UK than elsewhere, this too would be counter-

[694] http://ec.europa.eu/research/sam/pdf/scientific_advice_mechanism.pdf#view=fit&pagemode=none
[695] http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/559512/EPRS_BRI%282015%29559512_EN.pdf

productive for UKplc. We need to stay broadly in line with our leading international partners. This is most efficiently ensured by continued EU membership.

5.0 Funding

5.1 The funding of research and innovation by the European Commission is largely (but not wholly) the responsibility of the Directorate General Research and Innovation (DGRI)[696].

DGRI today has 11 directorates[697] for policy development and coordination; resources; common support centre; Innovation Union and European Research Area; international cooperation; key enabling technologies; bioeconomy; health, energy, transport; climate action and resource efficiency. Within these directorates, we find responsibility for particular funding streams (e.g. the popular European Research Council sits, in part, within Directorate R: Resources).

5.2 Perhaps the most striking aspect of the organisation of DGRI is its flexibility. The DG is responsible for all fields of scientific enquiry and is able to promote – or demote – a particular topic by rapidly re-organising its structure to align with changing scientific, economic, political or social priorities. Just ten years ago the DG was known as "DG Research" and there were not 11 but 15 directorates (A: Legal; B: European Research Area – legal; C: European Research Area – economy; D: Cooperation; E: Biotechnology; F: Health; G: Industry; I: Environment; J: Energy (Euratom); K: Energy; L: Society; R: Resources; S: Ideas programme; T: Outsourcing).

5.3 This flexibility is increasingly important given the relentless pace of technological, scientific and social change. However since change in the number or responsibilities of directorates is initiated because of economic, political or social considerations and not solely because of scientific considerations, this flexibility puts at risk the autonomy required for sustained human creativity and thus the long term health of European science. DGRI has sought to address this issue through the creation of the European Research Council, but the balance of funding is heavily weighted away from ERC and toward explicitly economic, political and social priorities through Horizon 2020. While economic, political and social issues are legitimate concerns of research and innovation, the specification of these issues must be a matter of democratic decision-making if the subsequent products of research and innovation are to be sustainably adopted. This need for democracy is as much an issue for the EU where the Commission holds sway as it is for the UK where arm's length research councils assert (but do not have) an autonomy that is at odds with democratic specification of economic, political and social research priorities.

5.4 By comparison, the UK's research funding structure is less flexible, and so slower to respond to evolving priorities.

The UK cannot benefit optimally from DGRI unless it adapts so that there is, where appropriate, some degree of correspondence between UK governmental scientific

[696] http://ec.europa.eu/research/index.cfm
[697] http://ec.europa.eu/research/dgs/pdf/organisation_en.pdf#view=fit&pagemode=none

administrators and EU research and innovation administrators. Our administrators need to know their opposite numbers and have inclusive briefs that allow them to argue for UK priorities. The use in the UK of "arm's length" bodies such as the research councils was, arguably, suited to earlier times. However, over the last 70 years, research, development, innovation and their supporting infrastructures have become the major drivers of societal development: science (both natural and human), and in turn influence rational policymaking in the UK and elsewhere in the EU. Hence science policymaking cannot be an arm's-length activity. Public involvement in science is not simply desirable but is becoming essential in certain areas (e.g. biomedical research). To facilitate this involvement, science policymaking needs to be more democratic. The SAM structure may start to meet this need for EU citizens and hence for UK citizens.

5.5 The EU has set a target of 3% GDP for research spending, and the UK falls significantly short. While targets are to a degree arbitrary, they afford a useful yardstick by which to gauge UK effort against the need, particularly in respect of the magnitude and pace of societal development.

5.6 Within UK industrial sectors, there is substantial variation in research intensity (R&D spend as a fraction of sales)[698].

Product Group	**R&D expenditure (£million)**			**R&D intensity**		
	2011	**2012**	**2013**	**2011**	**2012**	**2013**
Pharmaceuticals	4,914	4,197	4,081	34.8	34.1	33.8
Aerospace	1,438	1,518	1,656	7.7	7.4	6.9
Electrical equipment	509	463	391	3.9	3.6	3.1
Chemicals	523	592	617	2.3	2.7	2.8
Motor vehicles and parts	1,525	1,763	2,060	4.0	4.5	4.6
Other manufactured goods	146	133	170	0.9	0.8	1.0
Manufacturing total	**12,462**	**12,318**	**12,820**	**3.6**	**3.4**	**3.5**

Thus pharma exceeds the industry average R&D intensity by ten-fold while "Other manufactured goods" is less than a third of the average. This variation can be attributed to a range of national, international, social, economic, legal and political factors: to determine the "right" intensity requires, at least, careful evaluation of each sector and its stakeholders. Indeed, for industrial R&D, the definition of R&D itself is problematic since, for example, market research can be included in that definition in ways that are rarely found in publicly-funded research. Nonetheless, comparisons between the UK and other EU Member States can begin to identify those industrial sectors where UK wishes to excel, and the EU provides the framework where industrial collaboration can ensure more efficient use of R&D monies.

20 November 2015

[698] http://www.abpi.org.uk/industry-info/knowledge-hub/randd/Pages/expenditure.aspx#1

Sense About Science – Written evidence (EUM0073)

Background

Sense About Science is a UK charity that equips people to make sense of science and evidence. We are a source of information, we counter misinformation, and we champion the role of research and evidence in public life.

We interact with the valuable discussion about science and evidence that takes place across Europe in relation to evidence for policies and public discussion about science and research. While there are problems in the scientific and medical sphere with poorly derived regulations that are not properly held to account (these are described in answers to some of the questions below) we make comments about those specific areas in the context of the following:

Membership of the EU is the vehicle to influence regulations that govern science and research in Europe. These EU regulations are the rules that would continue to govern scientific and research practices in a European country even if the country was no longer a member state of the EU. But without membership there wouldn't be an opportunity to influence those rules. This would be a problem for a country such as the UK where research is a significant part of national employment and income generation and the basis of international influence. New guidelines and regulations (for example in clinical trials disclosure, magnetic resonance imaging, stem cells) are regularly developed with leadership by UK researchers and regulatory agencies.

It is essential that there's a Europe wide conversation among researchers to build the ability and capacity to develop rules and governance. Inevitably member state national agencies vary in expertise and resources for reasons of historical events, population and industry connections among other reasons. Expertise and knowledge can be generalised if there is a Europe wide conversation and development of regulations. For example the UK's Food Standards Agency is a relatively large, well resourced body with rich expertise forged through dealing with issues such as BSE while in Denmark food safety operates on a much smaller scale with far fewer personnel and resources. Research fields are more developed and extensive in some areas of Europe. Expertise and knowledge from more developed areas can be shared so that every area doesn't have to develop programmes in duplicate.

In areas in Europe with developed research fields, the discussions they are having about research among citizens and the media are more developed. Experiences and frameworks can be shared with researchers in areas where discussion hasn't happened. When an issue is misrepresented, for example, it means that researchers across Europe are able to respond together.

A Europe wide network of researchers means policy makers can draw on the broadest pool of experts across member states to source the best possible expertise.

Centralisation of regulation and scientific assessment means more robust science. Centralising the collection of research data from across the EU increases its usefulness. Information on side effects of medicines for example is centralised thereby leading to larger sample than is side effect data is siloed in individual countries. Centralisation of data forces researchers to produce data in standard format, which again makes it easier to pool. Data of interest to researchers across Europe and globally is easier for researchers to find and access if it is held centrally. Centralisation of data opens up strands of research may not have been possible if research data were scattered and held in a number of different countries. Centralising data collection and curation means the cost of this will be borne by the EC rather than member states.

Centralisation of regulation opens up the possibility of mutual recognition of research data. Clinical trials carried out under EU clinical trial rules for example produce data that are accepted by competent authorities in member states as well as the European Medicines Agency. The EC has been able to agree rules with regulators in the US and Japan, so data from a clinical trial carried out in any EU member states are accepted by the largest global medicines regulators. This greatly increases efficiency of research as research does not need to be repeated in individual countries to be recognised by individual member state regulators.

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

There is frustration among many researchers and research organisations we work with in the UK about a lack of transparency about use of evidence in European policy. This is shared by researchers and science bodies elsewhere in Europe.

Policy makers in Brussels hear from few groups beyond the companies, unions and NGOs who can afford it, and their umbrella groups. There are civil society and scientific groups across Europe struggling to find a way into discussions of evidence in policy making because the political structures and conventions in Brussels are opaque and hard to cut through. This is making European science policy polarized.

Even where there’s immense frustration, our understanding is that the research community is as committed as we are not to bypass Europe but to making it more accountable and transparent about the evidence it uses and more responsive to that evidence. Regulations such as the European Clinical Trials Directive and the EU Directive on the protection of animals used for scientific purposes are being used by UK researchers and are solidly part of UK research.

In our experience these problems include:

A lack of risk/benefit assessment and few opportunities for scrutiny by scientists and researchers early in policy making process. The EU Physical Agents (EMF) Directive 2004/40/EC, which aimed to define safe levels for equipment operators’ exposure to electromagnetic fields was published in 2004. It would have put limits on the exposure of operating staff (including those maintaining MRI equipment) that would have meant the end

of interventional MRI for tumour, cancer and other patients and that children in need of an MRI would have to be sedated. The limit proposed was an extrapolation from largely hypothetical possible conditions and an over-cautious interpretation of limited experimental data. Following intervention by MRI researchers (led by UK groups) the Directive was eventually delayed to allow further research and has not yet been enacted.

Regulation drafted for one central purpose having unintended consequences on research. The Data Protection Regulation which will supersede the EU Data Protection Directive risks making research involving personal data illegal or at best unworkable. The Regulation includes a requirement for specific and explicit consent for the use and storage of personal data in order to protect the kinds of personal information held by financial institutions among others. The original draft of the Regulation contained exemptions for research data, subject to certain safeguards. The European Parliament's recent amendments very significantly reduced the scope of this research exemption. If Parliament's amendments are accepted into the regulation the use of personal data in research without specific consent would be prohibited or become impossible in practice. This would put at risk significant European investments in research in genetics, cohort studies, biobanks, and the use of routinely collected health data and the associated progress in understanding of health and disease.

Regulation that is not fit for purpose and overly burdensome. It is widely recognised that that the EU's framework for development of genetically modified (GM) organisms is impacting on the science and research community in the UK. The regulations are based on an over-statement of the significance of this particular plant-breeding process. The assessment system is unbalanced. The regulations look only at risks, not at benefits. The end point of the European safety assessment process is not governed by any kind of scientific measure but by political factors. Member states can ask for more and more, sometimes irrelevant, tests. These requests for more testing and information do not have to be based on evidence. The expensive and complex regulatory system is a barrier to the conduct of research on GM foods in the UK. The layers of bureaucracy and a safety assessment without a defined end point adds millions of pounds to the cost of a new GM plant compared with non-GM plants and can take a decade or more. This means that development of new crops, and therefore research into new crops, is restricted to large corporations (though it should be noted that even large corporations are unwilling to tolerate the system). Small and medium enterprises, Universities and institutes are excluded.

Filtering food based on the process they were produced will lead to problems in the future. New techniques such as RNAi are coming on stream and will be used to produce new food but there is uncertainty over whether they are GM or not and so whether they will caught under the current GM regulations or not. Researchers report that this is likely to chill research in the same way.

The EU's approach to applying the precautionary principle. The precautionary principle was designed as a framework for policymakers in situations of uncertainty but is being used as a blunt instrument. It is short termist; in the absence of knowing the future risks of something, the precautionary approach inevitably draws on present fears and prejudices. The precautionary principle is irresponsible because its only tool is to stop a thing - a practice,

substance or technology. This can lead us to think we have protected ourselves from outcomes when we haven't.

The EU's use of the precautionary principle encourages evasion of responsibility for the status quo and for problems. When change is blocked for fear of unknown consequences, the people blocking it rarely assume responsibility for the consequences of current problems. If society wants to mothball a possible solution, such as genetically modified potatoes, then we need to take ownership of the present problem, which is spraying potatoes with fungicide 20 times a year to stop them being destroyed by blight. It stops us asking bigger questions and asking questions about alternative ways to solve problems.

The EU is using the precautionary principle only to consider the risks of doing something but not to consider the risks of not doing something which may have done some good. And it only looks at risks and not at benefits. Restricting the view only to risks, and in some cases only to hazards, is the opposite of responsibility. It reduces the options we can explore in society.

The EU regulatory approach to GM is based on a hazard, rather than risk-based, approach. Within a regulatory system a hazard approach is widely recognised as a backward step that does not support effective prioritisation and real risk reduction. It is a negative step for public and environmental protection. Professor John Beddington has said, on applying science to the management of hazards and risks in policy making, "Regulation by hazard alone is not a sensible or scientifically well founded approach, with any advantages heavily outweighed in most cases by the disadvantages."

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

It is very uncertain to us whether the UK could develop regulations on data protection and scientific assessments and still be able to be part of Europe wide research.

Different data protection rules may mean that data collected and held by UK researchers would not be allowed to be used by collaborators in EU member state countries. This would make it difficult for UK researchers to work in multi-national groups, potentially cutting off UK access to European research funds and to research fields. In practice, UK researchers would probably be forced to conform to the majority EU regulations. UK-specific research regulations may lead to data not being accepted by the EU's central scientific assessment agencies such as EFSA and EMA.

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

In 2014 European Commission President Jean-Claude Juncker decided not to retain the post of Chief Scientific Advisor to the EC and announced instead the formation of a panel of

leading experts and a new science advisory mechanism to pull in expertise from the academies of science in Europe.

We reserved our excitement when a panel replaced an individual. Committees can become faceless things that the public can't get a handle on. We don't know yet if that will be the case here, but where the committee is going to be based does not look promising. It will be buried in DG Research and the Commissioner will be the buffer between the panel and the President and rest of the Commission. It's very unlikely that any citizen of Europe will be much able or inclined to scrutinise what it does.

What is good is that the committee looks as if it will have a close relationship with European science and social science academies and access to the networks of researchers across Europe that come with this. It could be that this makes the committee less insular than the Commission can sometimes be, which is to be welcomed.

The UK government has an individual Chief Scientific Adviser, as do most Government ministries. This means that there is a person in Government and in departments willing and able to ask questions about evidence behind decisions and regulations. It is unclear whether a panel will be able to do this in the way that an individual advisor could, especially considering the internal politics of the Commission. It is awkward to ask about evidence at certain times, when perhaps you have one directorate trading with another – 'I won't ask you about your risk assessment if you don't ask me about mine'. We discovered this years ago in the EU with the proposed restrictions on MRI scanners. No risk/benefit assessment of the policy was done, and we understand that was because at the time the person responsible for assessing it was trying to get something of their own through without any awkward questions. It is in that kind of horse-trading environment, which of course is not just in Europe but in all polities, where somebody has to make it their job to come in and be the awkward squad, and ask whether something actually makes sense. It is possible that a committee could do this, but it will take some very strong people leading it and setting its agenda.

It would be a disaster is if this became a 'speak only when spoken to' committee, with no remit to ask questions outside of those put to it, no power to demand to be listened to, and no face accountable to the public.

November 2015

Siemens AG and Siemens UK – Oral evidence (QQ 90-106)

Evidence Session No. 9 *Heard in Public* *Questions 90 - 106*

TUESDAY 9 FEBRUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Baroness Manningham-Buller
Lord Maxton
Duke of Montrose
Baroness Morgan of Huyton
Baroness Neville-Jones
Lord Peston
Viscount Ridley
Lord Vallance of Tummel

Examination of Witnesses

Professor Siegfried Russwurm, Chief Technology Officer & Member of the Managing Board of Siemens AG, and **Juergen Maier**, Chief Executive Officer, Siemens UK

Q90 The Chairman: Good morning.

Juergen Maier: Apologies for my colleague being a little bit late.

The Chairman: Welcome, Mr Maier. We are delighted that we can make a start. We know that there is a tight time constraint for your colleague at least, and perhaps for you as well. We thought we would start on time. Professor Russwurm can join us and catch up. We are being broadcast, so I alert you to that. Would you like to introduce yourself formally for the record? If you would like to make an opening statement, please feel free to do so, otherwise we will go straight into the questions.

Juergen Maier: Thank you very much. I am Juergen Maier, chief executive of Siemens in the UK. I should declare that I am also a non-executive director in BIS, so I am obviously engaged there from a science point of view. I am also a visiting professor at the University of Manchester, so I have close links with that university. As Siemens in the UK, we have strong partner relationships with a number of our UK universities.

By very quick introduction, I will keep to our UK activities, especially in relation to research and development. We are an organisation of about £5 billion revenue in the UK. To give you a measure of where that fits within Siemens globally, Siemens globally is about €80 billion, so we are a significant part of it. We employ 14,000 people. We have 13 factories in the UK, and are just building the 14th, which you will no doubt know about, which will produce blades for wind turbines in Hull. A lot of our research activities in the UK happen around the activities of those factories. We do research to the tune of about £100 million in the UK. That is about 2% of our revenue. You will recognise that that is quite low, because for Siemens globally the amount of research we do is over 5% of our revenue. I am sure as you start asking questions, I will respond by informing you that we have been increasing the amount of research that we do in the UK over recent years. To give you a little flavour as an introduction, in 2008 we had 50 collaborative R&D projects in the UK. By "collaborative", I mean that these projects are not just happening in one of our factories on our own but are research in partnership with a university or a research centre. Last year, there were 160. That increase is predominantly because we have been encouraged by Great Britain's move to reindustrialise and to create an industrial strategy, and by institutions such as the catapults, which have allowed us to engage in more collaborative R&D. I will leave it there. I am sure we will talk about the EU linkage of some of that as you ask me some questions.

Q91 The Chairman: Thank you very much. That is a very helpful introduction. Following straight on from that, you have described how you are increasing your research in the United Kingdom. What features would encourage such an investment in research and development in this country? Specifically, what influence does our membership of the European Union have in such a decision?

Juergen Maier: The features that we look for above all are best in class: lots of good citations and knowledge of the research topic. That is one area. However, also key are universities or institutions that are already or are willing to collaborate. We see British universities as particularly strong at that, and they have got stronger over recent decades. That is where we are able to link up either universities across the UK or sometimes universities to other universities in the USA or Germany.

Increasingly, the EU angle comes into the research programmes that we are looking at, which are very large scale. We are heavily involved with an initiative called Industry 4.0, otherwise called the fourth Industrial Revolution or digital manufacturing. There are all sorts of different names for it. That programme is hugely complex in terms of the future automation of factories. No one university, country or organisation will be able to carry out all the facets of the research that need to take place, so we are actively looking to work with different partners to piece together the innovation and R&D that we, and indeed many other organisations, will be driving. Germany is quite centric to this research, but it is in our interest as Siemens in the UK to make sure that we link British universities into that, because ultimately that will help us to grow our R&D and manufacturing capabilities here rather than if we left it to Siemens in Germany and German universities to drive this research. That is where it is important for us in this collaboration across the borders on these big programmes.

The Chairman: Clearly, Siemens is very interested in a successful outcome to the research and development projects. You have explained that the quality of science is one of the prime drivers in determining where you make your R&D investment. You are collaborating with

universities around the world, and have mentioned the United States. Which is significant in wanting to have further investment in Britain as opposed to Germany: the fact that we are part of the European Union or that we are a European neighbour?

Juergen Maier: The answer is both, obviously. In other words, we are a neighbour and a part of the European Union, so proximity plays into that to some extent. When you are part of the European Union, you are able not only to participate in the research programmes but to shape the future look of those research programmes. We in the UK can be part of it and say, "Let's pick another area of autonomous vehicles", which is one of the research fields in which I believe, and Siemens believes, that the UK could be leading. Being part of the European Union means that we are able to exert significant influence on what these research programmes are going to look like over the next five years and the next decade. We would not be able to do that outside the European Union.

The Chairman: In your experience, have associate members of the European Union ever been able to exert influence on the determination of programmes?

Juergen Maier: It would be good to ask Siegfried that question, because he looks after the global research programmes more than I do. My knowledge is that we can do it a lot more significantly as part of the European Union. You will probably come to some of the Switzerland questions. Obviously Switzerland participates in these research programmes, but my understanding and knowledge is that they are significantly less influential in shaping them. I would not go as far as saying that it has no influence at all, but it has significantly less. Siegfried might like to express a view on that when he arrives.

Another point worth making is that it is not just about the research itself. As you develop this innovation and the R&D for such programmes, it is also very much about the standards that you are setting for those programmes. I would definitely say that it is only the people who are actively involved in setting the future direction of these research programmes who ultimately are at best advantage in defining the standards, which ultimately, of course, gives manufacturers and companies in your country the potential competitive advantage of being involved in those discussions and that influencing early on.

Q92 Lord Cameron of Dillington: You were recently quoted as saying that you are "very sure we can better grow our business in the UK as part of the European Union", and you go on to talk about "thriving rather than surviving". Do you want to expand on that and explain why you think that?

Juergen Maier: This builds on the last point that I made. I have commented a number of times that I am definitely not one of the scaremongers, and should a Brexit happen it is clear that we as Siemens would continue to serve the British market as best we could and that the UK will remain an attractive market for us. However, as I have said, we have 13 factories, soon to be 14. My personal ambition is that as we drive forward we do more R&D and manufacturing here. Manufacturing often follows R&D. Outside the EU it would be more difficult for me to influence Siegfried, who will hopefully join us in a moment, and other colleagues in Siemens to persuade them that the UK is a good place to start some of those R&D programmes. Be aware that some of that will be logical, rational thought, but some of it will be psychological, such as, "It will probably be more difficult to partner with these organisations, because they are ultimately not part of the European Union". Hello, Siegfried. We are in mid-flow.

Professor Siegfried Russwurm: Good morning. I am sorry. I hope it is not Siemens technology that has caused my late arrival.

The Chairman: I am sure we owe you an apology for being challenged by the transport system. I explained to Mr Maier that we are being broadcast. Would you like to take this opportunity to introduce yourself for the record, and then we will continue with the questioning? I know that your colleague has reserved some questions for you.

Professor Siegfried Russwurm: Thank you so much. My name is Siegfried Russwurm. I have the pleasure to serve on the board of Siemens, the parent company. I am a corporate technology officer for Siemens, and I have been with the company for 24 years.

The Chairman: Thank you very much. Lord Cameron, did you want to continue?

Lord Cameron of Dillington: I rather think I have finished.

Juergen Maier: Is it useful if I continue on that question? It will allow Siegfried to pick up from where we are. We were just talking about my comment about us thriving better within the EU and that with these large research programmes and, indeed, with new research programmes that we might drive in the future such as energy storage, where we are quite active in the UK, I am pretty certain that in the event of a Brexit it would be more difficult for me to persuade Siegfried and other colleagues within Siemens who are making these decisions to invest in further R&D here, and even to create some more manufacturing for these types of activities. I also said that part of that will be for rational reasons: we will probably find it more difficult to create the sorts of collaborations that we currently drive. But sometimes there are also psychological factors: i.e. if we are not part of the EU family, it may be better to keep some of this research back home or with other EU members. That is what we were just discussing.

Lord Cameron of Dillington: You said that manufacturing follows R&D, which is a pretty significant statement to make. Can you expand on that? Why would that be? Surely research is international.

Juergen Maier: That is not always the case. I can give you the history of the factory in which I started work nearly 30 years ago, which is still in Congleton in Cheshire today. It manufactures variable-speed drives, or inverters. The technology behind that started with a programme with the University of Manchester, which had particular knowledge of the technology that is required to manufacture those in smaller scale. It was that initial kernel of R&D that allowed us to develop that product. You are right: a separate decision is taken on where we now manufacture it, but obviously the fact that the knowledge is in Congleton, Cheshire, and in Manchester is a factor that, should other factors also be suitable such as the availability of skills et cetera at cost position, makes it easier to leap to the next decision and to say, “Maybe we could build a factory and produce this stuff here”.

Q93 Lord Maxton: You have been talking about British universities, but of course the Scottish universities come under the Scottish Parliament and the Scottish Executive, not the British Parliament and the British Executive. Does this make any difference? If we were involved in Brexit—I agree that this is asking you to speculate—the Scottish Executive has said that it would leave Britain. Does that make a difference to you?

Juergen Maier: To be honest with you, I had not particularly thought about it. You could think of a scenario where Scotland was part of the European Union and England was not. I

could well see a scenario where we would engage with more programmes through Strathclyde University, where we already have joint research programmes today, and that might be an easier way for us to engage.

Q94 Lord Vallance of Tummel: I should declare a former interest as a former member of the supervisory board of Siemens, albeit some years ago. Perhaps I could address my question to Professor Russwurm. It is clear that large companies in the UK when it comes to EU funded research are very much underrepresented in comparison with Germany or France. Could you explain that to us? Is there anything that the UK could learn from Germany about that?

Professor Siegfried Russwurm: We have no in-depth analysis for that pattern. However, I would like to offer some theories. Whilst typically the UK industrial strongholds are specialists and not the big companies, leaving aside aerospace and automotive for a moment, for smaller companies the bureaucracies around these funding programmes can be a distraction. There is no doubt that we need significant improvement in the Brussels apparatus to deal with that. There are different ways to deal with that bureaucracy. What we see in Britain, and which Juergen helps me to understand, is this bureaucracy—dealing with rules and regulations—being outsourced quite often to the universities. This explains why British universities have a significant share of this funding, whereas British companies do not.

A second string of explanation is that typically the Anglo-Saxon tradition argues for more self-sustaining companies, whereas the middle-European tradition I would not say enjoys interacting with Governments and intergovernmental institutions but has made peace with that. If I take the German example, we have some experts who can deal with this kind of endeavour and industrial associations that support that. Whereas in Germany it is more of a governmental or association lead and companies then join in, the Anglo-Saxon tradition is to do our own thing.

Taking the most recent example, you may have heard about the internet of things as the next big thing in digitalisation. You see the Anglo-Saxon approach in the Industrial Internet Consortium, which is purely driven by companies, whereas its counterpart in Germany, the famous fourth Industrial Revolution, originally started between government and industrial associations, and only recently have companies tried to get into the driver's seat when it is closer to an offer to customers. There is a different tradition.

On the other hand, if I add the universities plus the companies' total share, both for Germany and Great Britain, there is not much difference.

Lord Maxton: Where would you put the USA in that?

The Chairman: Lord Fox is next.

Q95 Lord Fox: This is on the same theme of intellectual property. In entering into some of these joint ventures, is there some reluctance or suspicion from an Anglo-Saxon point of view about the ownership of intellectual property, or is that not a relevant concern?

Professor Siegfried Russwurm: I would concur with Juergen's statement that decision-making in companies is not always completely rational. Whereas the rational answer to your question is that it depends on the subject, the contract, the fund that you are applying to, and there are significant differences between universities as to how they deal with that, there is this emotional caution: "Am I too close to governmental organisations? Will

somebody else have a say in my intellectual property, which should be the basis of my economic success in the future?" From an emotional point of view, I could not agree more, but from a rational perspective there are zillions of different solutions. Frankly, with very few exceptions, we have always found terms and conditions that created a win-win between the different participants, especially between universities and private companies.

Q96 Lord Hunt of Chesterton: I would like to pursue the differences between the UK and Germany in industry and government. The UK used to have many more large government labs, which have disappeared. You have Jülich and Karlsruhe. Similarly, you have the Fraunhofer system, which has been going for a long time. I know companies in Britain that regularly contact the Fraunhofer to get information that is no longer available in any comparable way in the UK. How important is it for a very big company like you that these government science operations in Germany affect you? Do you have comments on the UK?

Professor Siegfried Russwurm: These research associations are our traditional partners. I had the privilege to visit two of the catapult centres in the UK. Frankly, while it was explained to me that it followed the example of Fraunhofer in Germany, if I compared both of them to our Fraunhofer institutes our German professors would be jealous of the environment, the structure and set-up. I truly believe that the concept of the catapults is a strong lever to revitalise the industrial strength of Great Britain, which has obviously suffered in past decades. The challenge that I see in the catapult concept is the people. Quite frankly, you see elderly people like me and young students, but you rarely see a 40 year-old engineer. Whether this knowledge transfer between people can be revitalised is the biggest challenge for me. From the framework and the conditions to the options for companies, the catapult concept is highly intriguing, and we have taken advantage of this concept in our international research portfolio.

Q97 Baroness Morgan of Huyton: It is very good that you have been able to join us, Professor Russwurm. We have waited to ask you about Switzerland, which is a topic of endless fascination to us. You employ a lot of people and have a relatively small operation in Switzerland. We are trying to bottom out the reality of non-EU membership for industry. You are obviously in a good position to help us to work that out. We want to understand what impact EU membership has on business interactions and particularly on decisions relating to R&D. How much does it play a part in your decision-making, and how does it play a part in your decision-making?

Professor Siegfried Russwurm: Let me start with the example of Switzerland, which is extreme because it is not a member of the EU and it is a small market with its peculiar rules and regulations. Had this business called Building Technologies, which is headquartered in Switzerland, not stemmed from an acquisition decades ago from a Swiss company, we would not have that operation. It is a small market. We have some people there who try to serve our customers. We have to make up our minds whether special Swiss regulations are worth the buck to implement them for such a small market. Siemens does not want to wipe out this Swiss industrial tradition, so we keep this traditional headquarter up and running, with all the emotions that surround that, but frankly we have been reducing our R&D in this location constantly over the last 15 years. Even when it comes to university collaboration, which is with ETH Zurich, the renowned engineering hub, when I tried to find allies in the rest of Siemens to forge a more strategic relationship with the university in Zurich, I was not successful. Our very few Swiss colleagues interact with their local university just around the

corner, but otherwise Switzerland is merely a small market for us with interesting currency behaviour. All our efforts there are costly and becoming even more so. Even Swiss managers who have a global view have decided to relocate certain activities out of Switzerland to the EU.

Baroness Morgan of Huyton: Is that because Switzerland is a small and unusual market, or because it is not in the EU?

Professor Siegfried Russwurm: Yes.

Baroness Morgan of Huyton: Do you operate in any other non-EU countries where you can draw some conclusions?

Professor Siegfried Russwurm: It is both. The big difference is that the UK is a highly attractive market, so obviously whatever British decision is taken about being a member of the EU, we would be active here. However, all other things being equal in the decision-making, there are many small details, sometimes down to the fact that you send a sample from one lab to the other, and while the value of that sample is small you still have to go through all the paperwork for sending it cross-border. These are the small emotional things. It is not a big fact or a big rational argument, but, still, if there is any cross-border travel, if any sending of samples back and forth ends up in piles of papers, all things being equal you would rather do that somewhere in Scandinavia, Belgium or the Netherlands—I exclude France for mysterious reasons (I am joking)—than in a non-EU country.

Baroness Morgan of Huyton: Perfect. Thank you. That is very helpful.

Q98 Lord Fox: You touched on standards earlier, which I took to mean regulatory standards. Can we go into that more explicitly? We have heard from other evidence that, on balance, regulatory harmonisation through the EU is of benefit to the UK, despite some of those regulations being a problem. Obviously some are good regulations and some less good. How does that compare with your experience? Do harmonisation rules put firms outside the EU at a disadvantage versus those inside?

Juergen Maier: When you take it all on balance, it is most definitely an advantage to a company like Siemens operating in the UK. Of course, regulation and trying to get 28 countries to achieve a common standard, whether in electromagnetic field regulation or whatever it might be, is going to be difficult, but when you have achieved it it makes processes in design and manufacture a lot simpler.

I managed the factory that I talked about in Congleton nearly 30 years ago, and I remember the days when we used to have to put a different widget on every component that we shipped: a different one to Italy, a different one to France, a different one to Germany. The British one was more different than most. No, maybe it was the French actually. Now, coming out of that factory is one product for 28 countries. You can imagine that that is a massive enhancement in design and manufacturing productivity, but that is history: if you look ahead—Siegfried has talked about the internet of things and digitalisation—you can imagine how important it is going to be for the interoperability of components to communicate with one another. If that is not properly standardised and a country is not involved, you will definitely put yourself and your market at a disadvantage.

Q99 The Chairman: Sometimes standardisation could be incompetently or inappropriately determined. We had evidence from Syngenta operating in a completely different field from

yours in plant sciences, where they reported that their biotechnology enterprises have moved out of Europe in effect, not so much because the Commission but because the European Parliament had interfered in a way they found unhelpful to their business plan. Is there any experience in the field that you are operating in, which is obviously different, where you have found the European Union regulation inappropriate?

Professor Siegfried Russwurm: There are examples. The European Union is far from perfect in its regulations, do not get me wrong. However, if we move into the future, our innovation will be more digital, and in the digital space scale is everything, because customer N plus one does not carry any additional cost; it just gets another licence, which is the same. To get those two ends to meet, we are heavily engaged in this regulation and, frankly, it is a matter of whom you meet in Brussels as to whether you can make your argument. Not because he is a German but because he is making great efforts to understand the needs of industry, the Commissioner for Digital Affairs, Mr Oettinger, has held numerous round-table discussions asking us what we need and verifying their proposals for regulation and whether they would meet our needs in a common market. So there is light on the horizon.

But you are absolutely right: there are stupid regulations where, frankly, the line of defence is to go to your national parliament and try to influence implementation in the country.

Q100 Lord Maxton: What changes would you want to see in the European regulations? Let us say we stay in Europe. What changes would you like to see in Europe?

Professor Siegfried Russwurm: Following good practice from industry and what we have found to be helpful, at least looking to balance the opportunities of innovation and risk is something that Brussels could improve. It is strongly risk-based, and there is nothing bad in that, but balancing risk and opportunities needs improvement. If we agree that in the 21st century data is the new oil that is fuelling the economy, we have to balance data privacy, albeit taken on our own behalf as every individual, and the opportunity to create business and value out of data. Frankly, it is a constant struggle to convince people in Brussels that you can have both if you apply technology.

Lord Maxton: Is that because there are 28 countries? Would it make a difference if there was a more combined effort?

Professor Siegfried Russwurm: Yes, for sure. The fact that we are still talking to 28 constituencies mentally makes it more difficult. On the other hand, I plead guilty in that I use the same defence of one country to avoid nonsense. Please forgive me for being blunt. We are living in a global world and competition is global. The only chance that we in Europe have to compete against Asia or North America is to get our act together in a business where scale does matter. It does not make sense that Estonia, Portugal, Germany or the UK do their own thing if we believe that competition in the 21st century is global.

Q101 Lord Peston: From an economic point of view, it seems obvious, as you are saying, that standardisation yields enormous economic benefits. One of the first papers I ever wrote was on the single currency, and again I argued at the same microeconomic level that not having to judge all the different exchange rates was massively beneficial. The trouble is that everybody thought of it as macro. Is it part of Siemens' philosophy and policy actively to encourage and even campaign for standardisation in all relevant areas? I felt that you were leading us in that direction. Everybody gains. It is a no-loss game if you do not have everybody "doing their own thing". Would that be a fair view of Siemens' position?

Professor Siegfried Russwurm: That is an excellent description of what we are doing. We are trying to use opportunities as they occur from real business cases. We have been doing so in talking about the railway system in Europe. I love the opportunity to go to London by rail, but if I do that from Germany I have to cross three different jurisdictions. As a passenger I do not notice that, but being in the railway business I know how cumbersome it is to equip rolling stock with security mechanisms that all fulfil the same purpose. If you analysed them from a technical perspective, one is as good as the other, but the sheer fact that you need five of them in any locomotive is nonsense in the 21st century. We try to use such an example in arguing for that.

Going forward, when I cross the Channel—I am a frequent tourist to the UK; I come every year—with my own car, it is great that Newcastle offers me five minutes to become adjusted to driving on the correct side of the street, and then I am fine. If we extrapolate that to autonomous driving, if the rules in Britain are different from the rules on the continent or wherever around the globe, this is a massive hindrance to expanding technology. Things are getting more complicated. While the arguments that you mentioned were true and have proven to be true, we will see that exaggerated in the coming years and decades.

Viscount Ridley: Can I pick up on this point of standardisation? By the way, I hope you are not suggesting we all start driving on the right very soon. We will come back to that perhaps. I am interested in the degree to which standards are now being set at a global rather than a European level. Mr Maier mentioned the internet of things. Surely that is an example where there is likely to be a common standard between North America and Europe. We know that in the automotive sector, some parts of the food sector and many parts of financial services, the EU is effectively a transmitter of global standards to its member states.

Professor Siegfried Russwurm: You could call it the transmitter. I would prefer to call it an aggregator. I am involved in the discussions about the standards on the internet of things. If any country or standard association of any European country sat in that round in the United States, they would be polite but they would do their thing. If it is Europe, this is what we have achieved—

Viscount Ridley: Is it true for Japan too?

Professor Siegfried Russwurm: It is very much so.

Viscount Ridley: They are ignored compared with the European Union?

Professor Siegfried Russwurm: It is a special market. They have been special all the time and we have somehow accepted that as industries. Frankly, it kept many of the Japanese companies restricted to their own market. Okay, that is fair.

I give the example of dealing with associations in the US or the NAFTA area versus Europe. The difference is whether you are taken seriously at that table, speaking for Europe, or you are just speaking for a market where from a multinational perspective, as I argued about Switzerland, somebody argues, “If you don’t like our standard, get out of here and do something else”. It does not matter that much. Whether my product is accepted in Switzerland or not would have a miniscule effect on our P&L.

Viscount Ridley: Do you accept that in the case of the internet of things, there will be a standard that will be much larger than the European Union?

Professor Siegfried Russwurm: Absolutely, but it will strongly involve the European school of thinking when it comes to engineering. To bring that together with a kind of North American Silicon Valley broad-based internet success is the consensus that we have reached between those two parties: that we are approaching that matter from two different directions. It would be great—we are moving towards this—if we could bring the best of those two worlds together: the engineering know-how about the real world of the Europeans, and the internet know-how from their business-to-customer experience of the North Americans. There are clear conclusions for joint approaches and joint testbeds where this common standard will be tested both in North America and in Europe. We are meeting at eye level now as Europeans and not as Germans, so to speak.

Lord Hunt of Chesterton: Could you comment on how it has worked? There have been examples where the European Parliament has been quite influential in standards for cold chemicals and other issues. One of the differences between Europe and the United States is that industry and business in the United States take a tremendously strong role, through campaigning and so on, in who gets elected. Could industry do more somehow to make these institutions more effective? There are signs of effectiveness, and the point made by Lord Ridley is that European standards often have a global reach. Does industry underplay its role? You made the strong statement that if it is carried across Europe it could be very beneficial.

Professor Siegfried Russwurm: We need to do more and learn lessons. The fourth Industrial Revolution campaign is an example of where we have said that now is the time for industry to take over and drive that forward as we approach customer benefits. Frankly, we know more about customer benefits than politicians in Brussels may do.

On the other hand, coming back to your example about a different testimonial, there is a limitation that we as engineers, as researchers, have to accept in more and more societies around the globe that the limiting factor is no longer technology but social acceptance, especially when we talk about big infrastructures. Frankly, the fact that gene technology, pharmaceuticals and the like have taken a tough stand and have more or less left at least central Europe is more attributable to the fact that there was no longer any societal consensus to push that forward. The most recent research in the UK and the concerns raised in the continental press are simply more proof of that. The more straightforward infrastructure business that we are in, such as trains, mobility and energy transmission—we have our struggles with protest groups and NIMBY has made it into the German language and into German dictionaries—by and large in those areas our voice is heard, because it is less societal discussion and more the law of physics that we argue. We say, “If you have generation of wind power here and your industrial centres there, the law of physics tells you that there should be some kind of cable in between to balance that”, and there is not much you can argue against there. If you talk about genetically manipulated drugs, for example, there may be other levels where we in central Europe have our struggles.

Frankly, from an engineering perspective we have been able to influence legislation and standardisation on a European level. We can do more, and doing more is well received and accepted in Brussels. That is my experience. Whenever I hang around there—it is not my favourite occupation but every now and then I have to do that—I confess that the voice of industry is heard. The more companies liaise and give a common view across competition, the more the regulator accepts, “There seems to be a kernel of truth if even these competing companies argue the same way”.

Q102 Lord Hunt of Chesterton: Does the free movement of people within the EU provide all the R&D talent that you need, or do you have to recruit actively from other parts of the world?

Professor Siegfried Russwurm: Let me start with some facts. If we look at our total population of applicants this year in the UK, about 7% have no British passport, and of those a good half are people who we are moving deliberately to the UK—and, by the way, vice versa—in order to link this global network of things. Among those people, for sure, are scientists and chief engineers if we want to spread out technology and make it available here. If we start building windmills in Hull, for sure we will have some engineers from Denmark, for example, coming to the UK. When we talk about hard-core research, which we typically do with the universities, we find the international crème de la crème at that university, so it is not us triggering people to come to that place much, although there may be exceptions, but typically, in order to get the best of the brains at the university, it has to be international and global in its thinking and its population if it wants to be successful on a global scale.

In a nutshell, the answer is that we can well cope with that. Would it be a killer criterion? It would not. If a country were to decide to block the inflow of talented experts, this would have a significant effect on our activities there, the latest example being South Africa. The South African Government have greatly tightened the inflow of qualified workers, with the result that as this expertise is not available on the labour market in South Africa, we have reduced our activities and refrained from offering some of our Siemens systems because, frankly, we do not have the qualified experts. We are far from that discussion in Europe, be it in the EU or with friends or family, irrespective of the legal situation. That is less important than the free flow of experts again in a global world.

Lord Hunt of Chesterton: The EU is important in that respect.

Professor Siegfried Russwurm: It makes it easier, frankly. Travelling here, being here for some months, as an EU citizen, is easy. As a non-EU citizen, again it is doable but it adds to that pile of bureaucracy and to that emotional resistance that I talked about where, all things being equal, we would rather not do it. This free movement of experts is extremely helpful.

Lord Maxton: Do you need that free flow with modern technology? Does the internet not allow that, or will it not allow it?

Professor Siegfried Russwurm: The strong answer is that the internet, email and the like, will never wipe away face-mail, direct interaction and the creativity of people meeting and discussing, wandering around, standing at the white board and discussing. All modern media is great once you are familiar with each other and know each other and want to exchange ideas, but true creativity does not happen in bits and bytes; it happens between individuals. Maybe I am old-fashioned and maybe my child would tell you something different, but I am convinced that true creativity in science and technology happens between individuals.

Juergen Maier: It is always nice to talk about examples. If we take the new factory we are building in Hull at the moment, we have just recruited the first 120 people, all of whom are from the locality of Humberside, and maybe Lincolnshire and Yorkshire. All those 120 people will initially receive their training in Denmark, because that is where our expertise currently is. In the same way, there will be many Danish engineers, as Siegfried has already said, who

will help us set up that site. In three or four years' time, all that knowledge will be embedded here and we will have 1,000 people, largely British, with that knowledge. And not just that—we will be helping to grow our local supply chain and we will be helping to grow an industry. However, the kernel of it was all about moving knowledge and people across European borders, and if you put a barrier up to that, it would not make it impossible, but it would make it a lot more difficult.

Q103 Lord Fox: A slight rewind, if you will allow me, Chairman. Before you came, Professor, we heard from Mr Maier that the investment level in the UK was 2% of UK sales in R&D, which is less than half your average. First, why is it so low, and what do we need to do to get it at least to your average, if not beyond, given the quality that we believe we have around the science and technology institutions that we have here?

Professor Siegfried Russwurm: First, there is a broad spread within the conglomerate of Siemens when you look at the percentage of sales of the R&D effort. If we take the windmills in Hull, for example, the percentage is much lower, because, frankly, you are moving a lot of steel, iron and concrete to build such windmills, whereas the technology kernel is in the blades and, in that, the cell, so globally it is lower.

One effect is the mix of businesses. On the other hand, we are trying to increase that, and Juergen is the best ambassador for the UK in doing that. I came this morning from a discussion with the University of Cambridge on what we could do on our more basic research, because that is currently strongly focused on Germany and the US, but I believe that one percentage point to the average could be added here as there are splendid opportunities in the universities in the UK. So yes, we will grow. Will we make the average? I am not sure. We should not forget about consolidation, because you will see the revenue that we make with end customers here in the consolidation of the company several times, so we have to balance that. The way we steer our R&D is not about percentages but about competence. Where do I get competent partners? Research happens in networks. The times are over when research happened in the Siemens labs somewhere close by. It does not happen in the GE lab either. It happens in networks, so that is where the UK plays a strong hand. Then, if we account for research and development, the development part, the bigger part of the money, should correlate in our business with the manufacturing side, and the reason is quite simple: Siemens is a business-to-business company, so we do not sell anything any more to consumers. Since we got out of the home appliances business, not a single product from Siemens goes to consumers. The consequence is that our quantities are rather low compared with a car manufacturer that builds millions of cars for millions of consumers. If you manufacture small quantities, your process is never as stable as it is in this high series, so the interaction between R&D, the more development-type engineers and manufacturing engineers has to be pretty close. If you have a supplier who has a little change to a component, you need to talk to the engineer in deciding whether this can be done or not. This is why, as a Siemens rule, we try to co-locate not necessarily research but development and manufacturing, so it depends on the footprint of our manufacturing sites in the UK how much of the D in the R&D gets spent here. It is content-driven, not driven by percentages or any KPIs like that.

Q104 Baroness Manningham-Buller: Professor Russwurm, when we were talking about regulation, you talked a bit about the fact that the European Union is pretty focused on risk

and not necessarily on innovation. To what extent has the EU research funding helped, hindered or affected what you are trying to do with your business?

Professor Siegfried Russwurm: The good news is that EU research funding can be strongly influenced by industry, both by individual companies and associations, so with these big research programmes we try, and we are pretty successful, to target the opportunity while not neglecting the risk. We have learnt the lesson that we should involve non-governmental organisations early in order to take that blurring risk out of uncertainty, but again these programmes are not invented by some bureaucrats in Brussels; they are jointly collaborated on, which by the way is one of the major advantages of being a member of the family. For sure, a university from Switzerland, to go back to that example, can apply to sign into that programme, but they will not be able to influence it during its set-up. That is the difference. The influential power that we have, both individually as companies, especially when they are I would not necessarily say big but renowned, and as associations, is significant. We have to confess that while we joke about Brussels bureaucrats when it comes to the research programmes, there is a strong influence there and we can raise topics and they find their way into bigger programmes. Horizon 2020 is a broad programme, but it has focal spots that we in the industry have introduced into it.

Baroness Manningham-Buller: Is the effort and the energy that you as a company put into steering those programmes worth it, from your perspective, and does it deliver the results that you think are valuable?

Professor Siegfried Russwurm: Yes, exactly, and we will increase our efforts, because, frankly, you get what you invest. That is what we have learnt.

Baroness Manningham-Buller: Do you see other companies, in particular British companies, approaching this aspect of EU funding in the same way that you do? Are you better at it than British companies?

Professor Siegfried Russwurm: Now we come back to the harder question of why, from a statistics perspective, it is less the case with UK companies. The only humble advice that I could offer would be to synchronise national science funding with these programmes. Frankly, if it is our tax money that is spent via these programmes, then let us come to the conclusion that our national programmes should help companies and universities to make their way into these European programmes. Over the course of recent years, we have managed national programmes to help companies and universities to get their act together and be more successful in European programmes. We do not put that into the headlines, but it is a matter of fact, and I am not shy about testifying that to this Committee.

The Chairman: I have Lords Peston, Cameron and Hunt, who all want to ask questions and we have just a short amount of time left.

Lord Peston: My question relates to the previous question, so I think you ought to forget about me.

The Chairman: All right. We will go on to Lord Cameron.

Q105 Lord Cameron of Dillington: Is the threat of Brexit affecting your current investment decisions?

Professor Siegfried Russwurm: From an emotional perspective, there is this little animal that crawls up and says, "Can we be sure that Britain is part of the family?" It is less from the sheer legal perspective. Again, it is this emotional uncertainty. Will we be able to deal with that decision? I have no doubts, but it leaves that strange feeling: is Brexit just the first step to a fortress Britain that is different from the rest of Europe? There are actually no big investment decisions to make, and if it is market-driven, like this wind turbine factory in Hull, whether Brexit happens or not will not make a difference. If we are talking about components that are made here for a global market, there is more than £1 billion of exports from British Siemens' factories. If such an extension were on the table, frankly we would try to wait until a referendum was done, always all things being equal, but that is the emotional aspect that exists.

Lord Hunt of Chesterton: I am a professor at Cambridge, so I was pleased that you discuss with them. One of the things that you commented on, which indeed is a difficulty, is that you have these networks in Europe—I helped to set up one that involves aerodynamics, wings and so on—but it is quite difficult to get sufficient British involvement in these networks and to get the science and research councils, as you comment, to connect their programmes to the European programmes. Currently there is a discussion going on about that, but your point about anything you can do to help to produce that is important, I think.

Juergen Maier: Obviously I also advise government on this issue, and it is a fundamental issue that we in Britain are having this Brexit discussion even before we have got to the referendum. If anything, we are removing ourselves from some of these more co-ordinated and strategic discussions. It would definitely be more beneficial for British companies to be able to participate in these European programmes if, as Siegfried said, we co-ordinated the key focus areas better. If we then developed ecosystems of companies interested in those areas and there was a sort of British ecosystem of companies whereby we could help to support them to get access to these European-funded programmes, that would serve British industry overall. I am not talking now on behalf of Siemens specifically; it would serve us better here in the UK.

The Chairman: A final word from Lord Hennessey.

Q106 Lord Hennessey of Nympsfield: Forgive me for being late. It was an infrastructure failure, and I am pretty sure it was not a Siemens' bit of infrastructure. I may have misunderstood you, Professor Russwurm, but the emotional geography that you are describing is fascinating. Were you implying that Brexit just might be the start of an emotional detachment, or did I mishear you?

Professor Siegfried Russwurm: Again, the interpretation might be that. We are in that emotional sphere, you are absolutely right, so how would I read, as a German citizen, the debate in Britain and an outcome that moves Britain away from Europe? Is this just a first step? Are there more to come? We have accepted that the United Kingdom is different in some of the approaches, and we deal with that. The question is about the distance. Is that distance widening? Yes, Brexit would widen it. Is it just a first step and what is the next, or is there more consensus that, with all the cultural differences that we have, there is a common belief that European culture is a pillar and a force in the global dispute? This is why, although I appreciate all your analysis in the United Kingdom to count the rational arguments, on top of that is this emotional question of whether we have more Europe than a global world or whether we believe that it is country by country or region by region that makes us

successful. This is my final plea to all the British voters and the decision-makers: not only do this as an exercise in counting British pounds, but keep in mind the greater idea of having true diversity in Europe, which we prove to be possible, and, on the other hand, understand the global rules of the game.

The Chairman: Professor Russwurm and Mr Maier, you have been extremely frank and very helpful. You have given us a lot of very helpful information which we will follow up, I suspect, particularly with the further evidence that we are about to take. Thank you very much, both of you. You have taught me one thing that I was not expecting to learn today, and that is that NIMBY is now in the German language. Thank you very much.

Siemens UK and Siemens AG – Oral evidence (QQ 90-106)

Transcript to be found under Siemens AG

Syngenta – Written evidence (EUM0013)

Syngenta is a leading agriculture company helping to improve global food security by enabling millions of farmers to make better use of available resources. Through world class science and innovative crop solutions, our 28,000 people in over 90 countries are working to transform how crops are grown. We are committed to rescuing land from degradation, enhancing biodiversity and revitalizing rural communities. To learn more visit www.syngenta.com and www.goodgrowthplan.com.

In the UK, Syngenta employs close to 2000 people across commercial, manufacturing and R&D facilities. Our Jealott's Hill Research facility in Berkshire is the largest commercial agricultural research site in Europe.

We have made general comments in specific areas and would be happy to provide more information to the committee on any points raised in this document or in response to further questions.

Funding

Horizon 2020

1.1 The UK gains significant benefit from the financial support provided by the Horizon 2020 initiative; should the UK withdraw from the EU this would mean that researchers here will no longer be able to access the funding this provides.

1.2 On a commercial level, however, Syngenta is reluctant to engage with Horizon 2020 projects, primarily due to the number of administrative processes that must be adhered to along with the unacceptable requirements surrounding any intellectual property generated through these projects. Therefore, as a company, we are unlikely to ever lead a Horizon 2020 bid and would only consider engaging in any Horizon 2020 projects where the intellectual property considerations made commercial sense.

1.3 Additionally, we believe the primary focus of the Horizon 2020 funding is misdirected. Often the questions being asked are very narrow, too focused and consequently fail to look at the bigger picture and address the fundamental issues. Looking at details in isolation without investigating how this then impacts the problem as a whole can lead to all sorts of poorly structured and inaccurate conclusions being drawn.

1.4 Having said this, the UK's position within the EU does provide an important potential opportunity to influence decisions that impact the nature of research in Europe and its funding. The general direction of research funding in the EU is important to the overall UK research infrastructure.

EU use of scientific expertise

1.5 The current EFSA independence policy excludes many UK academic research scientists from working in collaboration with industry on joint research projects.

1.6 If academics do choose to work in collaboration with industry (and consequently benefit from the expertise of other leading scientists) then they are consequently excluded from all key EFSA expert panels.

1.7 As such, EFSA panels are being denied the expertise of experienced UK (and other EU) scientists as they are believed to no longer be independent (despite the fact those from opposition pressure groups are still allowed to contribute). Therefore the question has to be asked about whether or not leaving the EU would change this situation and allow UK scientists to share their expertise more widely.

Regulation

2.1 The nature of EU policy means registration of new products is increasingly difficult; particularly surrounding the development of technologies, like chemical pesticides and crop varieties produced using techniques like genetic modification. Regulation of agricultural technologies focuses primarily on the intrinsic hazard of products rather than on an assessment of risk in use.

2.2 Accordingly, over the past decade the number of products put forward for registration has decreased and maintaining and re-registering products is increasingly difficult. As a result of this situation, the EU increasingly runs the risk of missing out on the latest agricultural technology as companies opt not to address the needs of European farmers and instead focus on the rest of the world.

2.3 Leaving the EU could mean that the UK would be free to introduce more scientific, risk and evidence-based approaches to the regulation of agricultural technologies, and therefore could be better placed to provide UK farmers with the latest advances.

2.4 However, this would be completely dependent on the UK's ability to implement and manage an effective procedure for the registration of products (particularly without the work share opportunities being in the EU currently provides).

2.5 In practice, it may be better for the UK to play a more active role in promoting appropriate approaches to regulation in the EU as a whole, helping to ensure technology is available to farmers across Europe thereby creating genuine scale of market opportunity for innovators. UK farmers would benefit from such an approach too.

2.6 It should be noted that new discussions are emerging around the world relating to risk regulation. The aim of these discussions is to enable policy makers to shape regulatory frameworks in a manner that stimulates innovation whilst safeguarding the environment and protecting human health.

2.7 One such discussion is RISK21, which is currently being discussed in the United States. The UK and other EU member states may benefit from assessing RISK21 principles, an approach to the regulation of chemicals which focuses on exposure – the key variable for risk managers to assess and control. It would mean regulators would only need to review

information that is of genuine value to their decision making and with precise relevance to the use and application of a new chemical product seeking registration or older chemistry aiming at re-registration.

2.8 The current EU approach of increasingly focusing on hazard alone, without considering exposure and the consequent risk, results in the need to perform a lot of testing, including many animal studies, that actually provide no real value to the regulatory decision maker and result in negative decisions being taken for no good scientific reason. We believe that such an approach does not support innovation and leaves the EU, and consequently the UK, in a weaker position both in terms of agricultural productivity and investment in research activity.

<u>People and Recruitment</u>

3.1 One key benefit of EU membership is the ability for people to move freely across borders within Europe, making it easy for Syngenta to employ people from the EU in the UK.

3.2 At Jealott's Hill, Syngenta's largest global research and development site based in Bracknell UK, we employ a number of scientists originating from overseas, especially from within the EU. If the UK withdrew its EU membership and restrictions were placed on recruitment from the EU then Syngenta's ability to employ the best talent and scientific minds would be compromised.

3.3 This would not only impact our ability to remain as one of Syngenta's leading R&D sites but would also hinder the professional development of our UK scientists due to reduced interactions.

3.4 In our view, the ability for people to move freely between counties in the EU is not only good for Syngenta but also enhances the UK's agri-tech capability overall.

18 November 2015

Syngenta and BioIndustry Association (BIA) – Oral evidence (QQ 69-76)

Evidence Session No. 7 *Heard in Public* *Questions 69 - 76*

TUESDAY 26 JANUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Maxton
Baroness Morgan of Huyton
Baroness Neville-Jones
Lord Peston
Viscount Ridley

Examination of Witnesses

Dr David Hughes, Global Head of Technology Scouting, Syngenta, **Mr Steve Bates,** Chief Executive Officer, BioIndustry Association

Q69 The Chairman: On behalf of the Committee, I welcome Dr Hughes and Mr Bates. We are grateful to you for helping us in our inquiry. We are being broadcast, so I am going to ask if you would like formally to introduce yourselves for the record. If you would like to make any opening statement as you do so, please feel free to do so. Dr Hughes, would you like to start?

Dr David Hughes: My name is David Hughes. I have 20 years' experience in agricultural research and development for Syngenta and her legacy companies. I have been based at the Jealott's Hill research station in Berkshire all that time. It is our biggest single individual research station globally. It is focused on crop protection research. I have had a number of roles in that time, all of them very much scientific and technical. I very much regard myself as a practising scientist. About six years ago I became interested in collaborative innovation, and my current role is Global Head of Technology Scouting. That essentially means I run a network of scientists around the world whose job it is to go out and develop relationships with key players in the outside world, academics and other companies, with a view to setting up collaborative research projects, ultimately aimed at accelerating the development of new technologies for use by farmers.

Mr Steve Bates: My name is Steve Bates and, if I can, I will make an opening statement. Thank you for inviting me to give evidence to your inquiry. As the chief executive of the BioIndustry Association, the UK trade association for innovative bioscience enterprises, I am proud to represent today over 300 companies in a sector responsible for over 90% of the biotechnology-derived medicines currently in clinical development in the UK. Our sector is at the forefront of innovative scientific developments targeting areas of unmet medical need, and this leads to better patient outcomes, development of a knowledge-based economy and economic growth. Many of our members are small pre-revenue companies; some are multinational pharmaceutical companies.

Over a generation, regulators and legislators have built up an integrated EU regulatory environment for biosciences. It is corner-stoned in the UK, here in London in fact, and has significant UK input. The European Medicines Agency, their regulator, is at Canary Wharf. The EU is at present building an integrated unitary patent system, which will be corner-stoned here in the UK, with the life science decision-making part of the Unified Patent Court in London. The UK bioscience cluster leads Europe and is growing, and one facet of that is linked to our relationship being within the European Union, the single biggest market for pharmaceuticals. In innovative life science the UK influences and strengthens the EU. In the last few decades the UK has truly developed as a location of choice for global companies to build and grow their life science businesses in Europe. Just last week, to give you some context, Andrew Witty, the chief executive of GSK, said, “Europe has gone from having 27 fragmented, independent, not-talking-to-each-other regulatory authorities in the healthcare space to one, and that’s a big deal.”

From our perspective, if the UK were to leave the EU, this long-term integration would need to be unpicked. It would affect legislation, patient access to medicine, the European leadership role of the MHRA—the UK regulator—and our intellectual property and patents ecosystem. Any change to the current arrangement would lead to disruption, expense, and a time lag in setting up a new system, and we believe that uncertainty would pose significant risks to the UK’s attractiveness for inward investment.

Crucially, what businesses lack is the information they need to undertake a fact-based cost-benefit analysis of what any alternative would look like. The bioscience sector needs long-term stability for long-term investment. It can easily take a decade to develop a drug. We want the UK Government to objectively set out the logistics and costing scenarios of the implications of the UK leaving the EU and how they would be dealt with, and we have called on the Government to set up a plan on any expected disruption to UK life science. This should look particularly at how the European Medicines Agency and the Unified Patent Court might have to leave London, how medicines would be approved and regulated, and the likely impact on investment.

I look forward to the opportunity of being here and expanding on these issues today.

Q70 The Chairman: Thank you, Mr Bates, and we will move on now to the questions which we would like to put to you. Could I start by noting that the evidence we have had shows that, as a country, the United Kingdom does rather well out of European Union-funded research but, when you mine into the figures, it looks as if it is the universities which are doing well but not the business sector, which is, after all, a larger share of the research in this country. I wonder if you can account for the fact that United Kingdom large business participation seems to be rather low compared to some of our competitor countries, and

why SMEs appear to be doing rather better—albeit, again, not brilliantly—compared to competitor countries?

Dr David Hughes: I am not surprised to hear the statistics that you are citing there. I can speak only from Syngenta's point of view, of course, but Horizon 2020 as a funding mechanism is not particularly good from our point of view. Speaking from a big corporate point of view, there are better mechanisms, through schemes like the research councils and Innovate UK, that are far superior to Horizon 2020, so I am not at all surprised that big companies in the UK would prefer to use those mechanisms over and above Horizon 2020. Of course, big companies based in Europe do not necessarily have access to funding schemes of the same type. So I am not at all surprised; if you have such good funding schemes available, why would you resort to Horizon 2020?

The Chairman: Would you like to comment, Mr Bates?

Mr Steve Bates: I think this is all about access to finance and the different types of finance you can choose. All money comes with strings; the question is, which strings do you want to take with that money? Money is not only available from public sector support. Large companies in our sector may have the resources to avoid the hassle of onerous forms of money that come from the public sector. We held a round table on Horizon 2020 in the House and people were concerned about the burdensome process. However, SMEs perhaps are not as lucky with opportunities to get money; getting money for early-stage medical research is particularly risky and they do struggle to attract private investment, therefore Horizon 2020 is seen by many members as a useful component in a plethora of funding schemes.

There are a couple which I think work particularly well, and people do like the partnership working that you get with this. If I can just cite New Drugs 4 Bad Bugs, part of the Innovative Medicines Initiative, that is a good one, where you have companies in seven partnerships working on antimicrobial resistance, where it would be much harder to get investment. So I think it is to do with the attractiveness of the scheme and whether it works for you.

Lord Hennessy of Nympsfield: Dr Hughes, I was very struck by that paragraph in your evidence about the problems with Horizon 2020, which you have alluded to already. Could you give us the order of magnitude of difficulty of getting money from that source compared to a British research council? Also, if we stay in, and we were to respectfully suggest that there needs to be a little more reform than the ones the Prime Minister has come back with, and Horizon 2020, in a burst of open-mindedness, said to you, "How could we improve our ways?" what would you say to them?

Dr David Hughes: In terms of the order of magnitude, I would say approximately one. It is significantly more difficult to get money out of Europe but it is not impossible.

Lord Fox: Ten times worse!

Dr David Hughes: Yes, significantly worse.

Baroness Morgan of Huyton: When you say worse, do you mean it is more complicated or we do not get the money? I am sorry to interrupt, but from what you were saying earlier, it seemed to me to suggest that a lot of companies did not bother to try to get the money. Are you saying they try and they do not get it, or the complication just puts them off?

Dr David Hughes: A little bit of both. We have strict rules of engagement defined by our legal team, which say, "Okay, if you have a potential opportunity that could be funded through Horizon 2020, it has to tick all these boxes." The objections to Horizon 2020 alluded to already were the hassle and bureaucracy of doing it; there is a big overhead in terms of what you need to do in order to get money. But it is more than that from our point of view. There are significant issues around the intellectual property aspects in terms of what intellectual property rights we have to give other people, if that is relevant to the project, and what intellectual property rights are associated with the results of the projects that are actually done, also unacceptable from our point of view. It is not as if it is impossible to overcome these but, if you have other means of supporting these same projects, it is much easier to do so. For instance, from the research councils and Innovate UK, it is between the partners, who are free to negotiate what those intellectual property rights are, and that works very well indeed for us. For Horizon 2020, they are more or less defined and beyond where our red lines would normally be.

The Chairman: I am not sure I entirely follow all that because, presumably, the intellectual property rights issues are the same for other countries as they are for this country. Are you saying that, given that that will be equal inconvenience for both countries, it is simply the hassle and overheads which is the relevant factor?

Dr David Hughes: Yes. It comes down to a cost-benefit analysis: so if the costs associated with putting these agreements in place exceed the benefits that we perceive in terms of getting that funding out of the European Union.

Lord Hennessy of Nympsfield: It is inherent to having 28 countries involved. How would you reform Horizon 2020, or is it beyond reform?

Dr David Hughes: My impression is that Horizon 2020 was not really designed with big companies in mind. I think it was designed to encourage collaboration, primarily in the private sector, with small and medium-sized enterprises. You can tell that by what is missing in some of these boilerplate agreements; there are certain things to do with corporate structure, which is very important for big companies, which do not appear in these boilerplate-type contracts. Again, that is beyond our red lines. We would not necessarily be allowed to share results from a project that has been driven from the UK. I would not be able to share those results with other researchers in different countries, for instance, because they are working for different affiliated companies and that structure is not catered for in these standard agreements. That is never usually a bone of contention but the fact is that clause has never been included in the contracts that we are being asked to sign. Again, the lawyers would have to get involved and renegotiate what should be a boilerplate-type agreement, and that is just time and expense.

Lord Fox: So are we wrong to worry about big business not going to Horizon 2020, in that, as you say, you do not think it is designed for big business? Should we not be concerned about that or should we continue to worry?

Dr David Hughes: In our view, the processes in place via the research councils and Innovate UK are much better. We do 25% of our collaborative research in the UK, which is a remarkable statistic for a global company. We think the UK is a fantastic place in which to do collaborative research, and these support structures are a very important component of that.

Viscount Ridley: Can I just press a little bit further on this point? You also said of Horizon 2020 in your written evidence that "the questions being asked are very narrow, too focused and consequently fail to look at the bigger picture and address the fundamental issues". What do you mean by that? Are you referring to the loss of agrochemicals in Europe or the GM problem or something like that? What is the fundamental, big-picture thing that Horizon 2020 is missing?

Dr David Hughes: First of all, the way the funding structures are set up within Horizon 2020 is highly fragmented, so there are some big questions affecting agriculture in Europe right now which do not seem to fall within any of the categories that we can actually use. For example, the neonicotinoid in bees question remains scientifically open. We would suggest that the evidence we have to date suggests that there is no impact if these chemicals are used as they are designed to be, yet there are no Horizon 2020 opportunities to actually investigate that on a significant scale. The really appealing thing about Horizon 2020 is the amount of funding that is available, so you could in theory say, "Okay, we are going to spend a lot of money to actually get a definitive answer to this question" but that opportunity has been missed.

Mr Steve Bates: Perhaps I can give a perspective from the other side. You talked about whether Horizon 2020 tackled the big challenges, and I think an example where perhaps Horizon 2020 is tackling a big challenge is antimicrobial resistance, New Drugs 4 Bad Bugs. If you look at that, I would say there has been a development from the FP7 processes, the former processes, to the H2020 processes. They are not perfect but there has been an improvement. If you look at that, that is part of the Innovative Medicines Initiative, which is the largest public/private partnership in the world, which does have the engagement of global players in pharmaceuticals: GSK UK, European branches of AstraZeneca, Janssen, Sanofi-Aventis and others, with academic partners, SMEs and non-profit organisations, on the challenge of science, regulation, businesses around antibiotics. So there are some examples of things that are working as well as some that are not.

Viscount Ridley: Is it fair to say that Horizon 2020 is working better in biomedicine than in the agro-industry area?

Mr Steve Bates: Probably.

Dr David Hughes: Probably.

The Chairman: You are agreed about that. Lord Peston.

Lord Peston: Could you clarify something for me? The business sector is not a set of charities, is it? Companies are in business to make money, and they do, particularly in our country; the pharmaceutical companies are rather good at it. Do you accept that the taxpayers, who provide some of the money we are talking about, are entitled to some benefit as well? Can you let me know how they get a benefit, other than the pride that we financed whatever drug it was that saved so many lives? What is your position on how we recompense taxpayers, not just in our country but throughout Europe generally?

Mr Steve Bates: The major benefit to taxpayers or society of the development of new pharmaceuticals is the actual development of the product to tackle a disease or an unmet medical need. It is the translation of the science into something that turns into practical benefit. Without some support, many of the small and medium-sized enterprises in fact are pre-revenue companies, so you are right that the global pharmas do make money, but pre-

revenue companies are putting at risk significant amounts of venture capital, perhaps capital from other sources, to make the difficult steps from the breakthrough in the laboratory into something that can make a practical difference. That endeavour is not always a journey that private money will go on alone. Having the support of money from the state, as we see in the USA, as we see in Japan, as we see in Europe or in the UK, is an important component in getting that translation to happen.

Lord Peston: Do you accept, on the intellectual property side, where a lot of secrecy is of importance, that one group that ought to be able to benefit from this is university researchers? They should not be told that "this is business secrets and we are not going to let you know what we know". What is your position on that? I had an example years ago of a PhD in pharmaceuticals where I was the external examiner and I discovered I was not allowed to see the original data. I had a real ethical problem: did I reject the PhD because I could not see the data and so on, or did I award the PhD because it was a very good PhD? What is business's position on keeping things secret?

Mr Steve Bates: You are right that some intellectual property is held by universities, for instance through the work done by PhD students, and they then look to license that to a company for a royalty, and some of that money goes back to either a research council or a university. There are some good examples of new drugs, like Keytruda, which the Medical Research Council or MRC Technology will make a significant amount of recompense through to be able to reinvest. Similarly, if you look at a drug like Campath, an early monoclonal antibody, that also provides significant revenues back through the licensing deals they have done. So I think the intellectual property, where it sits, who owns it, is always a process of negotiation, and I would say a small percentage of something that goes to make a real difference in the world is better than a deal falling apart and something not being translated.

Dr David Hughes: I think I would echo that. We have seen a step change in philosophy over the last 10 years or so about how collaborative research is done. In the past it has been highly transactional: big companies got a lot of money. "We give you the money, you give us what you know and we will sell it, and thanks very much." Nowadays things are much more collaborative. We recognise the fact that collaborations are much more likely to succeed if the partners collaborating are much more open with each other and the benefits are shared. A collaboration which does not benefit all parties involved is very unlikely to succeed, and we have woken up to that now. Maybe it was not like that in the past but it is today.

Lord Maxton: Is not one of the better ways, however, that the university that has done the research then sets up its own company to carry out the financial benefits that come from it? Is that not the best way forward? That is happening in some universities in this country.

Dr David Hughes: It is one way. I would not say it is necessarily always the best. We are very open to that sort of interaction. It is in everybody's interests that technology is commercialised. Exactly how it is commercialised and how the value is shared is up for negotiation.

Q71 Lord Cameron of Dillington: Good morning. I would just like to ask Dr Hughes about Syngenta's written submission on the regulatory regime. You seem to start off by saying that because of the deficiencies of the EU regulatory regime, you think Britain would be better to come out and have its own regulatory regime after a period of time. One has to question whether being subject probably, if you have to trade in Europe, to two regulatory regimes is

necessarily the best option. Then at the same you say, "Actually, no, on second thoughts, our position really is that it is best if Britain stays in the EU and uses its influence to change the EU regime, and then we would all be better." Is that a fair summary of what you are saying?

Dr David Hughes: Well, yes. It is more of a thought experiment really. You have heard from many people that harmonisation of the regulatory environment is very important, and we would certainly concur with that, though I think in our particular case the argument is more nuanced, because for agricultural technologies—at least, some of them—the regulatory systems that are defining those technologies in Europe are not fit for purpose. They are non-scientific, scientifically unjustifiable and dysfunctional. It is a bit of a mess, quite frankly. From our point of view, it is at least worth considering what the options might be, so if the UK were to be in a position where it could somehow define its own set of rules, there would be benefits to that, clearly. Farmers are the obvious beneficiaries but also, by knock-on effects, British consumers would be too, innovators, UK PLC—they would all see benefits from that—but of course, on the flipside, there are significant costs, as you have outlined. For example, you would have to set up and run your own regulatory system and that would have significant costs. There would be the costs from our point of view of de-harmonising the regulatory system, which are very significant. There would be trade issues with Europe, as you outline, but the real key for us is that, if Britain went its own way in Europe, we would lose the most powerful, most influential, significant voice pushing for a rational, science-based regulatory system governing our technologies. If Britain went its own way, Europe would be in a pretty desperate situation, from our point of view. The chances of actually achieving a continent-wide, rational, functioning regulatory system for our technologies would be distant.

Viscount Ridley: Can I just follow up on that and perhaps encourage you to follow the courage of your own convictions here a little more? In our previous inquiry, on genetically modified insects, we heard, exactly as you said, that these regulations are not fit for purpose and that harmonisation has achieved harmonisation in the wrong direction, as it were; it has achieved harmonisation of a scientifically illiterate consensus, if you like. Therefore would it not be possible to imagine a world in which it might be better for Syngenta if Britain were in Europe, but it might be better for Britain if Britain were not in Europe?

Dr David Hughes: Yes, you could argue that, but of course, I am speaking from Syngenta's point of view. What we would like is a strong, predictable regulatory system which keeps farmers, consumers and the environment safe, and is harmonised across the whole trade bloc; that is our position.

Viscount Ridley: But you spoke of de-harmonisation. Is that not exactly the process by which we have tried to reform the genetically modified crops policy in Europe, to say it should be subsidiarity, it should be delegated to individual states? Is that not de-harmonisation?

Dr David Hughes: Again, that is scientifically unjustifiable because it is all based on non-scientific factors, is it not? We do not support that way forward, but that is what appears to be happening.

Baroness Neville-Jones: You alluded to but did not expand on this: you said there might be trade issues when you were talking about a different regulatory regime, say in a UK outside the EU. What is in your mind?

Dr David Hughes: I am a little bit out of my field, because I am a scientist, clearly, but I am following what is going on in terms of the TTIP negotiations, which is exactly the same kind of issues, and how difficult those negotiations have been. Following that thought experiment, if that is the way we decided to go, I would imagine that similar issues would arise with similar difficulties.

Baroness Neville-Jones: That is to say?

Dr David Hughes: That is to say that growing food under a different set of regulatory conditions may act as a trade barrier between food produced in the UK and consumers based on the continent.

Baroness Neville-Jones: That is the point I wanted to get to.

The Chairman: I note that we have provoked a thought experiment, perhaps a suitable role for a science and technology committee.

Q72 Lord Peston: My question follows on the previous question and on Lord Ridley's intervention. A priori, I am inclined to the view that, if you are in Europe, harmonisation is the right way to do things. A series—I have forgotten how many countries there are—of different harmonisations would just be a mess. It would be an intellectual mess and a practical mess. But Lord Ridley pointed out that if the harmonised system is itself nonsensical, you are in for a major catastrophe, so I am not clear how we get the right harmonised system, in your view.

Dr David Hughes: It is a very difficult question. I am not sure I have a good answer to that, other than to say that other parts of the world do seem to have more rational harmonised regulatory systems, but Europe has got itself into a mess where the regulatory system has become highly politicised, so the regulations being made do not make scientific sense any more. We have now gone so far down that path that it is difficult to see a straightforward way back but, from a rational point of view, that has to be the ultimate destination, has it not? We have ourselves a situation where we have a dysfunctional regulatory system, where technologies like GM crops, without actually being banned, have been taken out of the hands of farmers for 20 years, such is the dysfunctionality of the system that we have to operate in. That cannot be right. What is the solution? I do not know whether I have a good answer to that.

The Chairman: Perhaps Mr Bates would like to comment on the biopharmaceutical sector, as to whether you see the issues of harmonisation in the same way.

Mr Steve Bates: We see them very differently, I think. We would say that the overall balance of the benefits of regulatory harmonisation versus detrimental effects is positive. These are designed for patient benefit and, as an EU member with a seat at the table, we have had the scope to improve EU regulation. In fact, I would say that the challenge in recent years has been the interpretation of European Union legislation when it has come to the UK; that has been the actual challenge for the pharmaceutical sector rather than the other way round. The majority of UK legal frameworks governing medicines, clinical trials, marketing authorisation, licence to manufacture and pharmacovigilance is based on European Union legislation, and that is a harmonised benefit. The key purpose from our sector is that it is very attractive for the UK within Europe to be a place to place your European HQ for this sector. It is interesting that I am here representing over 300 companies based from the UK;

Syngenta is based in Switzerland, and the majority of companies that do GM crop work are not based in Europe.

Lord Peston: Just one other point of clarification. Supposing we cannot reform the harmonised system, would it then happen, if we all went our own separate ways, that any company exporting to another country in Europe would be subject to their regulatory system? They would have to convince the country they are exporting to rather than us, where it was all right. They are going to say, "Well, it doesn't suit us." To go back to my a priori argument, if we really did have a free-for-all, that would also be a total disaster, would it not?

Dr David Hughes: It would be a mess, yes, absolutely.

Lord Peston: There are two possible messes. Are you optimistic that somewhere between the two we can find the right way?

Dr David Hughes: That an outbreak of sanity prevails? Am I optimistic? No, frankly, I am not; I cannot see it happening, but it has to be the ultimate destination.

Lord Hennessy of Nympsfield: I am very struck, Dr Hughes, by the case you have been building over the last three or four answers you have given that the UK is a bringer of rationality to the benighted. It is a modern version of our civilising mission, a last imperial pang. I may well share it; it is just that you have been building this very big case. What is it about the other 28 that leads them to not follow the evidence in the way we do in our cold, damp isles off the mainland of Europe? What is it that is so special about us, and why are those other poor souls, as Frankie Howerd would say, so benighted so continually?

Dr David Hughes: I do not know, to be honest, but that is the case. This Government and previous Governments have been very supportive about applying rational, science-based principles to regulation, and that has been extraordinarily welcome. We do not see that same political will in other countries in Europe; the situation is more politicised there. They seem to be more willing to make poor decisions based on political judgments rather than scientific judgments.

Baroness Morgan of Huyton: Is it not the effect of having a PR system with lots of Greens? Is it not as basic as that really, that they have not been represented in our Government particularly?

Lord Hunt of Chesterton: The fact is you came up with the first remarks about being anti-scientific, for those people obviously all across Europe, the Greens and so on, who are very concerned about, essentially, the degradation of agriculture. You go to America and have all these marvellous things you like but the food is terrible; it is disgusting to eat an American tomato, and that is the point. As you said at the beginning, you do not understand the question of the bees and the plants. There are a lot of unknown scientific questions and, while these are unknown, the people in Europe who like tomatoes, and farmers and so on, are not persuaded by what you call the rational, scientific approach. Surely a bit more humility on that point of view would be appropriate. You have been, if I may say so, almost arrogant in the way you say scientists know and these benighted people do not. That is rubbish.

Dr David Hughes: I can give you some examples of some of the things we have to deal with. We are seeing an increase in hazard-based regulation as opposed to risk-based regulation, which is wrong. Safety correlates with risk; it does not correlate with hazard, yet we are now

seeing increasingly hazard-based regulation coming in. We are seeing an assumption in some cases that things which are natural are assumed to be safe; things which are synthetic are assumed to be harmful, and that is nonsensical, and, if anything, it should be the other way around, should it not? If you list all the most heinously toxic and carcinogenic substances known to science, almost all of them are natural.

We are seeing regulation on process rather than product, so we end up in the situation where identical products potentially would be regulated in very different ways according to the way they were produced—the genetics of a seed, for example. There is nothing wrong with precautionary approaches to regulation but the way it is applied in Europe makes it literally philosophically flawed and hopelessly open to abuse. So there is a lot wrong with the regulatory systems that we see in Europe.

Viscount Ridley: Just to congratulate Dr Hughes on that excellent little speech and to answer Lord Hennessy by saying that Scottish enlightenment is the answer to his question. I wanted very quickly to press Mr Bates on one point. You said that on the whole the various directives have been helpful in terms of your industry. What about the clinical trials directive? We have heard on other occasions that it has been really problematic for many parts of your industry.

Mr Steve Bates: The EU Clinical Trials Directive was not a step forward but the significant challenge with that was the interpretation of it into UK law. The EU Clinical Trial Regulation that is now going through, with significant input from the UK, we believe will improve things and make things speedier, simpler and more straightforward. If you look at some of the latest things coming from the European Medicines Agency, such as the PRIME scheme, or the ability of patients to get speedier access, we believe that that will be a positive step forward.

Lord Fox: I am sorry to prolong this issue but it is really the flipside of Lord Hennessy's question. Clearly, the scars on your back seem largely to be due to the genetically modified argument that has been going on around regulation. If regulatory competence was transported back to Westminster, what evidence do you have to suggest that the great rationality that was discussed on my left would prevail were Westminster under the same sort of pressure, political, social and otherwise, whether it is rational or irrational, depending on your viewpoint? Westminster has the privilege of being rational because it is not the competent authority. Once it became the competent authority, would it then revert to some of the same arguments that we find in Europe?

Dr David Hughes: I guess that would always be possible, though the arguments for science-based regulation in order to keep people and the environment safe are compelling, in my view. Whether the politicians would be able to resist the inevitable pressures that would come to bear is another question. I cannot really speculate.

Lord Fox: But it is not a given that our rationality, as you call it, would suddenly transform the regulatory horizon were it transported back to Westminster.

Dr David Hughes: I guess that is true.

The Chairman: I am going to move on to Baroness Neville-Jones.

Q73 Baroness Neville-Jones: I have one last question on the effects of the regulatory regime in Europe. Could you comment on the following? It has been claimed to us that the

regulatory regime has actually had a negative effect; that is to say, a reduction in commercial R&D in Europe, deriving from the nature of the regulatory regime. I sense that you may not be united in this; it may differ according to the regulatory regime, but I am interested to know whether you agree with that as a factual assessment of what has happened, i.e. there has been a decline, and what view you have as to its causes and how it could be reversed.

Mr Steve Bates: On this point, I would like to clarify that this is not a point in evidence that the BIA made, and our sense is that this point was made in relation to GM crops, because if you look at what the BIA sees, this point is not representative of the medical bioscience industry. In partnership with Ernst & Young we have published data on the UK and European biomedical research R&D business activity for the last few years, and the data shows that in terms of financing the UK leads Europe, and that Europe as a whole is also improving in terms of our sector. Europe experienced its best ever financing year, with total innovation capital raised of £3.9 billion, up 77% from 2013.

Baroness Neville-Jones: Are you arguing that the effect is actually positive?

Mr Steve Bates: I certainly do not think that we are seeing commercial R&D declining as a consequence of the regulatory environment. I think there are other factors to do with the business cycle and the fact that we are coming out of the banking crisis, which may be more significant than the regulatory environment, but I think what you are seeing is that the regulatory environment is not a barrier. The UK has raised almost a third of the innovation capital that is available in Europe, and perhaps the reason why the UK has the position to rival some of the big US biotech clusters is because of or despite our membership of the EU. So I think that is where we are at.

Dr David Hughes: From our point of view, I think I would differentiate one word in the question: commercial R&D in Europe, I do not think, from our point of view, has declined. We lost a big slug of people in 2004, when we shifted our GM crop research from the UK to the United States but the number of scientists that we now employ in the UK and in Europe is pretty much as it was before. What has declined though is the proportion of R&D that is aimed at developing products for use in Europe. That has declined significantly. I can tell you that anecdotally from conversations that I have been involved with in our R&D organisation. We see chemicals coming forward, for instance, which look very promising. Then the realisation is made that it would be a great product for use in northern European wheat and you can just see the energy drain out of the people involved, because you know that the hurdles in terms of commercialising such a substance are very, very difficult.

Baroness Neville-Jones: Does that mean that product development and exploitation goes elsewhere, outside Europe? You may develop the science here but the commercial exploitation goes elsewhere?

Dr David Hughes: If the European market would be the key driver, the commercial driver for a particular research project, and we realise that the hurdles are so tough, it is likely that we would focus on different research projects, aimed at developing products for use by farmers elsewhere. I have a report here which says that the proportion of global R&D aimed at crop protection for farmers in Europe went from over 30% in the early 1990s to 6% or 7% in 2013, when the report came out. So we have seen a catastrophic collapse in the amount of investment for developing technologies for use in Europe. The problem is, though, these technologies have a very long lead time; it takes 10 to 12 years sometimes to get these technologies from the bench to the market, so the fact is that people have not really noticed

yet. Because the investment stopped happening back here, we have not seen the lack of products coming to the marketplace, but we will. We can see this as a big gap in terms of new products coming forward and, of course, when that gap actually hits and farmers start struggling, it will be 10 or 12 years before we can start filling that gap again. It is a very serious situation.

Baroness Neville-Jones: As regards the future, if a company, a commercial organisation, assessed that a given product was unlikely to pass the regulatory hurdles for use in Europe, would it then simply not pursue that bit of science?

Dr David Hughes: That is right.

Baroness Neville-Jones: Are such decisions being taken?

Dr David Hughes: Yes. Consider the neonicotinoids, for instance. Neonicotinoids have been banned in Europe. They are one of the most effective and safe forms of insect control chemistry that has ever been invented, and if that is now the benchmark, you have to be safer and more effective than that, no chemistry has yet been invented. If that is the height of the bar, if you like, and it is just so difficult to jump that bar, why would you bother if there were lower hurdles in big commercial markets elsewhere?

The Chairman: Could I just follow this up? Clearly, the concern that Syngenta has about the European market arises from a regulatory background in which there is much more concern in Europe about agricultural leakages into soil, air and water than there are perhaps in other countries. Does it follow from that that you might expect new technologies which are less leaky, which are more precise and better targeted, to start in Europe rather than elsewhere?

Dr David Hughes: Yes, I think there is a very good chance that that will happen, if we look for alternative technologies, but some of those alternative technologies exist. At the moment though I think it is fair to say, in terms of cost-effectiveness from the farmers' point of view, they cannot compete with the best chemistry that is currently available. Farmers would be looking at a step down in terms of efficacies, costs and profitability in order to adopt those technologies, but if those technologies are not available, then farmers will have no choice.

The Chairman: I am simply making the point—and I had better declare an interest as a farmer here—that society has a right to look at the external costs that agriculture is imposing, and if there are indeed leakages into soil, air and water from agriculture, then it is not unreasonable for the regulation to take this into account in trying to capture these external costs. Of course, that will not be the case in other parts of the world where people do not live alongside their agricultural production in the same way as we do in Europe.

Dr David Hughes: True, though you have to make sure that the regulation is proportionate. For instance, the groundwater issue that you were alluding to: the limit for any single chemical in groundwater is 0.1 parts per billion. That is a number it is very difficult to relate to but you just need to understand how low that number is. If you drank a litre of water contaminated with a chemical at that limit, one litre of water per day for the whole of your life from birth to the age of 80, your total exposure would be under 3 mg—your lifetime exposure. That limit is incredibly low, yet you have to ask what sort of consequences would actually entail if it was one part per billion, 10 times greater. Would that really be environmentally significant?

Baroness Morgan of Huyton: Is it not fair to say that your business—I do not mean your particular business but your businesses, your sector—failed from the beginning to be part of

a sensible dialogue with the public? We saw it in the UK, let alone the rest of Europe, for a long time. It is not as if per se the EU regulatory regime is stopping any new technology developing. It appears to me from what I hear from both of you that, in your particular sector, it is from a historic failure at the beginning to have the correct dialogue with the public.

Dr David Hughes: Yes. I need to be a little careful what I say here, because my company was not the only company involved at the time

Baroness Morgan of Huyton: No, exactly. I am not talking about your company; I am talking about the companies which perhaps lost it for you.

Dr David Hughes: Quite. You would understand that maybe I should not comment too much on that particular question.

Q74 Lord Fox: A sigh of relief from everybody that this question does not involve the regulatory environment. It is people. Dr Hughes, in your evidence you cited the importance of free movement of people. I really want to probe that a bit and put it into context but also to set it into the context of European employment versus employment of people from outside of Europe in your European work; in other words, the balance of importance between those two groups of scientists and intellectual contributors.

Dr David Hughes: Looking at global megatrends in science at the moment, there are two big overarching megatrends. The first one is convergence, which is the blurring of scientific boundaries. The second is internationalisation. International collaboration and the physical movement of people to different locations around the world is now the norm; it is a very important trend, so anything which went against or hindered this free movement of people would seem to be a detrimental thing in terms of global science. In terms of how important employment of European nationals is, I got some statistics from our human resources people yesterday. Of the people employed at Jealott's Hill—there are about 750 scientists there—10% are non-UK EU nationals, and 5% are from further afield. So a significant proportion of our workforce is non-UK nationals.

Lord Fox: Another global trend is, of course, collaborative working without necessarily being in the same place. Do we need people to actually have to move and travel in order to contribute to your groups of researchers?

Dr David Hughes: I think you do. What you say is quite right but there is nothing like meeting people face to face to develop relationships. I mentioned earlier on the shift from a highly transactional way of collaborating to a more relationship-based way of collaborating. Nothing builds relationships like actually working with people and meeting them face to face. You can Skype or teleconference or whatever, and we do, but meeting people face to face is important.

Mr Steve Bates: Our sector is talent-based and is highly dependent on highly skilled employees at every step of the R&D and commercialisation pathway. We are a global sector. I echo the points about the different skills needed to make it successful. A lot of talent is home-grown from the UK science base, but business needs access to the best talent in the world, particularly from Europe, and any impediment to the freedom of movement of skilled employees in the EU inhibits the dynamism and success of bioscience in the UK.

Lord Maxton: We have been talking all the time about the UK but, to be honest, I come from a part of the country where, say, agriculture is not under the control of the UK. In Scotland it is the Scottish Parliament and the Scottish Executive, and they have said that they are going to ban GM crops totally in Scotland. How do you deal with that particular problem?

Dr David Hughes: You need to ask what that declaration actually meant in reality, because it is not as if any GM crops have ever been developed that could actually be used in Scotland. There is none on the horizon and nobody in their right mind would actually work on developing that.

Lord Maxton: What about fracking then?

Dr David Hughes: Okay. That is a little bit out of my area of specialisation, I am afraid.

Lord Hunt of Chesterton: Can I just comment? You have again used the word "science" in this very specific way but surely one of the points about both of your areas of expertise is that the science has to be applied in the cultural context. Surely that is one of the reasons why you have to have people from other countries, other cultures, working together. Even in weather forecasting this is very important, and how you interpret weather in different countries is part of what you have to do in a research lab. Is that not an important argument for why you have to have mobility?

Dr David Hughes: Absolutely. Quite right.

Lord Hunt of Chesterton: Science is not something you can do aculturally.

Dr David Hughes: That is right. We have over 100 R&D sites around the world. We have probably 10 big sites with 100-plus scientists working at them, everywhere from China, India, the United States, Europe, and we have to work together as integrated teams. The cultural compatibility between the scientists who are actually doing the work is a very important factor.

The Chairman: You referred earlier to the European Union presence within this country. Would you like to comment on the freedom of movement aspect of that?

Mr Steve Bates: I suppose if you look at the European Medicines Agency, which is staffed from people across the European Union, that is based here, that is providing jobs, and there is a number of service businesses that help support that through the people who do the regulatory dossiers, the people who do the intellectual property, which is part of the mix you get in London as a result of that. Those businesses depend on and need talent from across Europe and support jobs from across Europe. The flipside of this is, if the UK were to be a less attractive place for global businesses—we do not hear much these days about what was described as the UK "brain drain" back in the day—the US is still there as a very attractive proposition for scientists from the UK; Boston, Massachusetts, the Bay area are very attractive prospects and, rather than attracting in, we may see the flipside of this, which is people going out as used to be the problem.

Q75 Lord Hunt of Chesterton: We understand Syngenta is headquartered in Switzerland, and we have heard lots of very negative remarks by Swiss colleagues about what has happened to them with them leaving the EU. Nevertheless, are there advantages for companies to be in the European Economic Area, just outside Europe, and how has Syngenta's move been affected by EU sanctions imposed on Switzerland?

Dr David Hughes: This is quite a complicated question, because I am actually employed by a British company; I work for Syngenta Ltd, which is a wholly owned subsidiary of Syngenta parent company, which happens to be headquartered in Switzerland. Discussing this question among my colleagues, we came to the conclusion that it makes very little difference where our parent company is actually headquartered; it makes little operational difference, quite frankly. It is a bit of an unsatisfactory answer perhaps but it does not really matter where the headquarters are in terms of what we do in science and technology.

Lord Maxton: Is your company divided in that way because it is headquartered in Switzerland?

Dr David Hughes: No, it is not. Dividing up big, multinational corporations into smaller subsidiary organisations, often nationally focused, is quite a common thing to do. It is a very complex, byzantine, corporate structure we have, which means that when we do deals in the UK, collaborations in the UK, it is the British company actually signing the contract with partner organisations and the research councils, not a Swiss company, so in actual fact it really does not make any significant difference.

Lord Peston: I missed one point. Surely, where your headquarters are has major effects on your tax rate?

Dr David Hughes: I guess so.

Lord Peston: There is the current catastrophe over Google. If Google were situated in London, it would be paying several orders of magnitude more in tax than it does in Dublin. That is important.

Dr David Hughes: From a tax point of view, yes. I am talking from a science and technology point of view.

Lord Peston: You are talking from a science and technology point of view, and only that.

Dr David Hughes: Yes, that is the angle I am taking.

Lord Hunt of Chesterton: It is a wider question. We have a lot of companies in Britain that are owned overseas, and in many of these cases you could say the R&D strategy is defined outside. The UK has clever labs and people doing clever things, but actually, like Honda, for example, all the big decisions are taken in Japan. In the case of Syngenta, you have some clever people in Bracknell and wherever it is, but is in fact the strategy of Syngenta all defined in Switzerland?

Dr David Hughes: It is by people who are located in Switzerland but they could just as easily be located in London or Beijing or New York.

Lord Hunt of Chesterton: But the fact is therefore the strategy, the big strategic decisions, are being made outside the UK, wherever the headquarters of companies are.

Dr David Hughes: That is right, by the leadership.

Lord Hunt of Chesterton: You think that is okay, do you? If all the companies in Britain were in that way, it means we are just service providers of science and technology for strategic goals defined outside the UK.

Dr David Hughes: The important thing is the people who are making those decisions, not their physical location. I do not think that makes very much difference in any kind of practical sense.

Lord Hunt of Chesterton: Well, it is a point of view.

The Chairman: Can I move on to intellectual property rights? Lord Hunt again.

Q76 Lord Hunt of Chesterton: How will the UK's EU membership impact on the intellectual property and patent landscape in the UK? There has been some progress in the EU about patents.

Mr Steve Bates: May I say something?

Lord Hunt of Chesterton: Please do, Mr Bates.

Mr Steve Bates: Intellectual property is the life blood of our industry, and the new European unitary patent and Unified Patent Court aim to facilitate more consistent decisions in patent litigation across Europe and to reduce the costs for patentees by limiting litigation to a single forum, and that is the same whether you are a university or a company or whoever owns the rights. The signatories to the UPC agreement and participating EU member states will benefit from this, and the central division that deals with chemical and pharmaceutical patents is to be based in London. It is in progress at the moment. From our perspective, it is beneficial for the UK life science industry and illustrative of the UK's position as a global leader in life science that we have the key organisations based here. We are very concerned. We want the Government to set out clearly what the implications would be of a Brexit for the life science industry, and the logistics of how any changes for the UPC, like leaving London, a political likelihood, would be managed. That is really our take on this one. I think the UK Intellectual Property Office has a strong international reputation. Its five-year strategy, launched last week, includes a commitment to joining and shaping this EU-wide patent system, and it intends to take the lead and use our influence in Europe for this, which we think is a very good thing.

Lord Hunt of Chesterton: Can I just understand? Does that mean we have reached the stage at which you can just take out one patent for the whole of Europe, or do you still have to take out 28 patents?

Mr Steve Bates: We are in the process of developing a unitary patent. If you went to the patent court today, you would probably take out something that is nearer the former than the latter. You would probably take out patents only in the major six or seven rather than the 28. We are going to a system where you have one.

Dr David Hughes: I think I would agree with that. Again, from a practical point of view, the UK is a signatory of the European Patent Convention, which is independent of the European Union, so other signatories include Switzerland and Norway. That is driving the convenience of applying for patents across Europe at the moment, and that is independent of the UK's membership of the EU or not. We are looking very closely at the unitary patent and how that might be used. There are pros and cons but we are generally supportive, and it may well be a very useful tool for us to use in the future, but it seems independent of whether Britain belongs to the EU.

The Chairman: Thank you very much. Looking round the Committee, I think we have exhausted our questions to you. We are most grateful for the very patient way you have responded to our inquiries. There will, of course, be a transcript sent to you for any minor corrections that you feel would get the record absolutely accurate. On behalf of the Committee, I thank you both for a very informative morning. Thank you very much.

Technopolis – Written evidence (EUM0037)

Who are we to talk?

Technopolis is a contract research and consulting house, spun off from the Science Policy Research Unit, Sussex University in 1989. Since then we have undertaken about 2,500 projects on research and innovation and related policies across some 40 countries. With 120 staff in eight European offices, we represent (together with the Fraunhofer-ISI Institute in Karlsruhe) one of the two largest concentrations of expertise on research and innovation policy in the world. Our multinational configuration is unique in the field, providing a broad comparative base for policy analysis.

We have been privileged to be able to study the EU Framework Programme (FP) in considerable depth over a sustained period – essentially since the Fourth Framework Programme, which was the point at which the Commission and some member states started to commission serious evaluations and other studies of the Framework. Our roughly 95 studies related to aspects of the FP include evaluations of specific programmes in the FP, drafting the overall evaluation of the Sixth Framework Programme, doing national studies of the impacts of the Framework in most of the countries that have undertaken them – UK, Sweden, Norway, Denmark, Ireland, Austria, The Netherlands, China – as well as long-term impact studies of the Framework at national and EU levels.

In our submission, we focus on the Committee's Questions 4 and 5 as well as on the issue of alternative ways to participate in the FP in the event of a 'Brexit' – which we recently explored in quite some depth for the Norwegian Ministry of Education and Research, responding to dissatisfaction with Norway's position as a contributing member of the FP but without the privileges that attend EU membership. These are areas where our responses can be solidly based in evidence from our own studies. While of course we have opinions about the committee's remaining questions, others ought to have better evidence.

Question 4: Benefits of participating in EU collaboration

UK science and research derives at least three main types of benefits from participation in the EU collaborations and funding programmes: First, it benefits financially from EU funds. Second, UK research organisations benefit from access to networks and complementary knowledge. Third, participation has long-term structural effects, which are beneficial to the UK science and research system as a whole.

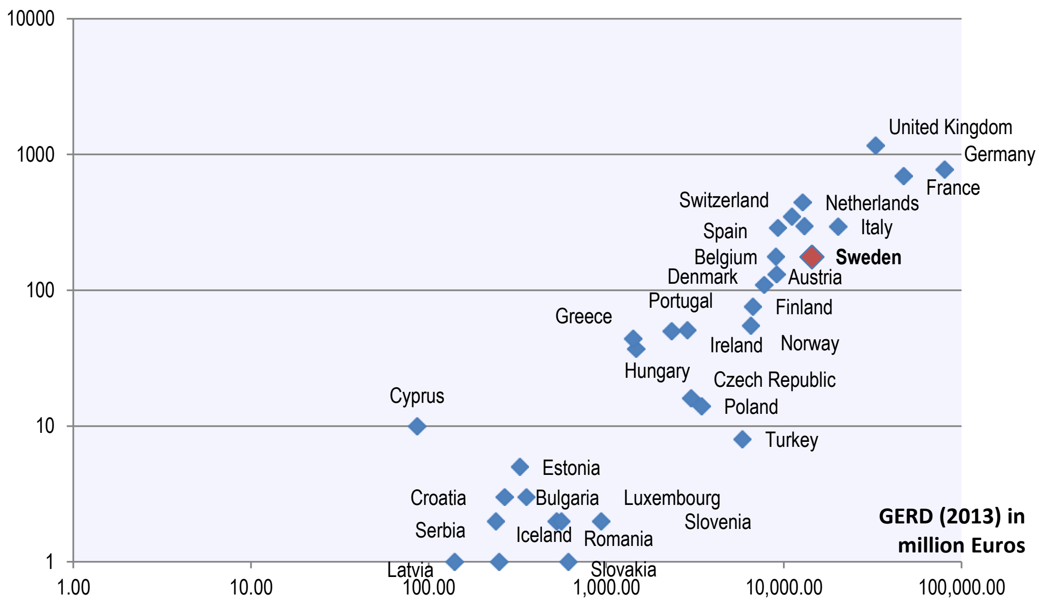
In absolute **financial** terms, the UK benefits significantly from the FPs (see Appendix). During FP7 (2007-2013), UK participants total funding of €6 billion, or about £0.6bn (at the current exchange rate) per year from FP7. This compares with an annual budget of £3bn for competitive project funding allocated through the UK research councils. The UK also gains significantly in relative terms. According to one estimate,[699] the UK received €1.9bn

[699] Fisch, P. (2015), Monetary (re-)distribution effects of FP7, THINK piece 2/2015, available at: http://www.peter-fisch.eu/european-research-policy/think-pieces/.

(£1.35bn) more from FP7 than it contributed to the programme budget. So, in crude terms, for every £1 the UK put in, it took £1.50 home. In comparison, France and Germany were net contributors, with a 'deficit' of about a billion Euros each. The UK stands out from most member states in that the main beneficiaries UK were the universities. This is partly because the UK does not have a strong research institute system but also significantly because business expenditure on R&D (BERD) is lower in the UK than in leading BERD-intensive countries like Sweden, Finland and Switzerland. If UK-based industry did more R&D, the UK would take home even more money from the FP.

It is easy to make the financial returns from the FP sound mysterious, but at the core they reflect a simple principle: the amount of money you get from the FP depends on the number of proposals you make and the proportion of those that are of high quality. 'Quality' here involves not only 'scientific quality' but also relevance to the FP agenda and presence in high-quality cooperation networks of researchers and companies. The inability of the most of the newer member states to get a better return from the FP reflects the difficulty of building first-rate research capacity and breaking into these networks. To continue to receive high returns from the FP the UK needs to maintain the volume and quality of the research it does with national resources. (Put simply: if you cut the Research Councils' budget, the returns from the FP will not remain the same; they will go down. If you increase their budgets, the UK's take will go up – though it may take time to build the additional capacity and network presence needed.) Figure 1 nicely illustrates for the ERC what is also more generally true of the whole FP: what you take out depends upon what you bring to the party in terms of national R&D.

Figure 1 Gross Expenditure on R&D (GERD) and Number of ERC Grants by Current Host Country, 2004-13



Source: OECD

Access to European **networks** is another major benefit to UK science and research. In our study of the impacts of the FP in the UK for the Department for Business Innovation and Skills[700] UK researchers reported that participation in the Framework Programme had improved their relationships and networks as well as expanded their knowledge base, reputation and scientific capabilities. Another major motivation for participation was the opportunity to tackle specific problems with a European or international dimension. These responses are typical of equivalent surveys in other countries and at the EU level.

The importance of networks goes far beyond research, however. For example, it may provide access to pre-normalisation R&D that in turns allows UK firms to contribute to shaping new technical standards to their own advantage. Or it may provide access to key business opportunities, as in the long-standing network of European aircraft engine makers present in the Clean Skies activity, which effectively defines and supports the division of labour in a significant part of EU aircraft engine manufacture.

Participation in EU programmes also has important long-term **structural effects**. National research and innovation systems benefit from an increased diversity of funding opportunities while the high demands of the FP drive up performance in national institutions through exposure to international competition. It often takes a decade or more for such effects to materialise and EU Framework programmes have an increasingly important impact at the level of *systems* as opposed to individual participants. The FP focuses on connections between actors, the ability to find and combine knowledge from a variety of sources as well as learning and mutual adaptation of strategies. Arguably, a key impact of the EU framework programmes is exactly these long-term system-level effects but they are very difficult to identify within the scope of conventional evaluations.[701]

Very few studies have looked at a time scale longer than a single FP. At the national level, the Swedish government commissioned a study of the long-term effects of the EU Framework Programmes in Sweden[702]. The study concluded that the FP funding complemented national funding, supporting more innovation-oriented work. By adding increased *diversity* of funding opportunities, this was seen to strengthen the national innovation system as a whole. In addition to uncovering a range of benefits for universities and industry in sectors such as ICT and car making, the study also highlighted the importance of having clear *national* strategies for research and innovation and FP participation. In the absence of national strategies, it becomes difficult to 'upload' national preferences to influence the EU FP.

A study of long-term effects of the FP at the EU level tracked impacts in six domains over the course of several decades from FP3 to FP6. Like other evaluations, the study found that the

[700] Simmonds, P., Stroyan, J., Brown, N., & Horvath, A. (2010). *The impact of the EU RTD Framework Programme on the UK. Technopolis Group*. http://www.technopolis-group.com/?report=impact-eu-rtd-framework-programme-uk
[701] Arnold, E., Clark, J., & Muscio, A. (2005). What the evaluation record tells us about European Union Framework Programme performance. *Science and Public Policy*, 32(5), 385–397. http://spp.oxfordjournals.org/content/32/5/385.short
[702] Arnold, E., Åström, T., Boekholt, P., Brown, N., Good, B., Holmberg, R., Veen, G. van der. (2008*). Impacts of the framework programme in Sweden*. VINNOVA. http://vinnova.se/upload/EPiStorePDF/va-08-11.pdf

FPs lead to increased knowledge production, cost sharing and networking. However, the systemic effects of coordination run much deeper

- Agenda setting, which helps to reduce uncertainty and risk associated with R&D
- FP works as a 'focusing device', focusing R&D on common technological trajectories and agendas
- Strengthening networks, integrating research networks and communities, especially in newer fields without established structures (for example, optical computing and communications)
- Empowerment of a range of stakeholders to self-organise research and innovation communities bringing together the strong players from participating countries
- Breaking national lock-in effects by providing alternative sources of funding and collaboration
- Exposing national actors to international competition, becoming a 'quality-driver' at universities and elsewhere

A long-term perspective makes it possible to see these effects, which extend well beyond the content of individual projects[703].

European collaboration can play an important role in the development of industry **standards**, a central element in the pursuit of competitive advantage. Such standards may be codified in international standards organisations but they are decided elsewhere. The development of the GSM mobile telephony standard illustrates how European collaboration can be instrumental in influencing this process.[704] Starting in the early 1980s, a European strategy was created for developing a second (digital) generation of mobile telephones. In parallel with market liberalisation, support was made available for the development of European industry in successive Framework Programmes (ESPRIT in FP1, RACE In FP2/3 and ACTS in FP4). Thus, public-private partnerships brought together the main industrial players in Europe. With a unified approach, the EU became an attractive international partner and with China's backing, GSM become the global standard for mobile telephones. In areas with a strong European industrial base, industry from participating countries can gain a very significant long-term advantage from their involvement in the process.

Through the current Framework programme, Horizon 2020, the EU invests heavily in **strategic sectors**. In ICT, the development of 5G is a major priority[705]: The European Commission and Industry have set up the '5G Infrastructure Partnership' (5G-PPP) and €700m from Horizon 2020 has been allocated to wireless technology, with a similar

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[703] Arnold, E, Mahieu, B, Stroyan, J, Campbell, D, Carlberg, M, Giarracca, F, Horvath, A, Knee, P, Meijer, I, Sidiqi, S and Wagner, C, (2011), Understanding the Long Term Impact of the Framework Programme, European Commission DG-RTD https://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/long_term_impact_of_the_fp.pdf; see also Erik Arnold, (2012), 'Understanding long-term impacts of R&D funding: The EU Framework Programme', *Research Evaluation*, Volume 21 No 5, 332-343 http://rev.oxfordjournals.org/content/21/5/332.short

[704] Arnold, E., Good, B., & Segerpalm, H. (2008), Effects of research on Swedish Mobile Telephone Developments : The GSM story, VINNOVA. http://www.vinnova.se/upload/EPiStorePDF/va-08-04.pdf

[705] https://ec.europa.eu/digital-agenda/en/towards-5g

commitment from industry.[706] In a development reminiscent of the GSM example discussed above, collaborative agreements on developing 5G have now been signed between the EU and South Korea (June 2014) Japan (May 2015) and China (Sept. 2015).[707] In the aeronautic sector, the Joint Technology Initiative (JTI) 'Clean Sky' is a major initiative aimed at developing next generation of jet engine. Following a €1.6bn budget under FP7 (divided equally between the Commission and industry), and an increased level investment is foreseen for 'Clean Sky 2' under Horizon 2020. This will be the culmination of a structured process of developing joint strategies and networks since 2001, using EU instruments like European Technology Platforms and Joint Technology Initiatives. Rolls Royce is one of the leading members of the partnership.

Question 5: Bilateral collaboration; multilateral collaboration

Here we add some observations about multilateral cooperation to the Committee's question about bi-lateral cooperation.

The main influence of EU membership on bilateral collaboration between the UK and other EU member states is that it provides an institutional context that *facilitates* collaboration between countries. The UK collaborates with other EU member states within the framework of EU programmes as well as outside. EU membership does *not* inhibit collaboration with other member states. In addition to the Committee's question about bi-lateral cooperation, we address the issue of European multi-lateral cooperation.

EU membership provides UK science and research with a **platform for collaboration**, both in terms of participating in established collaborative programmes and in terms of having access to networks and potential partners. This platform character has always been a feature of the EU Framework Programmes but has been further emphasised with the implementation of the European Research Area (ERA) starting in Framework Programme 6 (2002-6). The new 'ERA instruments' support 'variable geometry' networks where individual member states can decide which initiatives they are most interested in. A major role for the EU in this context has been to organise the interaction of the member states and other stakeholders. One type of partnership is 'Public-to-Public Partnerships' between government organisations from different member states. Through ERA-NETs, Art. 185 actions and Joint Programming Initiatives, member states can explore shared interests, build shared research agendas for addressing societal challenges and invest where it is deemed advantageous. These new initiatives have more organisational flexibility and can operate according to their own rules and regulations.

Although it is difficult to isolate the precise effect of EU membership as distinct from the general trend towards internationalisation of science, the UK science and research community does in fact **collaborate** extensively with other EU member states. Participation in successive EU-funded projects allows scientists to build up long-term collaborative relationships. Measured in the number of international co-publications, EU countries are the most important collaborators for UK science apart from the United States. (The USA produces by far the biggest amount of science in the world – so it tends to be the biggest co-

[706] http://ec.europa.eu/newsroom/dae/itemdetail.cfm?item_id=14764&newsletter=125
[707] https://ec.europa.eu/digital-agenda/en/5G-international-cooperation

publisher for research communities in many research-active countries.) The UK also chooses to participate very frequently in voluntary EU collaborative programmes. During FP6 and FP7, the UK is the 4th most frequent participant in ERA-NETs and has invested €80m in joint calls, more than any other member state except for Germany.[708] These activities leverage UK national investment across larger amounts of research than the UK could alone fund.

EU membership does not *prohibit* **bi-lateral or multi-lateral collaboration** with other member states, but it provides a framework that is often more attractive than inter-governmental agreements. The EU does not have legal competence over science policy in the member states and there is nothing to prevent them from working together outside of the EU framework in whichever way they choose. For example, France and Germany have a long-established bi-lateral agreement on transport research, DEUFRAKO[709], first established in 1978, and the more recent collaborative agreement between the French Research Agency (ANR) and the German Science Foundation (DFG). The UK (through ESRC) participates in the Open Research Area (ORA) with the Netherlands, Germany and France, which has also had the American National Science Foundation (NSF) and the Japanese JSPS as associates.

The history of multilateral research collaboration in Europe underscores the advantages of using the FP over other mechanisms. In the first wave of European science collaboration after the Second World War, intergovernmental treaties or agreements were the mechanism needed to establish new organisations. This period saw the creation of organisations like the Centre Européenne de la Recherche Nucléaire (CERN) and the European Molecular Biology Laboratory (EMBL). In the European Cooperation on Science and Technology (COST) and the European Science Foundation (ESF), attempts were made in the early 1970s to establish something like the FP. But they moved very slowly because of the continuous need to agree decisions at the level of all or most of the member states and organisations. Sometimes individual member states blocked progress in order to exert pressure on others in relation to other joint activities or negotiations[710]. The EU Framework Programmes provided a flexible instrument able to do the job. Since 1984 when the FP began, the only significant multi-lateral research cooperation established in Europe has been EUREKA the following year. COST has become a specialised networking organisation (funded from the FP budget), whose Actions often establish the communities that go on to do FP projects. The original ambition of the ESF has now been realised in the European Research Council (ERC) and ESF has essentially withered to a small rump organisation. Other collaborations built on member states priorities can be done through Joint Programming Initiatives (JPIs) and other EU-facilitated partnerships while the EU plays a key role in ESFRI, which coordinates major research infrastructure. For European multi-lateral cooperation, the EU Framework programme has more or less become 'the only game in town'.

Alternatives to EU membership

[708] Niehoff, J. (2014), *The ERA-NET scheme from FP6 to Horizon 2020*, European Commission.
[709] http://deufrako.org/web/index.php?id=2&L=1
[710] Arnold, E, and Brown, N, (2009) *Options for Implementing COST: A SWOT Analysis*, Brighton; Technopolis. This study is not published but the Committee could approach the UK member of the COST Committee of Senior Officials to obtain a copy

The benefits of the FP to UK science and research not only depend on participating as such, but also on the UK being an EU member and therefore able strongly to participate in setting the FP agenda. An important benefit of EU membership is the ability to participate in the decision-making process from an early stage and shape priorities in a direction that serves the national interest. This influence can extend from the overall shape of the FP down to the content of specific Work Packages.

If the UK were to leave the European Union, alternatives would be the Norwegian or Swiss models of 'buying into the Framework Programme' as an associate country. There are different models of association, which retain some of the opportunities for science and research actors in the UK participate. Depending on the model chosen, however, there are some significant downsides to this approach compared to full EU membership.

- In the Norwegian model (closest association), the UK would still have all the costs (calculated on the basis of national GDP) but lose early access to and influence over the shaping of the programme
- With a looser association (the Swiss model), regular renegotiations of the terms of association would additionally cause delays at the beginning of each new multi-annual FP. The Swiss have experienced gaps of up to two years at the start of new FPs before they could participate. This, in turn, could compromise the ability of UK science and research actors to participate and put them behind the curve compared to their European competitors

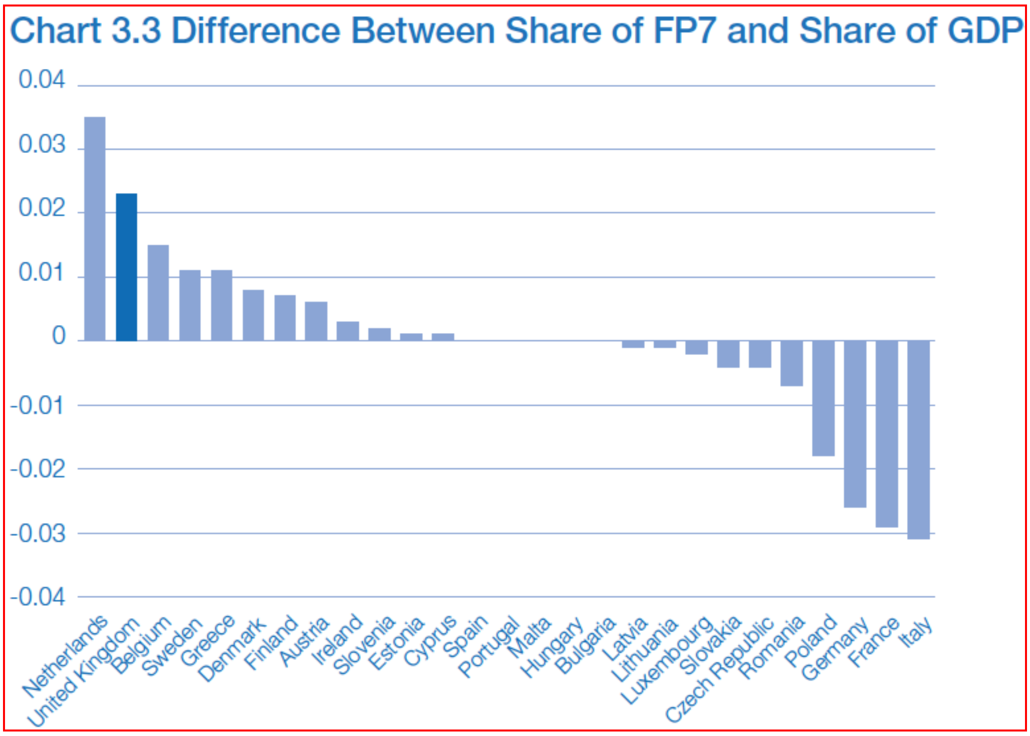
A more detailed account of options for participation in the FP by a European country outside the EU is available in a study for the Norwegian Ministry for Education and Research[711].

20 November 2015

[711] Åström, T, Jansson, T, Melin, G, Håkansson, A, Boekholt P and Arnold, E*, On motives for participation in the Framework Programme*, Norwegian Ministry for Education and Research, 2012 https://ec.europa.eu/research/evaluations/pdf/archive/fp7-evidence-base/national_impact_studies/motives_for_participation_in_the_framework_programme_(norway).pdf

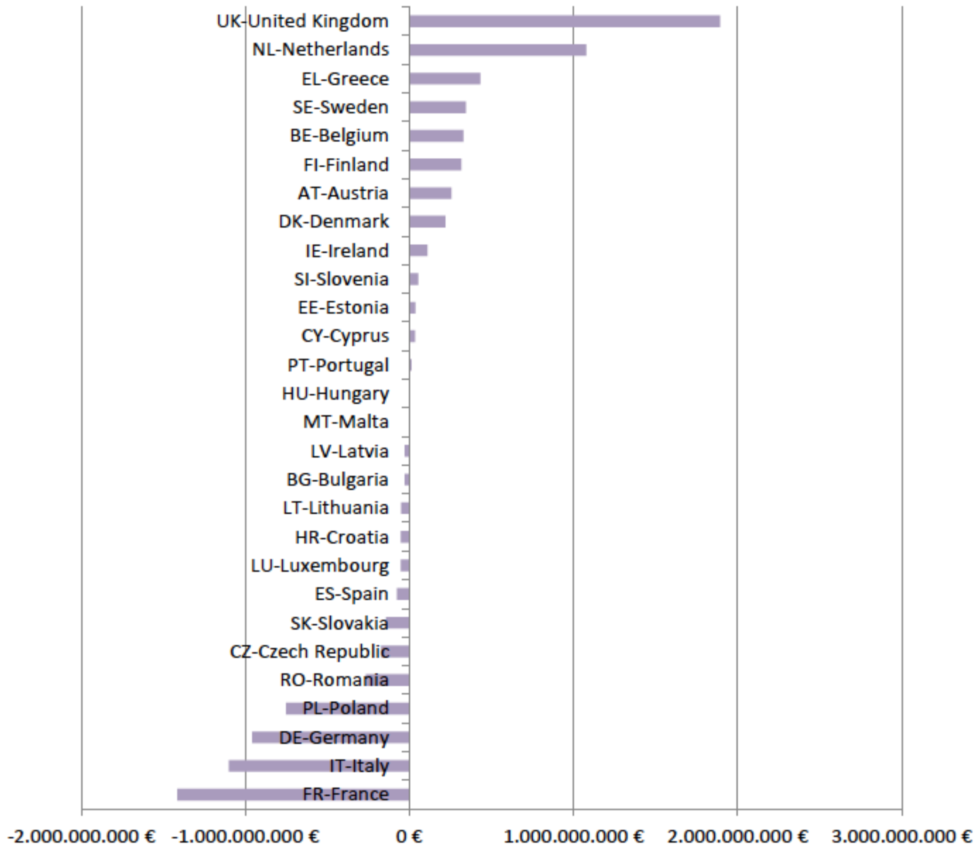
Appendix A: UK participation in EU programmes

A.1 UK return on the Framework programme

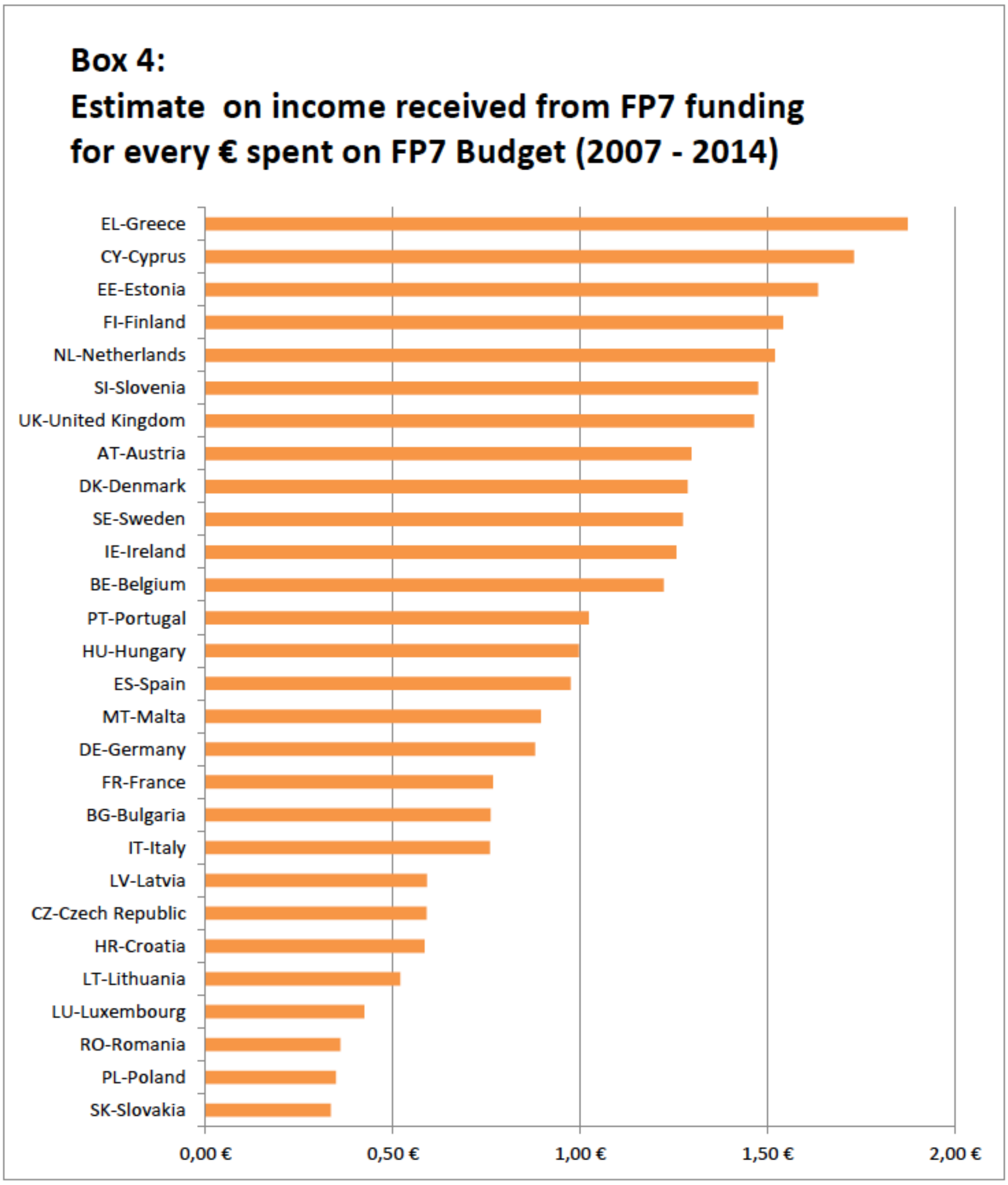


Source: HM Government (2014), *Review of the Balance of Competences between the United Kingdom and the European Union: Research and Development,* p. 33.

Box 3:
Estimate on net distributional effect of FP7 (2007 - 2014) ("money in - money out")



Source: Fisch, P. (2015). *THINK piece 2/2015 Monetary (re-)distribution effects of FP7*.



Source: Fisch, P. (2015). *THINK piece 2/2015 Monetary (re-)distribution effects of FP7*.

A.2 UK participation in ERA instruments

A.2.1 ERA-NETs

	budget contribution per country	[Euro million]	[%]
Member States	Austria	24,5	3,44%
	Belgium	27,9	3,92%
	Bulgaria	-	0,00%
	Croatia	0,1	0,01%
	Cyprus	0,3	0,04%
	Czech Republic	0,1	0,01%
	Denmark	24,1	3,38%
	Estonia	0,6	0,08%
	Finland	25,1	3,53%
	France	48,0	6,73%
	Germany	159,2	22,33%
	Greece	5,7	0,80%
	Hungary	0,4	0,06%
	Ireland	3,2	0,45%
	Italy	34,0	4,77%
	Latvia	4,1	0,57%
	Lithuania	1,1	0,15%
	Luxembourg	3,3	0,46%
	Malta	-	0,00%
	Netherlands	20,6	2,89%
	Poland	15,2	2,14%
	Portugal	7,4	1,04%
	Romania	9,9	1,39%
	Slovakia	0,5	0,07%
	Slovenia	4,2	0,58%
	Spain	38,5	5,40%
	Sweden	28,8	4,03%
	United Kingdom	80,9	11,34%
	COM Top-up funding ERA-NET Plus	53,0	7,43%
Associated Countries	Switzerland	18,2	2,55%
	Norway	26,8	3,75%
	Iceland	0,8	0,11%
	Turkey	20,4	2,86%
	Israel	8,4	1,18%
Third Countries	Burkina Faso	0,1	0,02%
	Côte d'Ivoire	0,1	0,02%
	Egypt	0,2	0,03%
	Kenya	1,2	0,17%
	South Africa	1,1	0,16%
	Belarus	0,0	0,00%
	russia	3,7	0,52%
	Canada	5,3	0,74%
	Taiwan	0,5	0,06%
	serbia	0,2	0,02%
	new zealand	1,0	0,14%
	USA	4,3	0,60%
		712,9	100,0%

Table 15: Total public funding per country and country share in ERA-NET and ERA-NET Plus calls for a sample of calls launched in 2009 - 2014.

Source: Niehoff, J. (2014). *The ERA-NET scheme from FP6 to Horizon 2020*. European Commission.

Appendix B: EU industrial policy

B.1 GSM story

Development:

- Agreement around the Groupe Spécial Mobile committee (created in 1982) to develop a second (digital) generation of mobile telephones.
- Memorandum of understanding between 13 European countries (1987), creating a network larger than that of the United States. Making everyone (government, industry etc.) work together around a common, open standard.
- Eventually become global standard. The EU funding programmes RACE (FP2/3) and ACTS were important in developing this.

Industry from participating countries were heavily involved in the process of developing the GSM standards and gained a significant competitive advantage.
No longer possible to develop standards in national context in 'development pairs' between the state and a national champion. Competition is global => need to create alliances and work internationally.

B.2 Current 5G development

Current role of DG Connect in development of 5G:[712]

- December 2013: Commission agreement with the 5G Infrastructure Partnership, industry association comprising public-private partners (the so-called 5G-PPP) (5G-PPP)[713]
- Funding from H2020: 700m for wireless technology ('pure' 100% funding), 'Innovation actions' (70% cost, for demonstration, testing, piloting) and supporting actions.
- 700m from industry (Ericsson, Alcatel etc.)
- Collaborative agreements on developing 5G with South Korea (June 2014) and Japan (May 2015) and China (Sept. 2015).[714]

B.3 Clean Sky Joint Technology Initiative

Clean Sky' initiative (JTI): stabling the next generation of jet engine. Long-term process of building joint strategies and networks.

- 2001 Report of the Group of Personalities "European Aeronautics: A vision for 2020"
- 2002-2004 European Technology Platform, Advisory Council for Aeronautics Research in Europe (ACARE), establishing the targets for 2020 (the ACARE 2020 targets)
- 2008: Clean Sky public-private partnership under FP7. Budget of 1.6bn Euros provided 50/50 by the European Commission and industry.
- Run by the Clean Sky Joint Undertaking (CSJU)[715]
- Clean Sky 2 (Horizon 2020) joint undertaking with a budget of up to 4bn Euros (up to 1.75bn Euros from the EU and at least 2.2bn Euros from industry partners).[716]

  "Advancements in the first Clean Sky are mostly related to major components and large systems. The time is now ripe for moving towards their **combination into**

[712] https://ec.europa.eu/digital-agenda/en/towards-5g
[713] http://ec.europa.eu/newsroom/dae/itemdetail.cfm?item_id=14764&newsletter=125
[714] https://ec.europa.eu/digital-agenda/en/5G-international-cooperation
[715] http://www.cleansky.eu/
[716] http://ec.europa.eu/research/participants/data/ref/h2020/other/legal/jtis/cleansky-establact_en.pdf

> **complete aircraft demonstrators comprising innovative configurations**. In addition to existing integrated technology demonstrators (ITDs), Clean Sky 2 will introduce further major demonstrations of several aircraft systems at the **aircraft platform level**. The technological improvements instilled through by Clean Sky 2 will underpin innovative advances in the next generations of aircraft in time to meet the next market window to replace the current fleet."[717]

British participation includes Rolls Royce[718].

Clean Sky is made up of 6 Integrated Technology Demonstrators.[719]

- **SMART Fixed Wing Aircraft - SFWA -** will deliver active wing technologies and new aircraft configuration for breakthrough, news products.
- **Green Regional Aircraft - GRA -** will deliver low-weight aircraft using smart strutures, as well as low external noise configurations and the integration of technology developed in other ITDs, such as engines, energy management and new system architectures.
- **Green Rotorcraft - GRC -** will deliver innovative rotor blades and engine installation for noise reduction, lower airframe drag, integration of diesel engine technology and advanced electrical systems for elimination of noxious hydraulic fluids and fuel consumption reduction.
- **Sustainable and Green Engines - SAGE -** will design and build five engine demonstrators to integrate technologies for low noise and lightweight low pressure systems, high efficiency, low NOx and low weight cores and novel configurations such as open rotors and intercoolers.
- **Systems for Green Operations - SGO -** will focus on all-electrical aircraft equipment and systems architectures, thermal management, capabilities for "green" trajectories and mission and improved ground operations to give any aircraft the capability to fully exploit the benefits of Single European Sky.
- **Eco-Design - ECO -** will focus on green design and production, withdrawal, and recycling of aircraft, by optimal use of raw materials and energies thus improving the environmental impact of the whole products life cycle and accelerating compliance with the REACH directive.

717 http://www.cleansky.eu/content/page/going-beyond-clean-sky
718 http://www.rolls-royce.com/about/our-technology/research/research-programmes/clean-sky-jti.aspx
719 http://www.cleansky.eu/content/homepage/activities

Appendix C: UK bilateral agreements

C.1 Science diplomacy

- RCUK in China (British Embassy in Beijing).[720]
  - "Facilitated over £160m in co-funded programmes" to date (e.g. funds from the Newton Fund) – this includes both UK and Chinese contributions.
- RCUK in India (British High Commission in New Delhi).
  - "Since 2008 RCUK, the Government of India and their partners have together invested over £150 million in co-funded research programmes."[721]

C.2 The Newton Fund (since 2014)

Newton Fund is the only significant international item in the science budget (international subscriptions are included in research council budgets).

- Set up to strengthen science and innovation partnerships with emerging economics.
- It is part of the Official Development Assistance (ODA) and has a budget of 375m GBP over 5 years.

UK research councils delivering Newton Fund programmes:

- RCUK-CONICYT Research Partnerships Call (UK-Chile)[722]
  - Newton Fund pays for UK participant with RCUK as 'the main UK delivery partner'.
  - UK budget for 2015 call is £2.5m.
- RCUK-TUBITAK Research Partnerships Call (UK-Turkey)[723]
  - Newton Fund pays for UK participant with RCUK as 'the main UK delivery partner'.
  - 2015 call to fund approximately 10 projects with RCUK funding of up to £250k each.
- RCUK-CONACYT Research Partnerships Call (UK-Mexico)[724]
  - Newton Fund pays for UK participant with RCUK as 'the main UK delivery partner'.
  - £200k-500k per project.
- Atmospheric Pollution & Human Health in an Indian Megacity Announcement of Opportunity: Initial Proposals[725]
  - With the Earth System Science Organization, Ministry of Earth Sciences (ESSO-MoES) and Department for Biotechnology (DBT) in India.
  - NERC and MRC have a budget of £6.5m (£4m of which is from the Newton Fund) for the overall programme
- Newton fund sustainable Gas Futures programme[726]
  - The exact level of investment is still to be confirmed. NERC has committed £1.05m to this programme via the Newton Fund, with matched funding from the São Paulo Research Foundation (FAPESP).
- Malaysia-UK Research and Innovation Bridges Competition[727]

[720] http://www.rcuk.ac.uk/international/offices/china/about-rcuk-china/
[721] http://www.rcuk.ac.uk/international/offices/india/
[722] http://www.rcuk.ac.uk/international/newton/rcuk-conicyt-research-partnerships-call/
[723] http://www.rcuk.ac.uk/international/newton/tubitak/
[724] http://www.rcuk.ac.uk/international/newton/conacyt/
[725] http://www.nerc.ac.uk/research/funded/programmes/atmospollution/news/aoinitial/
[726] http://www.nerc.ac.uk/research/funded/programmes/gasfutures/

    - There is up to £7.2 million available from the UK Newton Fund to allocate to the UK project participants with MIGHT allocating the equivalent to fund Malaysian participants (up to £14.4m in total).
    - Focus on translational research

C.3 Other international agreements

Current international activities listed on RCUK's website:

- MoU between RCUK and the Research Council for the State of São Paulo (FAPESP). Lead agency agreement whereby UK research councils receives proposals from both UK and BR applicants, following normal procedures. Each country funds their own researchers in joint projects. FAPESP nominates experts to participate in assessment and peer review. Primarily applicable to UK research councils 'responsive mode' schemes.[728] This is not a separate stream of funding but funded through existing (domestic) schemes.
- China-UK Programme in Global Priorities (CUKPGP):
    - One-off call for proposals (2012) to strengthen collaboration between the UK and China in areas of healthy aging populations, energy and food security.
    - Budget was 1m GBP from the UK side (up to 200k per project), matched by China.

[727] https://interact.innovateuk.org/competition-display-page/-/asset_publisher/RqEt2AKmEBhi/content/malaysia-uk-research-and-innovation-bridges-competition
[728] http://www.rcuk.ac.uk/international/funding/collaboration/RCUKFAPESPmou/

TransportNewcastle, Newcastle University – Written evidence (EUM0042)

Prepared from individual submissions by Thomas H Zunder.

1. transportNewcastle is a network of transport researchers at Newcastle University. These researchers cover almost every area of transport research from policy, practice, economics, logistics, health, operations research, management science, electrical engineering, civil engineering, mechanical engineering and maritime technology. The network includes five professors in various schools, dozens of academic researchers at all levels from Senior Lecturers and Principal Research Associates to PhD students. Newcastle University has a strong, prestigious and successful record of transport research dating back to the 1960s, funded by a variety of national and international sources, public and private. Staff have participated in all Framework Programmes setup by the EU from the very first, and within the current pool experience extends back to FP4, and to the wider range of EU funding such as ERASMUS, MARIE CURIE SLADOWSKI and INTERREG.

2. This submission is ONLY on behalf of the researchers within the transportNewcastle research network at Newcastle University. It is NOT a formal submission by the University itself, and is made only on behalf of the transportNewcastle team with regard to their extensive experience of transport research within the UK and the EU.

3. This submission is constructed from the personal narrative of professors, senior researchers and administrative and business development staff within transportNewcastle. As such we do not always hold the same opinions, and we may differ in our experiences. To that end each response to the questions is reported as an anonymous quotation, so that the Committee can hear the direct uninterpreted input of several experienced and successful researchers.

4. Within FP7 Newcastle University has a total of 31 projects, with a value of £7.5million, within H2020, so far: 4 projects, £with a value of 630k. At various stages in FP6 the University was *reputed* to be one of the largest recipients of EU transport research funding in Europe.

5. **What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?**

6. “I do not see one as necessarily better than the other – both have their differences but on balance I find the effectiveness and efficiency of both rather similar.”

7. “I don't think the EU process works particularly well anymore. All the activities are out sourced so there is no 'intelligent customer' and the bureaucracy is immense. Used to be better and more fit for purpose. Decision making on selection of topics to be

added to call themes and further down the line the selection of project proposals is not transparent and throws up surprises."

8. "The EU seem to have a very robust methodology whereby the process starts very early with evidence and policy based decision making which then leads to the funding. It seems like a transparent and inclusive process and information is communicated very early on so that everyone in the world knows when the Calls are available and when to attend events. They are vey well organised. The governance, process for decision making and feedback are very clear. The UK could learn a few lessons from the EU."

9. "I don't think the EU process works particularly well anymore. All the activities are out sourced so there is no 'intelligent customer' and the bureaucracy is immense. Used to be better and more fit for purpose. Decision making on selection of topics to be added to call themes and further down the line the selection of project proposals is not transparent and throws up surprises."

10. "Research funds managed by the EU are allocated to different programs focusing no only on specific challenges (e.g. Societal Challenges in H2020) but also on different sections of the innovation spectrum (e.g. TRL level 1-3 focus of ERC grants as opposed to TRL level 5-8 of societal challenges research). In addition, a number of instruments are specified for each topic, indicating the most suitable approach to a particular research action (e.g. innovation projects, coordinated support actions). This structure allows for a more targeted submission of grant applications and for reviewers/funders to clearly evaluate their merits according to the goals set. EU research programmes (e.g. FP7, H2020) have progressively attempted to reduce the administrative burden on awarded grants. This contrasts with UK research grants, particularly those targeting industry-led research, where the level of administrative requirements are significantly higher (e.g. monthly reporting as opposed to 6-12 months in EU research)."

11. "Administrative overheads: EU funding is naturally more complex to administer. However, the European Commission (EC) that manages Horizon 2020 (and therefore European Research Council) funding continuously strive to minimise administrative burden to institutions. This has resulted in a number of simplification measures which have been welcome by the Higher Education (HE) community. Examples include moving towards electronic systems, reduced time to grant, reduced financial reporting and similar. Although areas of improvement still exist we are encouraged that EC have been working with the HE community (either directly or via UK National Contacts) to address these wherever possible. Joint Programming Initiatives are managed through respective national funding bodies such as Research Councils so the bulk of the administrative complexity probably lies within those organisations rather the HE institutions in receipt of funding. European Innovation Partnerships is not a funding mechanism per-se and involvement in activities and coordination of can be beneficial to HE institutions."

12. "Quality of decision-making and advisory processes: Decision making and advisory process occurs on a number of different levels, these are broadly represented by the

following: Agreeing the overall programme priorities: these are normally coordinated on a national level, with some but limited input from the HE community. Agreeing priorities on an individual call level: these are achieved through a number of complementary ways from using groupings or associations of institutions representing a given call theme to advice from independent experts. Participation in decision making for these priorities can indeed be possible by the HE community where the HE institution clearly identifies and aligns its expertise and engages with the appropriate grouping Decision making on individual research projects level: is done by remote evaluation of project proposals which is moderated by the EC. It is certainly been the case that the transparency of decision making and the respective advisory process has improved where there are clearly identified and reasonably open means to engage with such processes. However, in terms of individual research project evaluation this could still be improved to ensure that better overall quality of reviewers."

13. **What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?**

14. "Broadens our networks, exposure to other ideas, viewpoints, methods etc."

15. "Benefit's are immense. There is no other funding source for proof of concept and demonstration and trials – research councils don't fund this type of research. Networks, access to shared research and access to potential markets are all real good reasons to participate in European research."

16. "It is imperative that our engagement needs to REFable research outputs so we should cherry pick project involvement to ensure that it fits into the research descriptor of the work undertaken. I believe that the EU funding of demonstrations provides and opportunity to work hand in hand with a local authority or industry/consultant to apply outputs from previously funded EPSRC research. In this way the EU opens the door to exploring opportunity and/or exploiting research outputs and thus provides evidence for Impact case studies for REF"

17. "The biggest benefit by far is the exposure to and from other leading institutions in Europe. When done right, this collaborative approach allows for acceleration of knowledge and the establishment of partnerships that go beyond the funding timescale, unlocking other funding opportunities (e.g. national programs)."

18. **What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?**

19. "The UK's membership of the EU is a benefit to collaboration in my view."

20. "It makes it easier to do business and research as the EU-membership helps provides common ground, infrastructure, legislation, guidelines and a set of rules which would

otherwise not exist in the non-EU member countries. The non-EU countries are starting off at a different baseline, in many ways behind that of the more advanced countries in the EU. That is why the EU membership was put in place, to help harmonisation and create a better Europe for all."

21. "The new EU-member states have participated in some projects and able to learn and put into practice what other leading EU countries have already adopted."

22. "From the transport perspective, I know the UK DfT works hard to influence the programmes and also in disseminating opportunities of H2020 collaboration to the UK. Bi-lateral collaborations work too. Look at UK and NL on autonomous and connected vehicles."

23. "|I am a pretty neutral here. Opportunities raise themselves in various guises and they have to be relevant to your needs/skills/interests to pursue. We have healthy collaborations with China and India currently and with Canada and the USA in the past. When Calls are announced – if they are relevant you go for them. However it is the research council funding that enables the fundamental research to be carried out to place us in the position to respond to funding calls per se. Our reputation and networking at conferences leads to invitations to collaborate as they recognise the value of the potential contribution. On balance I think EU membership strengthens bilateral working."

24. "EU membership is essential to the success of UK bilateral collaboration with other member states. While there are a number of bilateral programs between the UK and non-EU countries (e.g. UK-Japan), any attempt to collaborate with EU states is fostered and enhanced by EU membership. Without this, establishing mechanisms for such collaboration would be difficult to say the least."

25. **How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?**

26. "The UK makes it easier to do business than in some other advanced countries in Europe and has some different legislature which is maybe prohibited in some other countries. The UK also has a common language which makes doing business easier. All the above are the ingredients which help the UK as chosen location for Science and Research but as well the UK is often seen as the gateway into the EU."

27. "It is an important component, UK would really struggle without the EU research funding – and we do relatively well out of it. It is very important to the research community and to the wider industry and SME community"

28. "Not sure I am able to respond to this. However observations at the ITS Congress suggests that UK plc are leaders in EU in many respect and they are likely to value engagement in EU funding. Local authorities see the funds as a way to make things

happen on street. The Academic role is increasingly to support the UK plc to deliver and therefore academia follow UK business into EU."

29. "The ability to unlock and access EU research funding is often mentioned by industry enquiries into research and innovation investment."

30. "UK science and research has the highest international esteem and recognition, which has to be a key reason behind the level of private investment coming to the country. Part of that reputation build on the quality and skill of our research human capital, which is enhanced by the freedom of movement and access to talent across the EU."

31. **What contribution does EU membership make to the quality of UK science and research through the free movement of people?How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?**

32. "Obviously much less hassle and time wasted re applying to visas, trying to decipher constraints / restrictions etc."

33. "The Government needs to look to Universities to understand the extent that Science and Research interplay with the movement of people. With the advent of Greece and Spain in the last few years, people have sought to the UK for professions. This in turn helps economic development and flows of income from one country to another."

34. "In non-EU countries, there are issues with Visas and other barriers to entry. The EU reduces barriers and I support this. I would say this is very important indeed."

35. "We collaborate with all of the other countries mentioned above but the level and depth of collaborations are no where near what we achieve through within the EU"

36. "Again this is difficult and I present a personal opinion. We are seeing more Europeans in posts in Universities taking up jobs across the spectrum: RAs through Readers Lecturers and Professors This is because of a failure of the UK higher education system more than the EU policy regarding jobs. Due to the fact that more and more school leavers are entering higher education (45% today compared to 2% in the 1960s) and their need to pay substantial fees means that students have debts and want jobs straightaway. With fewer and fewer PhD stipends we do NOT attract UK graduates to stay for PhD. This has been going on for so long now we do not have individuals qualified to take on research and academic jobs in University."

37. "I fear for the future I believe the most successful of collaboration with China and India (or other countries for that matter) are borne out of relationships built between successful PhD studentship and supervisors when overseas candidates chose to stay after their PhDs and become members of staff. They are keen to maintain links with their home countries, so work hard and open opportunities because they recognise the benefits in their home country and of course the spin off of successful

collaboration is flights paid to visit family when exchanges occur. I am not saying this is not good at all - simply my observation. “

38. “We have strong flows of people from global locations which are not impeded by EU flows.”

39. “In addition, it is true that a significant number of non-EU individuals successfully get educated at British universities. However, the visa application process and restrictions are often contributors to the limited number of talented non-EU graduates being retained in the UK.”

40. **Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?**

41. “EU membership does not inhibit international collaboration beyond the EU, on the contrary.”

42. **If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?**

43. “I believe that if we are not part of the EU our position will be compromised and EU will just go it alone. Unless the UK plough substantial money into the research and industry to enable quantum leaps to maintain competitiveness we would lose ground”

44. **How is the innovation landscape affected by EU membership?**

45. “Innovation is a major driver for the EU with some EU members ahead of the UK in this regard – thus the UK benefits from exposure to this landscape.”

46. “We follow EU priorities. They generally effect the 'big challenges and needs for innovation we have in the UK so it is a 'win win' situation.”

47. **How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?**

48. “The EU helps advance policy and the UK can sometimes be slow to react. Again this is dependant on Political Parties in the UK. For example, note Wind Policy differences between EU and UK.”

49. “I believe that this is rather country specific. I believe the Dutch are good at this, but believe the UK work much more cooperatively with local authorities and central Government than other EU countries. In some ways UK are listened to and Government act (not always in the way we would wish) but at least we do have well established channels of communication. Government is accessible.”

50. “They are different but both effective. I note the EU are setting up a mechanism similar to the UK's Chief Scientific Advisor network. That is good”

51. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

52. “EU membership does provide mechanisms to influence public policy through evidence, priorities and large scale collaborative research for the public good. I don't see it having an inhibiting effect at the international level.”

20 November 2015

United Kingdom Atomic Energy Authority (UKAEA) – Written evidence (EUM0024)

UKAEA is responsible for managing the UK magnetic confinement fusion programme at the Culham Centre for Fusion Energy. The UK programme forms part of the European roadmap to deliver fusion electricity by the middle of this century. Fusion has the potential to deliver low carbon energy, but there are significant science, technology and engineering challenges to overcome. These require powerful international collaborations to deliver, and the EU programme is one of the key world endeavours, linked to the international 'next step' device ITER, currently under construction in the south of France. The UK has a unique breadth and depth of experience and competence in fusion as a future energy source, and has a major influence on EU fusion research strategy.

At Culham, UKAEA operates the JET fusion experiment on behalf of the European Commission, currently the largest EU funded research facility in the UK with operation costs of around £60m per annum. JET is the only experiment in the world capable of producing significant fusion reactions, thus UKAEA plays a leading role in world fusion research.

The UK contributes 1/8th of the funding for JET though an EPSRC grant of around £25m pa, which also supports the UK's MAST fusion project on the site. This investment levers over £50m pa EU investment into the UK in highly skilled science and engineering research for the JET operations. UKAEA also receives additional EU funding via EUROfusion, a consortium of fusion research institutes, for the UK fusion programme of the order of £5m pa. The EU funding enables, through industry and university collaborations, development of related research and contracts associated with the international ITER fusion project. So far, UK companies have won more than €400m worth of contracts directly related to ITER. The European management of contributions to the ITER project is managed by 'Fusion for Energy' F4E, based in Barcelona, and the UK also makes a small contribution to the annual costs for the operation of F4E of around £220k pa, funded by EPSRC outside of the fusion grant that UKAEA receives.

With additional UK funding outside of the EPSRC grant, UKAEA has been able to build its own portfolio of related facilities at Culham, including the Materials Research Facility, and RACE remote applications in challenging environments facility, both of which will bring in additional funding to the UK through EU and other contracts and research grants. Both also support the growth of future fission capability in the UK. Contracts worth over £100m from the EU / ITER have already been secured for the UK for joint work for RACE and industry.

EU support of the fusion programme is crucial to the continued development of this high technology programme within the UK, with the ultimate aim of demonstrating low-carbon electricity by the middle of this century. UKAEA aims to take a leading role in the development of the EU demonstration reactor DEMO. The EU has worked hard over the last few years to ensure that all European fusion research is directed towards a common fusion roadmap to deliver electricity (managed under a contract between the EU and the EUROfusion consortium of member states). The UK has a real influence on this EU research strategy through membership of the key committees and strategic bodies. We are also able

to have a say, through UK MEPs, on policy and funding discussions within the European Parliament.

Fusion is an international endeavour. To realise its full potential requires the input from multi-national programmes and facilities. It would be unrealistic to think that a single country could fund and deliver fusion electricity by the middle of the century on its own, although it should be noted that China has expressed such ambitions. By participating in these international programmes, the UK benefits not only from knowledge transfer and science and technology knowhow, but also in secondments to and from other countries, expertise and peer review that basic research requires to succeed. Full involvement means that the UK has excellent unhindered access to facilities, leading science teams and the R&D developed, including JET and ITER. Indeed, EU funding and collaboration is essential to sustain the world leading capability of Culham and to position the UK in the technologies of the future fusion (and fission) economy.

In answering the following questions we have concentrated on magnetic confinement fusion and related research funding from the Euratom programme rather than the total EU funding of research and development in the UK which is part of the wider Horizon 2020 research programme. We should also note that Research Councils UK (RCUK) are responsible for the overall fusion / fission research programmes as part of the Energy Programme, including research at universities and other organisations and the inertial fusion confinement programme at the Science and Technology Facilities Council and collaborators.

Funding

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

> The EU currently provides over £50m per annum to the UK for the operation of JET. This is supplemented by research funding from the EUROfusion programme of around £5m pa. Additional funding to STFC and university research groups is also provided for both magnetic and inertial confinement fusion research. Due to the location of JET in the UK, we receive larger EU fusion funding compared to other EU member states. The prominent status of the Culham Centre for Fusion Energy in the wider fusion community also ensures relatively high EUROfusion funding.
>
> The table below presents a comparison of national research funding (not including JET, 2013 data) showing the relatively small size of the UK programme. However the output in terms of journal papers remains high. All figures are approximate, as fusion research is usually part of a larger research organisation. The table also shows the 2015 EUROfusion contribution for each organisation, confirming the relatively large contribution to the UK in comparison to the national programme.

	2013 national research funding (compared to UKAEA)	2013 Journal Papers	2015 EUROfusion funding
UKAEA (not including JET)	1	446	€8.7m
Max Plank Institute (Germany)	4.7	696	€17.9m
CEA (France)	2.1	302	€8.1m
ENEA (Italy)	2.1	198	€9.4m

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

As noted above, the UK contributes 1/8th of the operational costs of JET as host nation, plus a small contribution of around £220k pa for the operational costs of F4E, the European joint undertaking for ITER. Under the EU fusion research organisation, all European parties to EUROfusion use national funds to co-fund the communal research programme, whether it is conducted in in the UK (e.g. on JET and MAST) or elsewhere in Europe.

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

In the new EU arrangements in place since 2014, but present in a reduced form some years earlier, the EUROfusion funds are allocated amongst the various fusion research topics in the EU by technical experts, including UK members. The management is both effective and efficient with continuous technical assessment and optimisation by the EU research programme leaders. The overall programme and sum allocated by the EU Commission to fusion (under EURTATOM) was assessed by independent experts selected by the Commission, and they performed a very rigorous review. This is a generally similar approach to that used in the UK.

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

See our introduction above. The 7th Framework and H2020 programmes have a major benefit in allowing substantial and prolonged joint projects between research organisations like UKAEA and industry, cutting across different fields, and thus transferring knowledge and stimulating innovation. UKAEA hasn't so far benefitted from ERC directly, but some fusion researchers in the UK have received ERC fellowships, and this highly competitive system with multi-year grants appears to be a very useful tool to allow individual researchers to have important research freedom.

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

Our full membership of the EU allows us full access to the relevant EU organisations and strategic bodies such as Euratom and EUROfusion. It also gives us access to international collaborations with other ITER counties and organisations, which would be more difficult if we were not fully collaborating in EUROfusion for example. In general we do not need separate bilateral arrangements with EU member states – the central system removes the need for that bureaucracy, but there is no impediment if we do need bi-lateral agreements. In some specific cases, such as diagnostics for the MAST project at Culham, bilateral arrangements have been put in place with other countries. These are made stronger by our membership of the EU programmes.

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

As noted above, EU membership levers significant funds for UK companies due to the operation of JET. In 2014/15 this was of order £45m, of which £17m was with SMEs. There are also significant contracts awarded for ITER and associated work. Much of this is from manufacturing industry but there are specific R&D opportunities such as robotics, additive manufacture and superconducting magnets. Private investment in fusion is small at this point, but will rise as we work towards commercial operation in the middle of this century.

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

The obvious example is ITER where the UK has input to the design and construction, but can also influence the exploitation of the facility, which is critical for rapid progress. The UK's experience from operating JET will be key. The UK has influence on a JET-scale superconducting fusion facility being constructed in Japan, which will support and complement ITER and JET on the path towards a demonstration fusion reactor. The UK will also have substantial influence on the development of this demonstration reactor (DEMO). These opportunities only arise because of the UK's deep involvement in the EU fusion programme and its organisation. There do not appear to be any major restrictions to UK involvement in other international facilities (e.g. China) – on the contrary, the EU often provides smoother paths for such collaborations.

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

Most movement is by researchers employed elsewhere in the EU, e.g. visiting researchers, often on prolonged visits, sometimes several years. This free movement is vital to the research progress, and is much better than the situation with non-EU countries where lack of free movement is a serious inhibition. UKAEA and the EU are currently considering the internationalisation of the JET programme at Culham, which will increase collaboration between UK and other non-EU states.

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

EU membership does not inhibit research with other countries outside of the EU as far as UKAEA is aware.

Regulation

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

No comment.

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

No comment.

12. How is the innovation landscape affected by EU membership?

In the fusion research area innovation mainly comes from the pressure to progress, peer pressure, and ideas that emerge from a large and diverse community. The EU has a declared fusion mission with a quite ambitious timescale which in principle provides a good environment for relevant innovation. Membership of the EU has had a direct positive impact through the funding of major facilities such as JET and associated projects around Europe. A number of smaller facilities and organisations would not have been viable without EU funding and their continued participation leads to direct benefits to the overall fusion community by widening the pool of available expertise.
Opportunities for innovation at ITER are highly influenced by the EU programmes, and management of contributions to the ITER project by 'Fusion for Energy' F4E, based in Barcelona. UK companies have gained over €400m worth of contracts in this innovative project.

Scientific advice

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

No comment.

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

UK being a full member of the EU scientific structure does allow more influence on major activities, notably ITER and JET at the moment. As noted in the introduction, the UK has a very unusual breadth and depth of experience and competence in fusion as a future energy source, and has the potential to have major influence on EU research strategy in the field, as long as the UK is fully engaged in the EU fusion programme.

20 November 2015

UKspace – Written evidence (EUM0028)

Introduction

a. UKspace is the trade association of the UK space industry, with a mission to promote the best commercial, political and public environment for the sector. UKspace is sponsored jointly by ADS and techUK encapsulating both the upstream and downstream nature of the industry. Details about what we do and of our membership are available on our website: www.ukspace.org/

b. The UK space sector is a major success story for the UK economy. It has enjoyed a compound annual growth rate of 8.6% since 2008/09, while exports in 2012/13 were estimated at £3.6bn. 31% of turnover from the UK space economy is generated from exports, more than twice the export share of the UK as a whole.

c. Average UK space economy output per worker is 3 times higher than the UK average, while the ancillary services sub-sector has the second highest labour productivity (£274k) behind only the very capital intensive mining and quarrying sector. In addition, the space sector also has significant downstream benefits in terms of providing revenues and services for telecommunications, satellite navigation, broadband and weather forecasting, for example. This is all achieved on an investment rate of just 0.020% (on average) of GDP.

Funding

Q1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

1. The EU provides substantial funding for space research and innovation. In the 2014-2020 Multi-annual Financial Framework (MFF) Horizon 2020 includes €1.4B earmarked for space[729]. In the 2014 round of submissions for direct funding under that part of H2020, UK participants were successful in winning €16.9M, representing about 20% of the total awarded. Funds from the space part of H2020 are also directed towards research and innovation indirectly through agencies such as the European Global Navigation Satellite System Agency (GSA) and the European Space Agency (ESA) but a breakdown of UK participation in those activities is not available. In addition to the funding explicitly earmarked for space research and innovation, many other elements of Horizon 2020 may involve the use of space technologies and services e.g. in health, security and intelligent cities.

[729] The 2016-2017 work programme is at http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-space_en.pdf

2. However research and innovation opportunities in Horizon 2020 for the telecommunications satellite sub-sector of the space business have been limited despite this being the side of the industry that generates the most commercial sales, jobs and exports.

3. Outside Horizon 2020, the EU has budgeted €6.3B for the *Galileo* satellite navigation programme and €3.8B for the *Copernicus* surveillance programme in the current MFF. Both of these programmes involve technology development and innovation and we therefore consider that they are relevant to this inquiry. The UK proportion of these activities is not known in detail. At a high level we understand that the UK has won about 20% of the Galileo work (well above our GDP proportion), including lead roles in the research-intensive cyber-security aspects of the programme.

Q2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

Q3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

4. UKspace welcomes the availability of research funding from the EU as a complement to other funding mechanisms. However some members have stated that they struggle to convince senior management regarding submission of Horizon 2020 (or FP7 in the past) proposals because of the difficult administrative process and the long timescales that are incompatible with the speed required for developments for the commercial market. The low success rate of Horizon 2020 proposals (always less than 50% and frequently much lower) also discourages companies from investing time, money and resources on them. Two stage competitions like those operated by InnovateUK may help to combat the latter problem provided that this does not add significant additional time to the process.

5. As concerns space R&D, the EU channels large parts of its funding for specific programmes through the European Space Agency (ESA), which is an entirely separate body from the EU and has well proven mechanisms for efficient management and for promoting industrial competitiveness. The UK also uses ESA for much of its space R&D[730] as well as conducting smaller national activities through UK Space Agency and InnovateUK competitions.

Collaboration

Q4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

6. As mentioned in the response to Q1, EU research and innovation programmes include Galileo and Copernicus both of which have the potential to spawn large applications programmes. EU programmes allow relationships to be developed with stakeholders in downstream application areas. EU funding also operates in different financial cycles to

[730] The UK Space Agency 2015-16 Corporate Plan shows that 77% of its funding goes to "international subscriptions" within which the large majority is for ESA

ESA and UK national programmes thus helping to improve the sustainability of research teams.

Q5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

7. One of the benefits of Britain's EU membership is that non-EU organisations (from USA, Japan, etc.) often find UK organisations attractive for collaboration <u>because</u> of our EU membership.

8. The UK collaborates closely with key EU partners in overseeing the security aspects of the EU Galileo satellite navigation programme. Britain and France are recognised as the most competent EU member states as concerns the security issues raised by Galileo and other member states generally accept Anglo-French leadership in such matters[731]. The fact that both the UK and France are EU members facilitates this arrangement because both countries are represented at all the levels of governance involved, up to and including the EU Council. It is doubtful that EU member states would permit the UK to have such a central influence on Galileo security matters if the UK were not an EU member, with consequences (mostly negative) for UK security and business.

Q6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

9. The large scale of the EU market makes it attractive for British and foreign investors to invest in the UK in the R&D phase of programmes to address that market. UK-based organisations have shown substantial interest in the EU's market-oriented R&D such as the Galileo and Copernicus programmes. EU space programmes help to strengthen the UK space sector and make it more competitive in world markets. SMEs and other parts of the UK space supply chain benefit from these EU programmes by gaining greater access to export markets.

Q7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

10. The EU Galileo and Copernicus space programmes are putting infrastructure in place that will provide global positioning (Galileo) and environmental (Copernicus) information services. UK organisations have had the opportunity to play a full part in the creation and operation of these systems because of UK membership of the EU. The benefits to the UK are expected to exceed the costs many times over – both directly by re-sale of the

[731] Britain currently chairs the Security Accreditation Board which is the highest level political forum dealing with Galileo security.

systems and services world-wide, and indirectly by virtue of the value added services that Galileo and Copernicus information will underpin.

Q8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

11. Much of the UK's best research and innovation takes place in the private sector and the same is true in many other EU countries. Since the formation of the EU and its predecessor organisations, the private sector has made enormous investments to adapt to the idea of a common market. The free movement of staff between a company's sites in EU countries has become a normal part of research and innovation. Many companies in the sector rely on recruitment of a proportion of their staff from other EU members states as there are often a lack of suitable applications from candidates with relevant qualifications in STEM subjects.

Q9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

12. See our response to Q5

Regulation

Q10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

13. Security, not least cyber-security, is an increasingly important aspect of many EU research and innovation programmes. The EU broadly adopts member state arrangements for controlling security and often looks to the UK and France to take the lead (see our response to Q5). This sensible arrangement has given UK (and French) organisations an opportunity to lead in the associated research and innovation.

Q11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

Q12. How is the innovation landscape affected by EU membership?

14. As is evident from responses to the earlier questions, the innovation landscape for space is intimately connected to EU research, development programmes and procurements. The UK space industry's competitiveness vis-à-vis other European member states could in this context be significantly affected if the UK were to be absent from EU space policy formulation and procurements such as Galileo and Copernicus; both are elements of developing critical infrastructure, for Europe in particular, but also with potential relevance to other parts of the globe.

15. Furthermore, innovation is frequently a product of engagement and partnership with other organisations from diverse backgrounds, which participation in such programmes with other EU member states and organisations helps to facilitate.

16. Note also that many of the larger players in the industry are multi-nationals headquartered outside the UK. Their R&D is largely concentrated on sites located in EU member states. The UK's membership of the EU strengthens the case for their inward investment in UK R&D, without which such R&D might well be undertaken elsewhere.

Scientific advice

Q13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

Q14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

17. UK scientists working in the private sector are able to directly inform and influence EU policy through the relevant contracts that UK industry wins. Contracts include the definition of future EU programmes. This has been the case for current research-intensive programmes such as Galileo. An example of a future EU programme on which UK private sector scientists are exerting influence is the proposed GovSatCom satellite communications service[732].

20 November 2015

[732] See for example p92 of House of Commons European Scrutiny Committee 28th Report of Session 2013-14, pp5-6 of EU Council - Space Renaissance and the more recent EDA Feasibility Study

Universities Scotland, Russell Group's EU Advisory Group and Universities UK – Oral evidence (QQ 62-68)

Transcript to be found under Universities UK

Universities UK – Written evidence (EUM0054)

About Us

Universities UK is the representative organisation for the UK's universities. Founded in 1918, its mission is to be the voice for universities in the UK, providing high quality leadership and support to its members to promote a successful and diverse higher education sector. With 132 members and offices in London, Cardiff (Universities Wales) and Edinburgh (Universities Scotland), it promotes the strength and success of UK universities nationally and internationally.

The UK Higher Education International Unit (IU) represents all UK higher education institutions internationally and delivers a number of programmes and initiatives to support the development and sustainability of the UK HE sector's influence and competitiveness in a global environment. It supports the sector's engagement in European Union and Bologna Process policy debates. The IU is funded by the Higher Education Funding Council for England, Higher Education Funding Council for Wales, Scottish Funding Council, Department for Employment and Learning (Northern Ireland), GuildHE, Universities UK, the Higher Education Academy and the Quality Assurance Agency for Higher Education. It is located at Universities UK.

Executive summary

- Membership of the European Union supports the UK's universities, and its science and research base as a whole. The UK is highly successful at securing funding under the EU's programmes to support research, and receives disproportionately large proportions of this funding. Out of 27 other member states, only the Netherlands receives a greater proportion of this funding when adjusted for GDP or population.

- The science and research base in the UK is more reliant upon funding from the EU, and from inward investment from EU countries, than many other countries.

- However, just as important as this funding support are the opportunities for collaboration (both bilateral and multilateral) and researcher mobility which are facilitated by our membership of the EU. Both international collaboration and researcher mobility are drivers of quality in research.

- The focus of EU programmes on collaboration and mobility mean that they are distinct from, and complement, the support for research that is provided by the UK government.

- The EU facilitates the establishment of international research infrastructure, and the UK's membership of the EU grants UK-based researchers preferential access to this infrastructure. This allows research to be based in the UK which, if we were to lose this preferential access, may move overseas.

- The strength of the UK's research sector means that it attracts researchers from overseas. Freedom of movement within the EU is a significant competitive advantage to the UK research base, and through that, to the UK's economy.

- Careful consideration should be given to the likelihood that even if the UK were to leave, the EU would continue to influence the UK as a result of (a) the fact that the UK would be likely to seek associate status to the EU's research programmes and to continue to have access to the single market and (b) the influence of the EU on the European global region.

- If the UK were to leave the EU, the UK would lose the ability to shape and influence the EU's policies which would continue to affect it. However, the EU would lose the UK's consistent advocacy for an EU focussed on supporting a modern knowledge economy in Europe, which could have significant impact on the UK's economy regardless of our membership of the EU.

Funding

Q1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

1. The EU contributes very substantial amounts of financial support to the UK's science and research base, and the UK is one of the largest recipients of EU funding for science and research. It receives funding which is disproportionate to the size of its economy – a measure on which the UK outperforms all EU member states bar the Netherlands in spite of having the second largest economy in the EU – and even compared to the strength of its (world-leading) research sector. The UK is also more reliant upon EU sources to support its overall research investment than most of its EU competitor countries.

2. The primary vehicle for EU funding of science and research are the Framework Programmes for Research and Development. The seventh such Framework Programme (FP7) ran from 2007-2013, and its successor (Horizon 2020) is running from 2014 until 2020. Membership of the European Union grants automatic eligibility for UK institutions to apply for funding under these schemes.

3. This section focusses on the funding received through the Framework Programme, and in particular through the entire cycle of FP7 – the significant back-loading of funding in each Framework Programme means that looking just at the first year of operation of Horizon 2020 would be misleading. That said, the UK continues to lead in Horizon 2020, having so far received €1.26 billion.

4. Table 1 details the total funding received by the UK through FP7 across the entire cycle of that programme (2007-2014). As funds are not evenly distributed within the cycle, this gives the best overview of overall levels of funding.

Table 1: FP7 funding and other demographic and economic factors, UK compared to EU28

	UK	EU28	UK as a percentage of EU28
FP7 Funding[733]	**€6,940 million**	**€40,262 million**	**17.7%**
Population[734]	**64.77 million**	**508.19 million**	**12.7%**
GDP[735]	$2,484 billion	$17,934 billion	13.8%
R&D Spend (GERD)[736]	$37,633 million	$325,744 million	11.6%

Notes:
- GDP and GERD figures relate to 2013, the final year of FP7
- Population figures relate to 1 January 2015
- GDP is expressed in 2015 prices
- GERD is expressed in 2015 prices, adjusted for purchasing power parity
- FP7 funding is expressed in nominal prices

5. The table shows that the UK benefits disproportionally from EU research funding, securing significantly more funding through FP7 than would be suggested by its population, its GDP, or its gross expenditure on research and development. The latter indicator in particular suggests that FP7 funding is a significantly more important stream of funding to UK research and development than is true for many other member states.

6. The UK has, alongside some other member states, consistently argued for FP7 funds to be distributed primarily on the basis of excellence, and the UK's excellent and highly internationalised research base has therefore put it in a strong place to bid for and be awarded funding through the EU. Indeed, there are more bids for funding through FP7 from the UK than from any other nation. Given this extensive engagement with the system, we also have a strong success rate (5th out of 28). Within the UK, the higher education sector does exceptionally well in securing funding on the basis of excellence. Over 70% of the total funding received by UK institutions under FP7 was awarded to higher education institutions.

7. The UK's comparative strength remains even when the UK is compared to other countries with similarly highly developed research bases. Table 2 shows funding received by UK grant-holders across the cycle of FP7, compared to three comparator countries which together make up the four largest recipients of FP7 funding. The figures are then

[733] European Commission (2015), Seventh *FP7* monitoring report https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report.pdf#view=fit&pagemode=none

[734] [2] Eurostat news release 124/2015, first population estimates. http://ec.europa.eu/eurostat/documents/2995521/6903510/3-10072015-AP-EN.pdf/d2bfb01f-6ac5-4775-8a7e-7b104c1146d0

[735] OECD (2015), Gross domestic product indicator

[736] OECD (2015), Main science and technology indicators

indexed relative to total population, GDP, and Gross Expenditure on Research and Development with the UK as the benchmark in each case.

8. Note that the comparator countries have been selected as those relevantly similar to the UK as major recipients of FP7 funding, rather than as representative of the EU as a whole. On a 'per population' basis or when compared to GDP, the UK outperforms every other EU member state bar the Netherlands.

Table 2: FP7 funding indexed by demographic and economic factors, for UK and other leading research nations

	DE	UK	FR	IT
Total funding through FP7 (€ million)[737]	7,136	6,940	5,143	3,590
Index of total funding through FP7 (UK = 100)	**102.8**	**100**	**74.1**	**51.7**
Population, millions[738]	81.17	64.77	66.35	60.80
Index of population (UK = 100)	125.3	100	102.4	93.9
Index of total funding through FP7 adjusted for population (UK = 100)	**82.1**	**100**	**72.3**	**55.1**
GDP, 2013 ($ billion)[739]	3,554	2,484	2,478	2,109
Index of GDP (UK = 100)	143.1	100	99.8	84.9
Index of total funding through FP7 adjusted for GDP (UK = 100)	**71.9**	**100**	**74.3**	**60.9**
GERD, GDP ($ million)[740]	96,069	38,116	53,493	24,835
Index of GERD (UK=100)	252.1	100	140.3	65.2
Index of total funding through FP7 adjusted for GERD (UK = 100)	**40.8**	**100**	**52.8**	**79.4**

9. Finally, the Committee has also asked for information about the funds received from the EU relative to the UK's research strength. The following table compares FP7 funding adjusted for an index of citations of research, which is weighted by the field of research. It should be noted that that UK is particularly strong on this measure of research

[737] OECD (2015), Main science and technology indicators
[738] Eurostat news release 124/2015, first population estimates. http://ec.europa.eu/eurostat/documents/2995521/6903510/3-10072015-AP-EN.pdf/d2bfb01f-6ac5-4775-8a7e-7b104c1146d0
[739] OECD (2015), Gross domestic product indicator
[740] OECD (2015), Main science and technology indicators

strength, with outcomes on a 'per spending' basis very significantly higher than our competitors. Using alternative measures of research strength may well result in the UK appearing to receive a greater share of EU research funding when adjusted for research strength.

Table 3: FP7 funding by nation indexed by research strength (field-weighted citation impact), UK and other leading research nations

	DE	**UK**	**FR**	**IT**
Field-Weighted Citation Impact (FWCI)	1.468	1.614	1.364	1.476
FWCI Indexed (UK = 100)	91.0	100	84.5	91.5
FP7 funding adjusted by FWCI (UK = 100)	113.1	100	87.7	56.6

10. The long-term impact of the last Framework Programme for Research and Innovation (FP7) was estimated at 900,000 additional jobs and a growth in GDP of nearly 1% across the EU. If this estimate is accurate, this growth would equal the total expenditure of all other EU budget lines combined.[741] [742]

11. Finally, science and research projects also receive direct and indirect funding through other means, in particular through Structural Funds in relevant regions of the UK (the level of ERDF and ESF income gained by UK universities has risen steadily over the last five years, surpassing £100 million in 2012–13; compared to just under £43 million in 2008–09), the Erasmus+ higher education programme and European funding programmes and calls for proposals for higher education and international activity from a variety of different EU sources (the UK HE sector secured £55m from these in 2014).

12. Universities UK has consistently argued for a greater proportion of the EU budget to be used for EU research and science investment, fostering sustainable growth and a European knowledge economy in the process

Q 2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

13. A definitive figure for the financial contribution from the UK to the EU to support particular streams of activities is difficult to give, as member states to not generally pay for specific budgets within the EU. Further reasons are given by the Government's Balance of Competences review:

    The difficulty of calculating a definitive answer is explained by a number of factors, including: the fact that the UK does not pay in to a separate 'EU research budget' but into the overall EU budget; over the course of a seven year budget period, annual

[741] European Commission (2011), Impact Asessment Horizon 2020.
[742] EU total expenditure minus FP7 spending is 0.95% of GNI. European Commission (2011), EU Budget 2011.

receipts for different budget streams can vary widely; and rules surrounding the UK abatement mean that, depending on which other countries and which types of projects are funded by the EU, the UK may receive proportionately more or less money back.[743]

It goes on to say:

However, the CBI observes 'the UK now receives a proportion of funding which is greater than would be implied by the ratio of its GDP to the aggregate GDP of the EU as a whole'. Indeed only the Netherlands receives a higher proportion relative to its GDP or population size.

Q3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

Administrative overheads

14. While bureaucracy has been concern regarding EU programmes, there is generally a recognition that the EU Framework Programmes fund, for the most part, collaborative activities. As such, they differ fundamentally in their nature and administration from domestic UK science funding, and direct comparisons of administrative costs should be made only with caution.

15. In terms of the administrative burden on institutions receiving grants, the fact that the EU makes collaboration simpler through providing a single framework and standards for collaboration goes some way to mitigating the any additional administrative burden. As such, they fundamentally differ in their nature and administration from domestic UK science funding. The benefits of the collaborative nature of these grants outweigh the minimal extra administrative cost from an institutional perspective.

16. The UK is heavily involved in decision-making and advisory processes on research and Framework Programmes, through the Research Councils, the UK Research Office and Universities UK making official representations, and individual institutions and academics sitting on expert groups and serving as evaluators. While representations have been by these organisations and others about (for example) the complexity of accounting procedures required of recipients of research funding from EU sources, there is recognition that progress is being made in simplifying and streamlining these.

17. European Research Council (ERC) grants and Marie Skłodowska Curie researcher mobility grants are individual grants awarded to the researcher and carry an administrative burden similar to that of UK domestic grants.

[743] HM Government (2014), Review of the Balance of Competences between the United Kingdom and European Union: Research and Development, paragraph 3.17

18. It should be noted that if the UK were to leave the EU but negotiate associate status for the purposes of its research programmes, any involvement in programmes would still require adherence to their administrative requirements – we would simply have lost the opportunity to shape these requirements, and to ensure they are effective in a UK context.

Strategic policymaking

19. At a strategic level of policymaking, the role of the UK in shaping EU policy (including the budget allocated to research and development, and the principles behind the allocation of these resources) should be considered. Whether or not the UK is a member of the EU, decisions made by the EU will have a profound effect upon the UK. The good governance of the EU, and its economic prosperity, is therefore in the interests of the UK in either case.

20. In the area of science and research, the UK has been a consistent advocate of both increasing investment in research and development and that this funding be predominantly distributed according to excellence. Both of these factors are important contributors to long-term economic growth, in particular in the context of the EU and Member State's objective to encourage a European 'knowledge economy'.

21. If the UK were to leave the EU, the UK would no longer be represented on the European Council, nor in the European Parliament, and its voice would be lost. The loss of the UK's voice in the EU could result in a move towards the use of more redistributive principles as the basis of research investment at EU level. This would have a profound impact on the effectiveness of the very considerable funding which the EU invests in science and research, and the further investment which is leveraged by it, and would impact on the economic prosperity of the region as a whole as well as make participation from outside the EU – assuming this was still open – less attractive.

Collaboration

Q4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

22. Cooperation and collaboration among researchers are set out as one of the aims of EU research policy in the Treaty on the Functioning of the EU (TFEU).[744] EU research funding contributes to the UK higher education's excellence and global profile through providing a number of opportunities and positive impacts which in many cases differ from those provided by national sources of funding: it provides access to large, transnational, multi-disciplinary projects as well as access to collaborative networks, it offers flexible funding for areas that national funders might not support (Research Council funding for collaborative research is bi-lateral) and also offers large-scale opportunities for industrial participation enabling universities to do research closer to market. As such, it is a source of funding that is more accessible to a wider range of institutions, thus playing a

[744] Article 179 (2) (ex Article 163 TEC) TFEU

significant role in supporting UK research capability. FP funding therefore represents a substantial investment in economic growth and enables international collaborations in a form rarely offered by domestic funding, increasing not only the excellence of the research itself but also the international reputation of our researchers and institutions.

23. Cross-border research collaboration exerts a positive influence on the quality and reach of research conducted by UK researchers. Papers with at least one international author also have greater reach and higher rates of citation than those with only domestic authors. According to one standardised index where 1.0 is the global average 'citation impact' of a paper, papers resulting from international collaboration (ie those with both UK and non-UK authors) have an average citation impact of 1.72, compared to 1.21 for those with only UK authors.[745] This could be a result of the increased quality of research, increased reach, or (most likely) both factors.

24. Horizon 2020 and other programmes aimed at fostering research collaboration have a significant positive impact on the ability of university researchers to undertake such collaboration: they directly incentivise such behaviours, and contribute towards allowing a critical mass of such collaboration to take place, on which further collaboration can be predicated. It is worth noting that the UK was the first or second most collaborated-with country under FP7 for 23 out of EU27/28 member states.

25. Researchers who have spent an extended time abroad tend to be significantly more productive in terms of articles published than those who have remained in the UK. The UK's leading position in terms of research efficiency is attributable, therefore, at least in some part to its effectiveness in attracting productive and internationally mobile researchers, and providing opportunities for mobility amongst UK-based researchers.[746]

26. The ERC, which provides individual grants allocated on the basis of excellence, is particularly valued in the UK. Indeed, the UK hosts the highest number of ERC grantees – almost 1,000, which is 22% of all grantees – and has won over 20% of ERC grants since 2007. The ERC Starting Grant, for example, a 'fellowship' fund for early-career researchers, has proven a highly effective alternative to smaller and fiercely competitive national schemes, allowing successful HEIs to retain a larger proportion of the most talented academic researchers.[747] The ERC reflects the UK's approach to science funding and has become a beacon of excellence across Europe. It has thus stimulated excellence in other countries with long-term benefits in terms of collaboration for the UK.

Q5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

[745] Adams, Jonathan, 'The Fourth Age of Research'. In *Nature*, 30 May 2013, Vol. 497, p559
[746] Department of Business Innovation and Skills: 'International Comparative Performance of the UK Research Base – 2013'
[747] 'The impact of the EU RTD FP on the UK' 2010, p87-8

27. Membership of the EU fosters bilateral and multilateral collaboration between the UK and other EU member states in particular, but also promotes collaboration with non-member states. Receipt of funding is often reliant upon a research programme involving some aspect of cross-border collaboration. It therefore is a direct stimulus towards greater research collaboration, but also requires the establishment of protocols and standards jointly held between EU countries that can form the basis of further bilateral and multilateral collaboration.

28. While membership of the EU automatically qualifies institutions in that member state as eligible to bid for funding, and allows the member state to shape and influence the programme's form and content, it is possible for non-member state countries to associate themselves with collaborative research programmes, and for collaboration with institutions in 'third countries' where there is demonstrated value in their participation in the programme. The EU research programmes can therefore act as a stimulus for collaboration with non-member as well as member states - FP7 involved participants from as many as 170 countries.

29. A large proportion of the UK's research collaboration is conducted with researchers based in other member states of the EU. The USA is the UK's main collaborator, in terms of number of co-authored papers, but seven of the UK's top ten, and 13 of our top 20, 'most collaborated with' nations are other EU member states. Given the geographic proximity and the relative strength of the research base of many EU countries it is likely that extensive collaboration would be vital to the success of UK research, but would be less effective, or more difficult, without the UK's membership of the EU.

Q6.How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

30. Membership of the EU will contribute to a variety of factors which will have an effect on private investment in research and development in the UK, many of which cannot be reliably estimated. However, two factors will have a substantial positive effect:

    a. The substantial research funding received by UK institutions from EU sources will leverage substantial additional private investment: research undertaken by BIS estimates that for every pound from public sources invested in research raises private investment by between £1.13 and £1.60.[748]

    b. Participation in the single market increases the potential rewards for private investment in research and innovation, provides greater access to innovation developed elsewhere in the EU, and provides conditions which encourage the growth of research-intensive companies. Recent analysis from the Bank of

[748] BIS (2015) What is the relationship between public and private investment in science, research and innovation? A report by Economic Insight ltd

England explores this in some detail, as does research commissioned by BIS and DIFD.[749] [750]

31. The UK is one of the most attractive countries in the OECD for foreign direct investment (FDI), and much of this investment comes from other EU countries. Evidence suggests that in 2013, EU countries accounted for £453 billion of the stock of inward Foreign Direct Investment into the UK, 46% of the total. This compares with 27% from the US and 27% from other countries[751].

32. Investment from EU public and private sources in university research accounted for nearly 16% of all UK HEIs' research income in 2013-14; and since 2004-05, UK universities' research income from EU member countries (from public and private sources) has increased by 169% in real terms, compared to 102% for investment from non-EU countries.[752]

33. It is difficult to give an exact figure for the proportion of this inward investment that is a result of the UK's membership of the EU. However, it is likely that the UK's membership of the EU is a significant system-wide stimulus for investment from both other EU member states and non-EU countries who wish to access the large European market. Leaving the EU would therefore create a risk of critically undermining this very substantial FDI, and the support it gives to our research base and economy.

Q7.How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

34. The sharing and developing of joint Research Infrastructures (RIs) is a core element of European research collaboration. Leaving the EU would impede access to this infrastructure for researchers based in the UK, and as a result make the UK a less attractive place in which to undertake research.
35. The expense of establishing research infrastructure means that it is often unfeasible for individual states acting on their own to do so. International co-ordination in this area is particularly helpful in streamlining and combining resources, and providing a forum for necessary negotiation. Research infrastructure can take the form of, as well as physical infrastructure, constructing and granting access to large datasets. Large datasets in the social science fields in particular are facilitated by the kind of collaboration between governments which the EU is able to underpin.

36. European research infrastructure activity has increased in recent years, with the European Strategy Forum on Research Infrastructures (ESFRI) now coordinating

[749] Bank of England (2015), EU Membership and the Bank of England
[750] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/43314/11-719-uk-and-single-market.pdf
[751] ONS (2015), cited in: House of Commons (2015) *In brief: UK-EU economic relations* (briefing paper 06091)
[752] UKK analysis of 2013–14 data from: Higher Education Statistics Agency (2015) Finance Record 2013-14

investment. The legal framework for European research infrastructure consortia (ERICs), the specific legal form designed to facilitate the joint establishment and operation of research infrastructures of pan-European interest, entered into force in 2009. The UK is leading on one of the first ERICs, the European Social Survey. The ESS ERIC headquarters are located at City University London.

37. Whilst researchers from non EU Member States have access to these infrastructures in principle, those from member states have preferential access. Benefiting from the preferential access allows for streams of research which make extensive use of international infrastructure while being based in the UK, and which therefore contribute to the UK science base. Without treaty-like participation of the UK in these organisations this research would be seriously disadvantaged compared with that based in our European competitors.

Q8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

38. The ability to attract the best researchers is of profound importance to the success of a nation's research base. Citizens of non-UK EU countries perform a very significant proportion of the research and teaching undertaken in UK universities – EU citizens make up 15% of the academic workforce, and significantly outnumber citizens of all other non-UK countries combined.[753] The strength of the UK sector means that the UK is a particularly attractive destination country, and 'receives' very many more leading researchers than it 'sends' overseas. This is a huge competitive advantage for the UK.

39. The EU's competence to create free movement rights within the EU and remove barriers to mobility[754] has been extremely beneficial to the UK research sector in terms of attracting talent, as well as offering UK nationals the opportunity to study and work abroad. This is a field where the EU's competence to create an overarching framework is beneficial, as the multilateral coordination of free movement across European borders would be very much more difficult to achieve.

40. We would note that this competitive advantage is true of the UK's ability to attract researchers from *outside* the EU as it is of the ability to attract researchers from inside the EU, and some aspects of the government's (non-EU) immigration policy remain of concern to the university sector – particularly changes to the student visa regime which have inhibited the ability of UK universities to attract and recruit postgraduate research students from outside the EU.

41. The EU also directly supports researcher mobility between member states. In the stream for researchers, the Marie Skłodowska-Curie Actions, the UK is the top host country for

[753] HESA (2015) Staff in Higher Education
[754] Article 20 (ex Article 17 TEC) and 21 (ex Article 18 TEC) TFEU

mobile researchers: 3,604 researchers have come to the UK under FP7[755] and 3,454 British researchers have also been funded to work abroad since 2007. The budget awarded to UK organisations between 2007 and 2014 was €1086.4 million - the UK received the most funding from MCSA in FP7.[756] For student mobility, the Erasmus programme is of similar importance to the sector.

Q9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

42. The EU's competence in the field of immigration as it relates to third countries has limited impact on the UK given its opt-out of the border and visa aspects of the Schengen Acquis. The UK has also opted out of existing and proposed directives which seek to harmonise some matters of immigration policy related to third country nationals involved in study, research and exchanges within the EU.

43. The Schengen opt-out may make it more difficult for UK institutions to attract non-EU researchers based in a Schengen area institution than might be the case for institutions based elsewhere in the Schengen area, as moving to the UK would require a new visa application. The same considerations apply to student mobility.

44. We would add that changes in recent years to UK immigration policy has not always been helpful in supporting universities to attract the best students (including research students) and researchers from outside of the EU, and that many other EU member states are – contrary to the UK Government – making concerted efforts to increase the number of students they attract from outside the EU.

Regulation

Q10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

45. The division of competences between the EU and its Member States is set out in the Treaty of Lisbon, in effect since 2009. Article 4 of the Treaty on the Functioning of the EU (TFEU)[757] sets out that the EU and the Member States have shared competence in the field of research and space. However, for the field of research in particular, the Article sets out an exceptional definition of shared competence: 'the Union shall have competence to carry out activities, in particular to define and implement programmes; however, the exercise of that competence shall not result in Member States being

[755] European Commission, *FP7 People Marie Curie Factsheet,* June 2013, http://ec.europa.eu/research/mariecurieactions/documents/funded-projects/statistics/eu-countries/marie-curie-actions-country-fiche-uk_en.pdf
[756] UK Research Office, Brussels
[757] See http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:0047:0200:EN:PDF

prevented from exercising theirs.'[758] The TFEU therefore explicitly sets out that the exercise of the EU's competence in the field of research therefore does not limit the competence of Member States; and the latter may take action on their own account.

46. The Treaty of Lisbon introduces a legal basis for the creation of a European Research Area.[759] The European Research Area (ERA) aims at the free movement of researchers, scientific knowledge and technologies. The Treaty further conveys competence on the European Parliament and the Council to 'establish the measures necessary for the implementation of'[760] the ERA under the ordinary legislative procedure.

47. The creation of a world class ERA, which promotes the open flow of information, knowledge and researchers, will allow Europe to compete with major economies such as the US and, increasingly, China. The large-scale, international projects enabled by the Framework Programmes are an essential component of this. The UK higher education sector supports the creation of the ERA. Overall, the UK is well advanced in terms of meeting the ERA objectives. In a number of areas the UK sector has good practice that can be shared at a European level and take a leadership role in the process, in particular in areas such as HR excellence in research and research careers, research integrity and performance-based research funding.

Q11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

48. There are many areas of regulation and law which directly and indirectly impact on universities. Where these are matters over which the EU has competence, the UK must seek consensus with other states in order for reforms to take place. It should be noted that there is little reason to think that, in general, regulation emanating from UK legislative bodies is more supportive of science and research than that emanating from EU bodies.

49. It should further be noted that should the UK leave the EU but wish to retain access to the single market it would in any case still be bound by regulations which relate to this, including some of those referred to below, but would have less ability to influence the nature of these regulations and seek reforms.

50. Given the broad range of areas in which the EU has competences, actions in other areas might affect the area of research and innovation both intentionally and unintentionally.[761] The Commission is divided into different Directorates-General (DGs) and (as is the case between departments in many governments) the coordination between the different DGs in these cross-cutting areas is often not optimal. A particular

[758] Article 4 TFEU (introduced by Lisbon), Ibid.
[759] Article 179 (ex Article 163 TEC) TFEU
[760] Article 182 (5) (ex Article 166 TEC) TFEU
[761] Article 17 Treaty on European Union (TEU), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:0013:0046:EN:PDF

DG will often have established stakeholder groups and it is sometimes difficult to get other voices recognised by that DG.

51. EU Data Protection legislation is one example of EU regulation which impacts on UK research, and one where the EU has power to act in a way that could seriously damage research. The removal of scientific research from the legitimate exemptions for the processing of personal data, as proposed by the European Parliament, would have a substantial negative impact on UK research.

52. A further policy area where EU initiatives could impact on UK research and innovation is copyright. It is the Internal Market and Services Directorate General that is responsible for copyright legislation at EU level, and not DG Research and Innovation. There have been issues in the past of the former DG responding more to its established stakeholders in its policy-making. Overall, all of the Directorates-General involved (Internal Market DG, Research and Innovation DG, Connect DG and Education and Culture DG) need to cooperate more closely to reflect the cross-cutting nature of copyright.

53. Such examples demonstrate the fundamental importance of the UK playing a leadership role in research and higher education and maintaining and increasing its influence in the EU institutions. The UK's membership of the EU, and resulting voice in the European Council and elected representatives to the European Parliament, are fundamental to our ability to shape the future of research, science and higher education in Europe.

Q12. How is the innovation landscape affected by EU membership?

54. The UK has an excellent track record in innovation and attracting investment. The EU supports this through increased incentive to invest in innovative products created by our access to the single market, and the increased opportunity to do so as a result of the access to the research undertaken elsewhere in the EU.

55. Under Horizon 2020, the EU has moved to a more much comprehensive approach in its R&D policy and funding. Horizon 2020 comprises a number of previous R&D-related EU programmes, including the former Competitiveness and Innovation Programme (CIP), employs technology readiness levels in the work programmes and has a very strong innovation focus overall, supporting basic as well as applied research and closer to market actions. EU Structural Funds, which are allocated on a regional basis rather than won competitively, also make an important contribution to local growth and innovation.
56. The Commission under President Jean-Claude Juncker has a particular focus on innovation financing. It has initiated the European Fund for Strategic Investment (EFSI) which aims to mobilise private financing for strategic investments which the market cannot finance alone. It intends to provide support for strategic investments in infrastructure as well as risk finance for small businesses.

57. It is disappointing that the EFSI guarantee is, to a large extent, financed by cuts to the Horizon 2020 budget totalling €2.2 billion. Supporting an innovative economy requires funding throughout the 'innovation cycle'. Fundamental research, which is not funded to

an optimal level by private investment, is the part of this cycle which most requires public funding support and cannot often be funded through loan-based financing. We hope that this will be reflected in the EC's nascent plans for a European Innovation Council.

58. EU Structural Funds, which are allocated on a regional basis and targeted at particular areas deemed as requiring economic development, make an important contribution to local growth and innovation in those areas. The level of income gained by UK universities from schemes under the Structural Fund has risen steadily over the last five years, surpassing £100 million in 2012–13 (compared to just under £43 million in 2008–09). This reflects a growing focus in the allocation of Structural Funds to projects focused on supporting an innovation-based economy in these areas.

59. We hope the EU will use future opportunities – such as the upcoming mid-term reviews in 2016 and the negotiations of the next cycle of programmes and budget – to prioritise investment in areas that boost productivity and show high EU value–added, like research and innovation. The small increase for Horizon 2020 in the 2016 EU budget is an indication that the EU does listen to evidence-based arguments.

Scientific advice

Q13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

60. The European Commission has historically operated in a system very different to that of the single Chief Scientific Adviser (CSA) in the UK, with various bodies and agencies providing scientific advice. We think something akin to the CSA model is generally the most effective model for the providing of scientific advice.

61. Under the last Commission President Jose Manuel Barroso, a CSA post was established and Professor Anne Glover, a molecular biologist from the University of Aberdeen was the first incumbent. The decision by President Juncker not to renew the post was criticised by many in the science community.

62. The Commission under President Juncker has now established a new Scientific Advice Mechanism (SAM), at the centre of which a new seven-member panel will provide vetted scientific advice on policy. SAM is more formal than the prior arrangement, including a formal link to Europe's national academies of science, and it will receive greater resource (€6 million of funding and approximately 15-20 staff). The initial membership of the SAM has recently been announced, and includes Dame Julia Slingo, the chief scientist at the UK's Met Office.

63. UUK supports the development of the SAM, and will work to ensure that scientific advice in the EU continues to play a central role in the determination of policy priorities, and that the UK plays a leadership role in this process.

Q14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

64. As noted in response to other questions, the UK science and research community is actively involved in shaping policymaking in the EU as it relates to research. Membership of the EU allows the interests of UK scientists to be considered in shaping EU policies and funding frameworks. We do not see any way in which EU membership inhibits UK scientists from influencing public policy at EU or international levels.

20 November 2015

Universities UK, Universities Scotland and Russell Group's EU Advisory Group – Oral evidence (QQ 62-68)

Evidence Session No. 6 *Heard in Public* *Questions 62 - 68*

TUESDAY 19 JANUARY 2016

Members present

Earl of Selborne (Chairman)
Lord Cameron of Dillington
Lord Fox
Lord Kakkar
Baroness Manningham-Buller
Lord Maxton
Baroness Morgan of Huyton
Lord Vallance of Tummel

Examination of Witnesses

Professor Dame Julia Goodfellow, President, Universities UK and Vice-Chancellor, University of Kent, **Professor Sir Peter Downes,** Convenor of Universities Scotland and Principal & Vice-Chancellor, University of Dundee, and **Professor Sir Leszek Borysiewicz,** Chair of the Russell group's EU Advisory Group, and Vice-Chancellor, University of Cambridge

Q62 The Chairman: May I extend a welcome to the three vice-chancellors who join us for our second session? We are most grateful to you for coming to give evidence today in our inquiry. We are being broadcast so could I invite each of you to introduce yourselves for the record and, if any of you would like to make a statement at this stage, feel free to do so. Shall we start with Sir Leszek?

Professor Sir Leszek Borysiewicz: I am Professor Leszek Borysiewicz, vice-chancellor of the University of Cambridge. For the record, just because this is about Europe, I am also chair of the Identification Committee of the European Research Council. That is a direct interest. From the perspective of a research-intensive university, the importance of engagement with Europe is paramount. A huge component part of our research income now is coming through the EU and therefore the issues that surround collaboration—dealing with large-scale projects and programmes, as well as the importance of the engagement with Europe to small and medium-sized enterprises as part of the cluster that surrounds Cambridge in relation to economic growth—are key elements that we debate and discuss on numerous occasions. This is a matter of great significance to the university, the region and many of the research-intensive universities of the UK.

Professor Dame Julia Goodfellow: My name is Julia Goodfellow. I am vice-chancellor at the University of Kent and I am currently president of Universities UK. Universities UK has spoken out for Europe because we feel it benefits students by having the best facilities to study and work in Europe; it benefits researchers and research per se; it benefits society as a whole because of the impact of that research; and from the university perspective, it also benefits the local community because of the considerable investment that comes from European students and research funds.

Professor Sir Peter Downes: I am Peter Downes; I am the principal and vice-chancellor at the University of Dundee. I am also the convenor of Universities Scotland and, in that respect, vice-president of Universities UK. I am speaking primarily on behalf of Scottish institutions through that convenorship role.

I am very much in agreement with my two colleagues and the comments they have made, but if I could give a particular Scottish perspective and a Universities Scotland perspective, it is that we recognise it is not universities that will be voting in a referendum but the people of the UK. We believe strongly that it is the role of universities and indeed the leadership of universities to be both the source of informed evidence and the places where informed debate will take place. With respect to the vigilance of Universities Scotland, we are there to ensure that policymakers understand the implications of their preferred outcome within the referendum and the implications for Scottish universities. We will work to secure policy outcomes that ensure the sector's continuing success. In that regard, when we examine the evidence, we find that much of the relationship with Europe described by my colleagues is absolutely vital, in our view, to the future success of Scottish universities.

Q63 The Chairman: From those three opening statements, it is quite clear that, in your view, Europe is a great asset to you as universities, and indeed the written evidence spells out in some detail how you see that. Could you give further detail on how you feel about this relatively minor source of funding, if you look at the totality of research, to universities in this country? How do you see the impact on the scale of funding and the scientific impact? Do you feel that the impact would be much the same if we had associated country status?

Professor Sir Leszek Borysiewicz: First, I would challenge the view that it is a relatively minor source of funding. The total source of funding from all European-based funding is equivalent to having another research council. This is a very significant part of the budget that we deal with. In my own university, 17% of all research funding to the University of Cambridge comes from Brussels now, so our own academic staff, who are free to apply elsewhere, choose to apply to the European Union. It is not an insignificant amount; it is actually a very important component of the budgets we have. Suffice to say we would pay as much attention now—as a university, and as most Russell group universities would pay—to the policy directions and debates that occur in Brussels as we would to what is going on in London.

Professor Dame Julia Goodfellow: I absolutely agree with that. We think about £0.7 billion in funding from the last year of FP7 came to the UK. That compares with £3.6 billion through the Higher Education Funding Council for England and RCUK—yes, I have mixed up devolved administrations—for the UK. It is very significant for us. The impact of it is the ability to collaborate much more easily. It is much harder with national funds—and some of you will remember I did run a research council at one time—to collaborate across Europe with those

funds, whereas with the European funds per se we can collaborate with the best in Europe. That is the impact and the added benefit of those funds.

The Chairman: Presumably, you collaborate with other countries outside the European Union equally successfully?

Professor Dame Julia Goodfellow: Absolutely, but there is not such an easy mechanism. There is no similar mechanism with America, for example, so it is very difficult to get joint funding there. Americans have restrictions on NIH money coming to the UK; there is a little they can do but there are a lot of restrictions. However, this is money for cross-country collaboration so, from that point of view, it is very important and perhaps unique in some way.

Professor Sir Peter Downes: I could add a couple of points which my colleagues have not mentioned. First, numerically, funding from the EU for Scotland is around 13% of the total research funding we receive. Again, I echo the point that it is a very significant figure, equivalent to any of the other major sources of funding we receive. Two specific points: first, what this does is fuel a qualitatively different set of relationships that support our research, and it is those relationships and their connectivity which are vitally important, not merely the numerical value of the research that it funds. We know that collaborative research is more highly cited and therefore more influential and has more impact than research done in isolation. That occurs whether or not that collaboration is with other groups within country—more significantly, internationally—and, very importantly, when some of that interaction involves working with industry and business. European funding promotes all of those things: connectivity and relationships with business as well as international collaboration.

Professor Sir Leszek Borysiewicz: It is very important that we begin to think and try to quantify what we mean by these collaborations, because they are things which are talked about. The best analysis of this we have been able to come across is an analysis of the framework programme 7 that completed before. If you take UK participation in that programme, 100,000 collaborative links were established as a consequence; 18,500 of those were with Germany; France was second with nearly 13,000, and then Italy with 12,000. Consequential on those framework programme 7 links, 10,000 of those links were made within the UK.

The net output of that is also important. If you look at publications where there is international co-authorship, the United States would probably lead that, but four-fifths of all of those internationally co-authored papers included an author from the European Union. These collaborations really matter now; they are an integral part of our academic system, and those collaborations are going to become ever more important as we move forward to try to get into the big, grand challenges that European Union funding will enable to happen. Some will happen bilaterally, but the European Union does enable this to happen much more readily than if we had to have bilateral negotiations with Germany and France, or tri-laterals—even more difficult—with individual member states in this way.

The Chairman: The particular point made to us time after time about the disadvantage of associated country status is that you are not there in the committee to set the agenda. If, with associated country status, you were making a bid to collaborate, even though you had not set the agenda, would you feel that your opportunity to collaborate would be inhibited by associated country status?

Professor Sir Leszek Borysiewicz: I think it would be. If necessary, you need to look very hard at those countries that are involved with associated country status at the moment, such as Switzerland, Israel, Norway and Iceland. There are several of them that hold this state. Colleagues in Lausanne and ETH**,** superb federal universities in Switzerland, at the end of the day, have no capacity to influence the nature of programmes that are undertaken. We have to understand these collaborations are about very big collaborative programmes that will involve scientists of all disciplines—arts and humanities as well as pure scientists—from many countries. It is essential to be at that table to be able to put the priorities that are important, not just to the European Union and to the solution but also to the UK.

Secondly, associated member status carries with it a huge disadvantage, particularly if we think of the outcomes of that research as they will pertain to the capacity of the UK to exploit them. If you are an associated country you have to negotiate that position on intellectual property in a separate way because you do not form part and parcel of those areas. Were we outside the European Union, it is quite likely that we might still be invited because of the quality of research that is undertaken in Europe, but there is no way that any discoveries would then be exploited necessarily in the UK because we would not hold the intellectual property; it would be held by member states. I believe that being there is a huge advantage. Frankly, I would say you may need to talk to ETH and the Rector of Lausanne to hear about the disadvantages they have and, particularly, the problems Switzerland has had as a result of its referendum on migration. I am very much of the opinion that being around that table allows you to have far more influence than we would otherwise enjoy.

Lord Maxton: Would there be a UK to even ask that question? Perhaps Sir Peter can answer that question better than anybody else. Scotland has made it clear that if it votes "yes" to staying in and the rest of the United Kingdom votes "no", Scotland will hold another referendum on independence and may very well leave, which would mean there would be no UK to even apply for associated status.

Professor Sir Peter Downes: There are several layers of speculation in what I believe was a question. I am not quite sure how best to answer it. First of all, you are expressing a view that relates to the position of one party in Scotland, albeit the one that is currently leading, and it is not the only one. I was at a leaders' debate last night held in our university which was quite interesting. That was not the view being expressed even by the Scottish National Party in that particular debate about the policy direction that they would pursue in the event of victory in May in the Scottish elections. There are too many layers of speculation to develop. I am quite sure that Scotland's view about membership of the EU will remain positive, irrespective of its own direction of travel as a member of the Union or as an independent nation.

Q64 Lord Maxton: That leads into the next question. Is there a variation between the universities on EU funding? Do some universities get more and some get less than other parts of the United Kingdom?

Professor Dame Julia Goodfellow: Basically, it depends on where the universities are. The research-intensive universities, as Sir Leszek has said, are very, very dependent on the research moneys coming in, which means the majority of the funding tends to be in London and the south-east because that is where the majority of universities are. At the moment we are talking framework funding. Obviously, there is structural funding, which can go to certain areas with relatively low GDP, which I think would be Wales—we do not have a colleague

from Wales with us—and possibly Cornwall. There is some variation there. However, as regards framework programmes it is basically going to the research-intensive universities. About 15% of academic staff in the UK are actually from continental Europe, but it is higher in the south and south-east; it is 22% at Kent, for example, and perhaps less in the north.

Lord Maxton: In a sense, you have answered the second question, which is, why does this happen, if it does happen?

Professor Sir Leszek Borysiewicz: Can I speak as a Welshman who does pay a fair amount of attention to where Wales sits on this? There is a very strong perspective that universities in Wales do benefit from these funds being made available and, particularly, the Assembly Government do use them in a variety of ways to promote the academic well-being of their institutions. I think our colleagues in Wales would expect us to be able to identify that. Therefore, in the same way it takes a rather more positive view than many other parts of the UK.

Professor Sir Peter Downes: There is an overall regional variation with respect to Scotland versus the UK. We are about 10.5% of EU funding, a little bit less than our success rate for Research Councils UK funding, but still punching slightly above our weight by population. Our figures for EU staff are around 16%, so very much in line with UK figure.

The Chairman: Punching above your weight as a percentage of GDP?

Professor Sir Peter Downes: Yes, absolutely.

Professor Sir Leszek Borysiewicz: If you try to do the correlations, if you look at research-intensive universities by total research income, you will find the proportionality of distribution of European money more or less follows the trends of other sources of income in those universities; there is a very good correlation between that. The regionality we are observing is no different to the regionality we observe in relation to other sources of funding.

Lord Kakkar: If I may go back to Sir Leszek's earlier point about the strong case being made beyond funding for collaborations, networks and access to infrastructure to do major research, is the science community and the university community in the UK making that argument so it is more broadly understood by the population in general?

Professor Sir Leszek Borysiewicz: I think we do make that argument. It is a very interesting argument to make because we have to recognise there are many facilities, particularly physical facilities—I am talking about the physical sciences, which are very dependent on areas—and we have two different types of infrastructure funding available. There is funding by treaty, and I am sure Professor Goodfellow will wish to comment on that, as a member of Council of STFC. For example, CERN is an international treaty; we merely pay a subscription. Then there are EU-related activities, and here I would pick out EMBL with its laboratories in Trieste and Monterotondo; the Grenoble facility that we have; and, ultimately, the large terrestrial telescope being built in Chile.

These are all very dependent and are being built with funds in the European Union. Access to these can be negotiated, as certain other countries negotiate their position from outside the EU, but you would be doing this on a case-by-case basis instead of being able to have the right to engage with the underlying primary programme they undertake, and therefore giving priority to where British scientists believe they should be playing a part. It is a circular argument, but it comes back to the idea that you can influence and engage in that discussion

with a freedom you would not have if you were constrained by individual membership on a case-by-case basis for these facilities.

Lord Kakkar: How do you think those arguments are understood more broadly by the British people in influencing their decision at a forthcoming referendum?

Professor Sir Leszek Borysiewicz: I suspect they are not at all and I doubt whether it will influence their individual decisions. We will make the case, but of all the factors that might influence voting, I suspect the impact of the large terrestrial telescope in Chile is not going to be the vote-winner in a referendum.

Q65 Lord Cameron of Dillington: I would like to go deeper into the structural funding versus the framework programme funding, which you were talking about just now. I am not quite sure what proportion of structural funds is focused on R&D, and maybe you know the answer to that. Bearing in mind structural funds are based on GDP earnings per head of population—and, as you have already said, quite a small part of the UK is in Objective 1 or 5b areas, so we do not get a lot of that—do you think structural funds should be included when considering the overall case for funding? We do very well under framework programme funding—but almost nothing under structural funding.

Professor Dame Julia Goodfellow: I think that is not quite the situation. It is quite hard to find out all the details of structural funding because there are several different tranches/streams of it. Under the research and innovation theme, we believe the UK gets just under 10%[762]—and it is less than that. A lot of structural funding is about providing a basis for research. Where the UK does exceptionally well is where it is a free competition, because of the excellence of our science base. Certainly, when I have been in policy—and I think when Graham has been making policy—that is where we have wanted to be; we wanted to be able to go in and fight for European Research Council funding competitively, and we have not always been looking for the infrastructure funds going to countries that possibly are not as competitive as the UK and some of the leading science nations there.

Professor Sir Leszek Borysiewicz: If I could come in on this area, as chair of the Russell Group EU group which engages in this, we have engaged very closely in discussion with the so-called EU13 countries. These are the countries that receive the vast bulk of structural funds because of their relative positioning. There is a dual debate that goes on in these countries. The structural funds are there for those countries to decide how best to use them in creating the necessary infrastructure, but it is an argument also used within particularly ERC and Brussels to say, "You have been given structural funds to compensate for the fact that you may not have had the infrastructure or the capacity to develop. The choice is yours as a country to decide how you utilise those funds, but now do not come back and penalise the United Kingdom twice over by impacting on ERC and other grants which are given on excellence alone because you have not put that investment from resources made available".

How we view science in the EU13—which is largely central Europe, by which I mean the strip of Poland, the Czech Republic and Slovakia going south and the southern part of Europe, where research is less strong and they are less competitive for ERC funds—and the balance

[762] For clarity, this figure (9.72%) refers to the proportion of the total European Structural and Investment Fund money awarded to the UK for 2014-2020 which has been allocated to the 'Research and Innovation' budget theme.
This budget theme has had €1.60 billion earmarked from a UK total of €16.42 billion.

of how much of structural funds should be used, is a topic of debate with those countries, country by country and member state by member state. Brussels is looking very hard to make sure they are putting in a significant fraction of structural funds in this area, rather relying on trying to interfere with grant allocation programmes by offering preferential treatment in these countries. It is a very important position that Britain takes in those discussions on the ability of those structural funds to be utilised, and the freedom to use them is the freedom of choice of those countries; they therefore cannot turn round and blame the fact they are not receiving as many ERC funds if they have not shown that investment themselves.

This is a major topic within the European Union that goes to the heart of that debate—the competitiveness issue as opposed to the level playing field issue. These are two fundamental principles, and this particular theme often finds itself involved in a contretemps between those two ideals that Europe proposes.

Professor Sir Peter Downes: Just moving from the generic to the specific, in Scotland I can give two examples of ERDF funding and what they achieved: £6.5 million of funding from the ERDF was the essential component that led to Strathclyde University building its technology and innovation centre, which was overall a £90 million project; and there was a very similar ratio of leverage for the development of the Centre for Regenerative Medicine in Edinburgh, with £5 million of initial funding. In the context of our infrastructure environment in the UK, we can find additional sources of funding to match and leverage those ERDF funds in that sort of way. Nevertheless, they are a vital ingredient that leads to these very significant outcomes.

Professor Dame Julia Goodfellow: In England the funds are going to local enterprise partnerships and, again, it is very much up to each of the 39 LEPs to decide where they want to focus their funds. A lot of it has been on very basic infrastructure, not even science or technology based.

The Chairman: Indeed, there is no reason why structural funds should be. Last week we did have some difficulty in disentangling how structural funds and other research funding amount to a total support for research; that is something we need to have more information on eventually.

Professor Sir Leszek Borysiewicz: You will have to do this country by country as to policies, and the implications of individual country allocations for higher education and R&D funding has huge variability when you start looking at the EU13. Indeed, some of the smaller countries now subjugate all of their funding in relation to peer review processes conducted by the ERC. They say, "We will only support those things that have gone into the European Union and those that have failed but have got into the final area are the projects we will support". There are huge changes where the centralised EU processes are seen to be better than national processes in some of the smaller countries of the European Union. It will be a very complex question you are asking.

Q66 The Chairman: It seems misleading, on the face of it, to put the two together and then draw a conclusion as to where we stand expressed as a percentage of GDP. Once you add the structural funds, far from being one of the best for outcomes, we are comparing rather unfavourably with most other member states.

Let me move on to ask about freedom of movement of people within the European Union. How does this affect the science and research community in the United Kingdom? Could you also tell us your views on schemes such as the Marie Sklodowska-Curie research fellowships and the Erasmus Plus exchange programme? How do you see these contributing to research activity in this country?

Professor Sir Peter Downes: I think we all have very similar views. The principle of freedom of movement of people is not only one of the most important principles of the EU but one of the most important benefits of EU membership to higher education in the UK. I have already mentioned that 16% of academic staff in Scotland are from the European Union, and that figure goes up to 23% for research-specific staff. They really are an integral part of our research teams and the talent base for research in Scotland and the UK. In Scotland, 33% of EU country staff are in the STEM subjects. We are disproportionately recruiting people in the important STEM disciplines, which are vital for innovation, to ensure we have that talent base alive and well in the UK.

I have also mentioned the fact that collaborative research is generally more highly cited than research done in isolation. That is a vital part of it as well. In Scotland, around 48% of collaborative research is internationally co-authored, with a substantial fraction involving European co-authors. On student flow, in Scotland 24,000 students come to Scotland currently from European countries, bringing a substantial economic benefit but also enormously enriching our campuses and enhancing the experience of Scottish-based students, who have access to a broader cultural understanding as a consequence of those relationships. I will stop there and let others fill in some of the other gaps, I am sure.

Professor Dame Julia Goodfellow: Sorry, we are going to be very boring. Across the UK 15% of academic staff come from continental Europe; at Kent it is a little bit more, 22%, across all disciplines. We have a lot of European students especially coming to the south-east of England. From the Marie Sklodowska-Curie point of view, we all have examples from our own institutions where we have seen students come and benefit from the excellence of research in the UK. We can also bring in American students, for example, through some of these collaborative schemes, whereby we can have an American student come in and collaborate with Kent and a university in Italy, for example. The UK does incredibly well in European PhD students who want to come and study and have fellowships in the UK. We are a key part of developing young science talent. We are less good at encouraging UK-domiciled undergraduates to go and study in Europe. However, at Kent we call ourselves the UK's European university; we are absolutely adamant that it is good for all undergraduates to have some experience of studying and working overseas. Therefore, the Erasmus programme and Marie-Sklodowska-Curie give them opportunities at different stages to do that.

The Chairman: Perhaps you have a geographical advantage there.

Professor Dame Julia Goodfellow: I need some advantages in this job.

Professor Sir Leszek Borysiewicz: The numbers for the Russell group universities as a whole is that they won 27% of all Marie Sklodowska-Curie grants awarded in the EU, which gives you some idea of the strength of this collaboration. Currently, Russell group universities employ a third more academic staff from EU countries than from the rest of world. Undoubtedly, one of the reasons is the fact they come from the EU, which means you do not

have to get through the tier 2 immigration processes, and therefore they have become more and more attractive as potential areas where we would go to look for world-class individuals.

For undergraduate and graduate students, the numbers for the Russell group are 55,000 EU students, roughly divided 50:50 between postgraduate and undergraduate, and that is despite the issue of fees which have to be paid here and elsewhere. It is roughly 10% of all students within Russell group universities. That has increased, despite fees, from 6% to 10% of the population. We have to understand that, particularly in research-intensive universities, we are not in a parochial United Kingdom game; we are in a global game, and it behoves every single institution that aspires to be research led to recruit wherever the talent is. If that talent is in the European Union and it is easier to recruit it because of issues surrounding immigration, then we have to go there to help to ensure our institutions remain right at the forefront, remain competitive and help not only in the development of the academic area but, as a consequence of these individuals being in the UK, help drive economic development of the regions which associate themselves with research-intensive universities.

For Cambridge, that is very simple and straightforward; our unemployment levels are such that we need trained manpower from overseas and the European Union, particularly Germany and Italy. These are the countries where we are able to recruit particularly well—and, latterly of course, France. We are able to recruit exceedingly well from those countries, and these, I believe, provide a net asset to the UK in the longer term.

The Chairman: If we are in a global game, as clearly we are, and you make a very powerful point there, is there any evidence that this freedom of movement within the European Union inhibits or discourages scientific talent from other countries outside the European Union?

Professor Sir Leszek Borysiewicz: No, I would have said there is very little evidence for that. I cannot give you objective numbers on that, my Lord Chairman, but the impression one gets at every single university I talk to is when you look to recruit staff, you seek to recruit the best you can. The bigger issues for recruitment from overseas are not made easier by the current immigration restrictions, particularly the fact that tier 2 is very full, and we recruit most of our post-docs and PhDs under that tier. That, undoubtedly, causes some ructions.

There are other issues in countries such as India, where the rules we apply are not necessarily different, but there is a perception that we are not a country that is willing to entertain those—but to disentangle that impact from the impact of the EU numbers coming in is extremely difficult to do objectively. Frankly, I would say the most important issue is for British universities to remain right at the forefront and to be hugely competitive in the research they are capable of delivering. It is a case of that US film saying, "Build it and they will come". If we are the place that is seen to be the best, most academics around the world will choose to work in those places where they can best achieve the goals they would want to. At the moment, Britain is an extremely good place to come because our institutions are doing so well in that international perspective.

Professor Dame Julia Goodfellow: From the figures we have we think international academic staff number slightly fewer than those from continental Europe; at Kent, for example, it was 22% EU and 18% international, and it looks to be very similar across the UK. We have had tables out on international universities in the world. Kent and a large number

of us are in the top 100 because of our ability to attract international staff and students. We are a place people want to come and work; they really add to the location.

If I could add to the point you made about Cambridge, if you take a very different city, Canterbury, one in ten jobs, directly or indirectly, are due to the University of Kent alone. Therefore, the investment we get from the EU, modest as it may be compared with Cambridge, adds tremendously to the region. We will definitely have less money to invest in the region if we cannot have access to EU funds and EU students and staff.

Q67 Baroness Manningham-Buller: That is a pretty consistent piece of evidence; thank you very much. I want to pick up on a comment in the Russell group evidence to this Committee. There are a few things you would like reformed, notwithstanding the thorough support of all of you for avoiding a Brexit. In particular, we would like to understand what you would like to see better in the way universities benefit within Europe. If we remained within the EU, what reforms would you particularly like to see which would affect what you are trying to deliver in your universities?

Professor Sir Leszek Borysiewicz: That is an extremely good question. From my point of view, there are three things and they are rather large scale. First, for the European Union to recognise that being cemented to the common agricultural policy, the policy of others, is not good because in reality it has to become a more competitive region internationally, and therefore increasing support for knowledge-intensive industries and activities is absolutely key. A big step towards this was made and supported by the UK Government in relation to the fraction of the total European budget that was committed to competitiveness in the last round of budgetary negotiations within the EU, where I understand we improved the competitiveness from about 9% to 11%.

These are slow gains because you are not going to make substantial changes within Europe around the common agricultural policy. Nevertheless, despite a falling budget, there was this extra emphasis on the importance of competitiveness. That is where Britain has an edge within Europe: to work in that knowledge-intensive set of universities I believe it is important we keep the trade links open. Personally, I believe it is important we subscribe to a single intellectual property around Europe to ensure that intellectual property is not challenged in 28 jurisdictions every time it is made. This has a big impact on small enterprises that have limited budgets to defend the intellectual property they have.

Lastly, there is the need to make sure that British companies, particularly our small and medium-sized enterprises, benefit from simplification of the rules by which they can access European funding. In fairness, if you look at the negative side of Britain's performance, our performance by small and medium-sized enterprises has not been good, and universities are big creators of these enterprises. There is a lot of work to be done to enable that support, so that European Union funding not only benefits the academic institutions but it can genuinely contribute to economic growth in the longer term. Those are the changes I would like to see.

The big challenge, for me, is probably nothing to do with the questions the Prime Minister asked; the overriding question is not the one everyone picks, on migration; it is how you ensure that a 15-member eurozone does not trump every majority decision that has to be made. Probably that is the key question, ultimately, Britain will have to address.

Baroness Manningham-Buller: Thank you very much.

Professor Dame Julia Goodfellow: I agree mainly with what Sir Leszek has said. It was interesting a couple of years ago, when the then Government looked at competencies within the EU, that they did actually see that UK industry does less well as regards funds received, and that is obviously an area we should be looking at and, I think, should be worried about, as you have said. The responses to the competency review from this industry group were largely positive, particularly with regard to the forums and networks the EU provides for collaboration. They thought it was important to be in there and discussing the priorities, which is something we have come back to before. We want to be in there, being able to argue and change. Any organisation has to change. Sir Leszek led a delegation of vice-chancellors earlier this year to the EU because we were unhappy taking money away from Horizon 2020 for basic research and putting it into innovation and changing the goalposts. We debated it ourselves, and had a partial victory.

Professor Sir Leszek Borysiewicz: We had a very good victory inasmuch as at least the component parts of the ERC and Marie Sklodowska-Curie programmes, which could not conceivably benefit from the European Investment Bank in the way it was constituted, were protected.

This is very important, because we keep talking about the EU in its totality but we have to remember there are parliamentarians who now show an ever-increasing interest in the science and technology side and the way in which budgets are set for the Commission. It was a salutary exercise for me to realise not just how much support there has been from the UK MEPs, but their capacity to engage those in other countries to rally in support of knowledge-intensive activities and the freedoms under which the European Research Councils, which are seen as a very big positive within the EU, actually operate. It is a complex structure; it is not a single structure. We are dealing with the Commission, at one end, endlessly proposing change, and the parliamentarians who scrutinise the budgets ever more carefully and have their own committees that engage in science and technology, and we also have the member states.

Our relationship with how we use funders in the UK, particularly the research councils taking a leadership role among national funding agencies, is of real importance. We need to bear in mind that EU funding directly is only 11% of the total R&D available within the European Union; the other 89% is managed by individual agencies. The greater cohesion we get, the more the likelihood that Europe as a region can adequately both compete and collaborate with North America and China in this regard. There are real reasons to be able to pick up on this and to ensure we use all the tools available to us. It comes back to that question of how we can exercise the influence that we get from being inside this organisation, rather than outside.

Professor Sir Peter Downes: I could say "I agree with Borys"—that might not be the best comment to make—but there are two additional points. I do not think anybody mentioned VAT and its impact as an unhelpful barrier to improving collaboration in some circumstances; developing cost-sharing groups within our collaborative programmes of activity as a concept that would limit VAT liability would be very helpful, and there is a model for how that is done in Scotland. Otherwise, I agree. The context of this is that our enthusiasm, strong support and commitment to the EU and its value to the UK higher education system is not dependent upon the reforms we are talking about; these reforms would enhance our relationship and all the things we have been discussing.

Professor Sir Leszek Borysiewicz: I would hate the Committee to take away the idea we have such a rosy-eyed view of the European Union that it can do no wrong; we certainly do not. There are good examples of where considerable difficulties have been posed by directives and issues within the EU. I just pick on one, and that is the directive about intellectual property related to embryonic stem cell development. That is forcing an institution like Cambridge to look for exploitation in California or India in relation to these areas. It is not that everything that comes out of Europe glows and is brilliant—there are the issues with clinical trial directives and the welfare of animals in relation to experimental work—but the important thing is that we do have allies within Europe and we can engage in that discussion and debate.

Some of these directives, whether we like it or not, would apply regardless of whether we were in or out because we would not be able to collaborate with programmes on an individual basis, and they would still apply to us. The strictures might still be there even on a case-by-case basis, even though we play no part in setting those rules because we are then controlled by the rules set by somebody else.

The Chairman: I quite appreciate you are saying that, insofar as some of the directives are far from perfect, you would rather be able to influence than not.

Professor Sir Leszek Borysiewicz: Absolutely.

Q68 Lord Kakkar: I just want to turn to the question of the European Union's role in fostering university-business collaborations in the United Kingdom. We have seen and taken evidence on the Dowling Review of Business-University Research Collaborations in the UK. Does the European Union have a significant role in this area, driving business to work more effectively with universities here in the UK?

Professor Sir Leszek Borysiewicz: If I could start on that, the answer probably is yes. Could it do it better? Very much so. What we are seeing within the European Union and Horizon 2020 is that a bigger fraction of the budgets are going to be directed particularly at small and medium-sized enterprises, and there is more innovative thinking going on than happened under framework programme 7 about how large-scale industries can engage. We have the European Institute of Technology, based in Budapest, which is one area where Imperial College, for example, plays a very important part in leading the climate change agendas, and many institutions across the board participate in that in partnership directly with industry. We have mooted whether the European innovation grouping will have a similar area. That is in discussion at the present time. These are areas where we could foster that.

Where I would say we have a failure and we could do better—and it may not be Europe's fault in its entirety—is that our SMEs do not see the opportunities there for European funding and do not apply for it. The number of applications from British SMEs is very low. I have taken this on board in my own university and we have debated this at the Russell group board, actually asking the question whether universities that are well-versed in the mechanics of application could do more to support our local enterprises in enabling and supporting them on issues surrounding the management of EU contracts and elsewhere. I would say the onus is on us, as universities, to work with our local industry sector to help them extract more value out of Europe. The fact is if you do not apply you do not get, and it is important that we promote the capacity to apply. There certainly is resource there; the issue is that we are not bringing that resource adequately back to the UK.

Lord Kakkar: Do you think, beyond the universities helping SMEs, there is also an argument for the European Union to make its processes less complex in driving business-university relationships?

Professor Sir Leszek Borysiewicz: I think we would all say "amen" to that. It is one of the three avowed pillars of Horizon 2020 which Commissioner Moedas has made very clear—simplification remains one of those areas. We have put forward the case that the real onus comes with its contractual nature; that you sign a contract, in essence, with the EU. This is then audited by EU processes as you would audit other contractual arrangements; it is not a grant in the way you receive from a research council; it is a very different process.

The nature of audit procedures is onerous, if you are unluckily chosen for one of these. If you sit in front of one of the European Union application forms, they are substantial and you need support groups. Those universities that are well versed have the support structures to be able to do that, and our academics have overcome this, as you can see, by the success rates that they enjoy. Can it be made easier? Yes, it definitely can. Yes, Britain should push for simplification of EU processes, particularly for SMEs. I am aware that if you are running a small and medium enterprise, you have the manpower of seven or eight people; you do not have the manpower of Cambridge University that is capable of overcoming this. For somebody running an SME, this is not a Sunday afternoon pastime; this is why we have to engage in providing greater support, and thinking how we can support those enterprises to make the case that they should be successful participants in the European project.

The Chairman: There are SMEs throughout Europe and throughout the member states. You have already said, Sir Leszek, that SMEs in this country are doing less well than some of their competitors.

Professor Sir Leszek Borysiewicz: Yes, that is correct.

The Chairman: Can you confirm that industry as a whole in the United Kingdom, whether SMEs or larger businesses, is not getting the degree of funding that comparative countries in Europe are getting? Given that simplification is an overriding requirement, can universities make a contribution in any shape or form to help industry as a whole get what we might think an equitable share of European funding for research?

Professor Sir Leszek Borysiewicz: I will also leave it to colleagues to comment, but from my point of view I think we can because we have the expertise and experience; we have the track record to show we can do this very successfully. The issue here is about getting local engagement with LEPs and other areas. As to the issue of how well British industry does as a whole compared to the EU, it is important that we do not just look at the overall sums coming in, but consider whether British industry may necessarily look to Europe as a source of funding that you would seek as a primary area. You need to look at the way and frequency of application from Britain. One certainty in this life is, if you do not apply you will not get. The question is whether we can get enough people knocking on the door to obtain more of this resource.

I believe British universities have a role to play in trying to enhance our capacity to win. This is a competitive game with partners in Europe, but we do need to remember that many of the large-scale industries are multinational and therefore have access to sources of funding from different budgets within the European Union, not necessarily from Horizon 2020 but, for example, loans from the European Investment Bank and other sources. It is important for

large-scale industries to choose the most appropriate area, and we have to be careful not to just use Horizon 2020 as a surrogate but to look at the totality of benefit that companies enjoy.

Professor Dame Julia Goodfellow: In one area, space, UK industry has won out a lot and it might be worth the Committee exploring why the UK space industry has benefited perhaps more than others.

Professor Sir Peter Downes: I think it is important that we do not imagine that European collaboration and European funds are the only ways in which we can support an innovative economy and innovation within our industry and commercial base. One of the fundamental problems in the UK is that the expenditure on R&D by business—and this is more extreme in Scotland than other parts of the UK but it is a familiar feature throughout the UK—is low by comparison with any OECD competitors. Therefore, some of the base in R&D that you need—R&D awareness and the value of R&D in creating innovative elements of your business—is not as well developed in the UK. Therefore, the starting point for interaction, claiming funds and working with the universities is not as strong as it needs to be. We have work to do there alongside encouraging and supporting industry of all scales, but particularly SMEs, to engage in co-funding opportunities. Universities will become horribly stretched if they try to do all of these things, so I think there are also roles for local enterprise partnerships and other things which create regional infrastructure to support all of these activities, in which universities play their part but are not seen as the only means by which this expertise can be developed.

Within the Scottish context, the Scottish Government are currently refreshing their economic strategy. John Swinney, who is responsible for that, is very keen to see innovation at the heart of the Scottish economy, and all the things we have been talking about as a UK-wide issue are writ very large within current Scottish objectives. Both the positives, seeing Europe as a source of collaboration, a source of interaction between universities and businesses and some lessons on how to do that better, will be very important messages for Scotland in the near to medium-term future.

The Chairman: Sir Peter, Sir Leszek and Dame Julia, thank you very much. You have given us very clear evidence today. We are in no doubt about your views now, if we ever were before. There will be a transcript sent in the usual way for minor corrections, and if there is anything you want to add as a result of the questions we have posed today, please feel free to submit that. Thank you very much for your help.

Universities UK – Supplementary written evidence (EUM0079)

European Structural and Investment Funds (ESIF)

ESIF is the EU's main funding programme for supporting growth and jobs across the EU. It is formed from four primary strands: the Regional Development Fund (ERDF); the Social Fund (ESF); the Agricultural Fund for Rural Development and the Maritime and Fisheries Fund.

The university sector is relatively less engaged with the latter two funds, but does undertake significant amounts of activity which has, at least in part, been funded through the ERDF and ESF.

England has been allocated a total of €6.9 billion from these two Funds for the years between 2014 and 2020. Funding through ERDF and ESF is, in England, allocated to the 39 Local Enterprise Partnerships (LEPs). It is a major source of funding for Local Enterprise Partnerships.

LEPs set their own economic strategies for the regions they operate within, and the ways in which ERDF and ESF funding will be used will therefore vary significantly across the country. The amounts allocated to LEPs also vary significantly, as the relative state of economic development in regions is considered in apportioning funding.

Universities can access this funding to pursue the objectives of the LEP through applying to calls for projects issued by LEPs. This is a fundamental difference to the 'responsive' way in which much funding through the Framework Programmes (currently Horizon 2020) is allocated, which allows researchers and universities to bid for funding to support projects they have themselves defined.

Funding through ESIF will also normally require significant amounts of match funding (normally 50%), which is again different from much funding through Horizon 2020.

Activities funded by ESIF

ESIF funds research and development as a method of pursuing the economic development, or social inclusiveness, of a region. Bids are judged in terms of their ability to generate economic growth, rather than on criteria related to research excellence (although these two factors will frequently, of course, coincide).

Examples of university-based activities that are frequently funded through ESIF include:

- R&D centres to collaborate with industry
- Innovation centres and campuses to provide specialist facilities, support and funding to SMEs embarking on R&D and innovation projects
- Collaborative PhD and Masters programmes to support research projects specified by SMEs and undertaken by a research student supervised by the university

- Innovation voucher schemes offer funding to businesses to support early-stage innovation.

The current new programme also offers opportunities through the Social Fund to invest in higher level skills, which were previously out of scope in England. This is enabling universities to leverage EU funding to extend their activities focussed on local employers and communities, in particular.

Levels of ESIF funding allocated to R&D; and levels received by universities

For the period of the current multiannual financial framework (2014-2020), 9.7% of the EU funds allocated to the UK as a whole are earmarked for the 'Research and Innovation' theme. This is a sum of €1.596 billion over the seven years.

However, there are other budget themes through which research and innovation could potentially be supported: in particular the theme focussed on improving the competitiveness of SMEs, which is the largest UK theme with €2.462 of EU funding over the seven years. Ultimately, the level of ESIF funding that supports research and innovation will depend upon the strategies and funding decisions of LEPs.

Similarly, it is not possible to accurately predict the level of support that projects undertaken by higher education institutions will receive through these funds, as this will depend upon funding decisions yet to be taken. However, the record of the previous multiannual financial framework (2007-13) shows a pattern of increased engagement.

Figure 1: HEI income from ESIF sources

Year	**HEIs Income from ERDF-ESF, £000's**
2007-08	£114,784
2008-09	£47,712
2009-10	£57,495
2010-11	£67,812
2011-12	£85,051
2012-13	£102,561
2013-14	£99,889
Total	£575,304

Source: HE-BCI Survey

The total UK allocation through ERDF and ESF for 2007-2014 was €10.9 billion (approximately £8.1 billion using current conversion rates). Higher education institutions were therefore awarded approximately 7% of this funding during this period.

The above figure of 7% is an estimate and should be used with caution, as income received by an institution in a particular years (and recorded via the HE-BCI survey in that year) may have been awarded in a different year to that in which it was received.

HEI income through ESIF is therefore very considerably lower than through Framework Programme funding.

Relationship between ESIF and Framework Programme funding

ESIF and Framework Programme funding operate in substantially different ways, and towards separate objectives – supporting a significantly different range of activities when accessed by universities (albeit with some overlap).

The European Commission is seeking to pursue 'synergies' between ESIF and Framework Programme funding. This may involve ESIF projects providing 'upstream' or 'downstream' support to research which is funded through Framework Programme funding.

'Upstream' synergy might include supporting the establishment of a research and development centre which can host researchers well positioned to secure funding through Framework Programmes. Examples of research centres supported by ESIF funding include Biovale in York, the Graphene Institute in Manchester, the Environment and Sustainability Institute in Cornwall and several centres which are part of the Advanced Manufacturing Catapult including the Advanced Manufacturing Research Centre in Sheffield

'Downstream' synergy might include providing funding to catalyse knowledge transfer relating to the findings of research funded by the Framework Programme.

27 January 2016

University Alliance – Written evidence (EUM0065)

Introduction

1. University Alliance brings together 19 universities with a common mission to make the difference to our cities and regions. We use our experience of providing high-quality teaching and research with real world impact to shape higher education and research policy for the benefit of our students, businesses and civic partners.

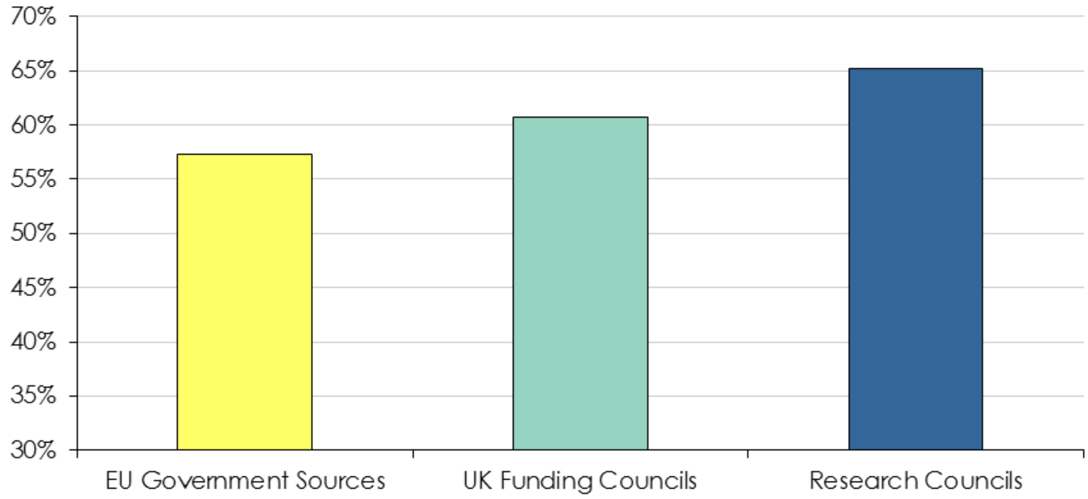
2. We support the position of Universities UK (UUK) with regard to the UK's membership of the European Union, and our response here should be read in conjunction with their representation. In this paper, we provide supplementary evidence of how membership of the European Union has supported excellent research and innovation within our universities and, through our wider partnerships, the regeneration of our cities and regions. We particularly value:
    - **European funding for research**. This is an increasingly important source of research funding for Alliance Universities as funding from UK sources reduces and becomes more concentrated. Alliance Universities received £33m research contract income from European government bodies in the last year. This amounts to twice the share of funding received from equivalent UK funding streams and represents 33% of all research grants and contracts to these universities. In some disciplines, Alliance universities are now entirely reliant on EU funding. For example, one world-leading agriculture research unit, which formerly received funding from DEFRA, is now fully reliant on EU funding.
    - **The facilitation and incentivisation of partnership working for activity to regenerate our cities and regions**. Alliance universities are key facilitators within their locality, often acting as anchor institutions to enable local collaborations and provide innovation support to promote growth in their regions. Alliance universities receive 22% of all European Regional Development and European Structural Funds which go to the UK higher education sector.
    - **The opportunity to create networks in the EU and beyond - particularly for early career researchers**. European funding opportunities also provide benefits beyond the monetary through enhanced mobility. Access to large, transnational, multi-disciplinary projects and the large number of collaborative European-wide networks encourages excellence and facilitates peer-peer learning for researchers at all levels. Schemes such as Erasmus+ bring long-lasting benefits to students, staff and their institutions.

Funding

Question 3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

3. Overall, we find allocation criteria, mechanisms and decision-making processes within EU research funding bodies more likely to recognise the excellence within our universities than the UK funding councils. The following graph demonstrates that EU funding is less concentrated than UK funding.

Graph 1. Proportion of Funding Concentrated in Top Decile of UK Institutions[763]



4. This supports the dynamism and diversity of our research and innovation ecosystem. It allows new institutions to develop research excellence and challenge incumbents to raise their game. It also supports a geographical distribution of research and innovation facilities. This is particularly likely to benefit SMEs, who may not have the resources to identify and access facilities in other parts of the country, and local civic decision-making bodies that value working in partnership with a university in their locality that understands the challenges and is committed to overcoming them.

5. Alliance Universities benefit from both framework programmes and from non-framework EU funding. For example, we have received funding from EFSA (food safety), DG-SENCO (health) and DG-Justice (drug misuse and also domestic violence). However, to continue to access this funding, the UK needs to negotiate and accept the relevant protocols. When we do not, we lose access to the funding. For example, when the UK rejected certain protocols relating to the DG-Justice programme, UK programmes that had previously received funding from the drugs programmes, became ineligible for funding.

6. However, EU funding application processes can be burdensome, and further simplification measures would be welcomed. For example, Structural Funds are overly prescriptive and could be more flexible to local need. To address competitiveness, this could mean allowing these funding streams to be targeted in a more focused manner, making in-depth interventions where these could add particular value rather than a broader application which can spread funds too thinly.

[763] Top decile as defined by total research income (HESA 12/13)

Collaboration

Question 4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

7. Participation in EU collaborations brings benefits to Alliance universities in three equally important areas: a. it improves the quality of research and the research environment; b. it supports the development of researcher careers; and, c. it delivers societal benefit, through research and innovation, to our cities and regions.

8. **Participation in EU research programmes improves the quality of UK research and the research environment:** There is strong evidence that international collaborative research drives excellence, with resulting research outputs achieving greater field-weighted citation impact.[764] European research funding programmes support international collaborations by providing access to large, transnational, multi-disciplinary projects and collaborative networks. EU funding, because it may support areas that are not supported nationally, also allows for diversity and innovation within UK research. The industry focus of Horizon 2020 encourages institutions to think about the impact of their research, particularly for SMEs. We list some examples below:
    - The **University of Hertfordshire** leads a Recreational Drugs European Network (ReDNet) involving 8 EU countries. This was awarded a prestigious international health award. By tracking the spread, toxicity and street names of 'legal highs' (officially termed Novel Psychoactive Substances), researchers have been able to provide policy makers with evidence to help them develop policies to protect vulnerable and at-risk groups.
    - **Plymouth University** was one of 9 European partners in a €8.3m collaboration project to develop robots capable of improving children's healthcare. Transferring and enlarging Plymouth's expertise in the ethics of human-robot interactions, researchers observed the interactions of pupils in schools across Devon with the 60 centimetre socially interactive 'Nao' robot. The project results demonstrated that young people are more inclined to perform tasks related to their condition if prompted to do so by a friendly robot. For children with diabetes and autism, these interactions can help them understand the nature of their condition and become more confident about their futures.[765]
    - As part of the EU collaborative SURFSTAND project into developing a basis for 3D surface texture standards, the **University of Huddersfield**'s Centre for Precision Technology changed the way the roughness of parts in manufacturing are measured. This led to nine new International Organization for Standardization (ISO) standards and influenced the practices in sectors including aerospace engineering, micro-electrics and bio-implant production. All quantitative 3D surface measurements worldwide now draw upon this research.

9. Collaboration through the European Union joint programmes brings further soft benefits to UK research. It creates a shared understanding of the cultural difference between

[764] Elsevier and BIS, International Comparative Performance of the UK Research Base, 2013.
[765] https://www.plymouth.ac.uk/news/social-robots-helping-young-with-diabetes

partner organisations and the ability to build trusting relationships. These allow robust joint decision making through consensus, the development of a shared strategic vision and the ability to achieve greater impact through combining resources, which promotes both efficiency and innovation capacity.

10. Without the Horizon 2020 programme, pan-European collaboration would require resource-intensive and complex negotiations between partners who are answerable to separate national funding bodies, with different priorities, mechanisms and timescales.

11. **Research career development is aided by participation in EU research collaborations and programmes:** Alliance universities are growing their research capacity at a significant rate. They are therefore committed to the development of their early career researchers. Participation in European research collaboration programmes has provided opportunities for early career researchers to develop their careers. For example, the Marie Skłodowska-Curie Innovative Training Networks (ITN) aims to develop researchers who can work within academia or in industry. They aim to train "creative, entrepreneurial and innovative early-stage researchers, able to face current and future challenges and to convert knowledge and ideas into products and services for economic and social benefit". This aims aligns closely with that of Alliance universities. These development opportunities are particularly valuable in the context of UK research councils increasingly concentrating their funding for PhDs and early career researchers into fewer universities.

12. Examples of Alliance universities engagement with European early career researchers programmes include:
    - In 2012 **Sheffield Hallam University** launched a Marie Curie Initial Training Network – NEWGENPAK. This brings together experts in sustainable packaging from eight European universities, four research institutes and six enterprises across Europe to create the next generation of environmentally-friendly paper products. It brings together expertise in chemistry, materials science, biopolymer chemistry, nanoparticle production and characterization, paper, board, innovative coating formulation and processing methods, as well as package concept, design, testing and production, meaning the group can develop packages from the initial concept phase through to realisation.[766]

13. **European Structural Funds deliver benefits, through research and innovation, to our cities and regions:** Whereas the majority of research projects funded through Horizon 2020 are pan-European, many have directly funded and facilitated links between Alliance universities and other institutions in their cities and regions, particularly the public sector and SMEs.

14. ERDF complements research funding by targeting users and businesses further down the innovation chain, helping to draw these businesses into a higher-value innovation activities with universities, and increasing private investment in R&D. This often catalyses new phases of growth by bringing businesses into other UK support schemes, like

[766] http://www.newgenpak.eu/; https://www.shu.ac.uk/business/news/eu-funded-network-can-change-face-paper-packaging

Knowledge Transfer Partnerships. Whilst the ERDF programme may benefit from a more simplified approach to administration, audit and reporting it continues to be an essential part of the Higher Education and City region collaborative R&D infrastructure. Examples of how it has been used include:

- **Coventry University** co-funds various ERDF projects that offer significant opportunities for small West Midlands based businesses to absorb and participate in the creation of research. One project specifically helps SMEs to benefit from knowledge transfer in the sustainable construction sector, by supporting collaborative development, testing, assessment, and implementation of innovative environmental technology products and services. Support for businesses extends to start ups, market expansion, and the development of new products in this growth area.
- Another **Coventry University** ERDF project, *Technology and Innovation Futures,* is run in partnership with the Manufacturing Technology Centre. It helps West Midlands SMEs to link foresight and strategic planning directly to technology identification development, adoption and commercialisation. This will drive the uptake of baseline technologies and adoption of new-to-market and future and emerging technologies.[767]
- Enabled by €1.2m ERDF funding, the **University of Hertfordshire** furthered its contribution to carbon reduction efforts through the establishment of a subsidiary company EValu8 Transport Innovations. Applying expertise from the university, the company rolled out the SourceEast electric vehicle charging infrastructure in the local area. EValu8 has subsequently scaled up through £3.2M of UK government funding to pilot off-grid energy storage using recycled electric vehicle batteries.
- ERDF funding is a central pillar of **Sheffield Hallam University**'s innovation provision for SMEs. Over the past five years investment of £2.4m of ERDF has leveraged significant additional funds to enable Sheffield Hallam's ERDF supported Innovation Futures project to work with 220 SMEs delivering an increase in GVA of £17.2m to the City Region. Through ERDF, the University has been able to deliver SME-focused delivery support for its industry relevant-research centres, which include Materials, Advanced Manufacturing, Digital and Computing, and Product and Packaging Design. Through this, SMEs have been enabled to introduce new products, processes and ways of working, recruit more highly skilled staff and placements, enter new markets and become more resilient and profitable, and enter into new collaborative R&D partnerships.

Question 5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

15. EU Framework Programmes have provided agreements for scientific and technological cooperation and a method for engaging with international partners beyond the EU. This has mean that countries like Brazil have aligned some of their national research priorities

[767] These examples and many more from this area are detailed in DCLG (March 2014, Version 5), *Business Support Guide: West Midlands European Regional Development Fund (ERDF) Programme 2007—2013.*

with those of the EU. This has made it easier for researchers from the UK to work with researchers from these countries.

16. The benefits of collaborating through the EU are widely appreciated. University Alliance has strategic partnership with the Australian Technology Network of universities and we are currently developing international research collaborations. Our ATN partners tell us that the UK's membership of the EU is a significant draw factor for them.

17. The **University of Hertfordshire** alone noted that EU programmes had facilitated three USA-based research partnership with Yale, NASA and USAF; and links with a further 45 universities in North America, 9 in Asia, 8 in Australia, 6 in South America and 1 in Africa through Erasmus +. The same university also benefited from collaborations with Brazil, China, Russia, USA, Israel and South Africa through Marie Curie actions.

Question 6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

18. A significant part of Alliance universities' European engagement with international businesses is facilitated by the Enterprise Europe Network, run primarily in this country by Innovate UK. Similarly, the European Business and Innovation Centre Network (EBN) helps to leverage private investment in research by bringing together business and innovation centres and other organisations that support the development and growth of innovative entrepreneurs, start-ups and SMEs.[768]

19. An FP7 project looking at developing the world's first real-time, affordable and portable detector of airborne asbestos fibres has led to a technology license agreement between the **University of Hertfordshire** and a UK-based SME from the Select Group of Companies, who supply to the building sector. The detectors work using light scattering analysis for particle classification and utilise unique magnetic properties of airborne asbestos fibres for identification, and the produce is now being commercialised with manufacturing set to begin in 2016.

Question 7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

20. **Liverpool John Moores University** owns and operates the Liverpool Telescope, the world's largest fully-robotic telescope, based in the Canary Islands. In order to get the largest scientific benefit from the facilities the university ensures that it is available to the wider astronomy research community through a variety of access agreements. Through the FP7 funded OPTICON Transnational Access program EU investigators can apply for time on the telescope and gain access to the large body of data that is produced. Due to the success of the Liverpool Telescope and the large volume of high-

[768] http://ebn.be/

impact papers in leading journals that were produced proposals are now underway to upgrade the telescope and create the LT2.

21. Through ACTRIS-2 the **University of Hertfordshire** have access to European ground-based stations for long-term observations of aerosols, clouds and short lived gases, which proved useful during the Eyjafallajökull volcanic eruption in 2010. The Met Office asked researchers at Hertfordshire to forecast the amount and trajectory of the ash from the Icelandic eruption. This justified caution and the closing of northern European airspace to safeguard passengers.

Question 8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

22. EU students are a vital and vibrant part of our student body and our research communities. We teach over 16,000 EU students, have overseas provision for 9,000 students in Europe and over the past 5 years have awarded 630 PhDs to EU students.

23. Our staff base also benefits immensely from the ability to recruit from within the EU. 10% of our academic researchers are European Union nationals. This compares to 7% from other international countries, including 1% from each of China, India and the United States.

24. As well as the benefits outlined for the early career researchers through doctoral and early career research opportunities, schemes that enable student and staff mobility such as Erasmus + help improve career options, spread diplomatic benefits through increased understanding and enrich the quality of research and teaching.
    - A staff member at one Alliance university who benefitted from an international placement as part of the Erasmus + programme captures the cultural benefits of mobility and exchange: *"I found the overall experience both insightful and useful and it has changed … in particular the way we communicate with our international students"*.

Question 9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

25. There is widespread agreement that a global search is necessary to attract the best talent. This is problematic at the moment – but our universities report that this is due to UK visa policy, which restricts the recruitment of non-EU PhD students and project staff, rather than immigration policies within the EU.

27 November 2015

University of Bristol – Written evidence (EUM0027)

Funding

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

The University of Bristol ranked 9th in the UK in terms of participation in FP7 as a whole, and 6th in the UK for number of ERC grants secured. FP7 and now H2020 is an extremely important source of funding for us, particularly ERC and Marie Sklodowska Curie, and enables us to recruit and retain excellent researchers from across Europe, work with European partners to address questions that would be difficult to answer nationally, and secure funding for cutting edge blue skies research undertaken by some of our top researchers. EU government funding consistently ranks as one of our top sources of research income each year and therefore becomes increasingly more important as RCUK money becomes more competitive.

In February 2014, BIS compiled a report entitled "Review of the Balance of Competences between the United Kingdom and the European Union Research and Development" which looks at financial contribution at the UK level:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/279331/bis_14_592_balance_of_competences_review_government_reponse_to_the_call_for_evidence.pdf
E.g: "The UK does exceptionally well from the EU's current seven-year research budget, Framework Programme 7 (FP7), receiving €6.1bn or 15.4% of the funds allocated to date, second only to Germany which has received 16.1%. This equates to a higher percentage of FP7 funding than either our share of EU Gross Domestic Product (GDP) or population.

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

FP7 could sometimes be viewed as complex, bureaucratic and slow due the number of different funding instruments with different rules and requirements, the sometimes protracted length of time it took to get from proposal submission to actually starting the grant, and complex reporting requirements. The majority participants however felt the benefits of participation outweighed these issues.

Significant progress has been made in these areas since the start of H2020 however; the structure of H2020 has been simplified making the schemes and their purpose easier to understand, and the funding rules are clearer as the rules are the same for almost all

schemes. The 'time to grant' has also been shortened due to the introduction of the 5+3 rule (5 months for evaluation, 3 for grant signature), and the introduction of the participant portal has made it easier for institutions to manage their participation and pre and post award administration.

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

The benefits of participation in H2020 in the ERC are significant and include:

- Access to crucial funds, additional to those available from UK sources, in particular:
    - The ERC supports 'frontier research' focussing on excellence. It funds single teams, often based at a single University, and does not prescribe policy driven outputs. The UK's research-intensive universities are the most successful in Europe in attracting ERC funding, with the University of Bristol securing 55 grants to date across FP7 and H2020 with a combined value of €89,598,807. This is a crucial funding source for us, placing investment in our top researchers and funding the growth of their teams and essential major equipment.
    - Similarly, the UK is very successful in obtaining Marie Sklodowska Curie fellowships, which enable us to recruit talented researchers from across the world. To date the University has secured 127 fellowships across FP7 and H2020. This is a rich and valuable resource for us enabling us to attract and retain excellent overseas researchers, in many cases leading to longer term collaborations and the development of networks after the fellowships have finished. Some of these fellows also move onto permanent positions at Bristol.
- EU research funding enables us to access pan-European networks which make it possible to address questions that would be difficult to address nationally
- FP/H2020 support for international research represents a major increase in available funds compared with UK international schemes
- EU funding facilitates awareness of EU colleagues' priorities and research programmes, leading to ad hoc knowledge transfer
- FP/H2020 awards help to secure new research grants or other follow-on funding (e.g. UK Research Councils peer reviewers credit major FP contracts)

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

EU schemes (in particular Marie Sklodowska Curie) facilitate the mobility of researchers within Europe, enabling top researchers to move to UK Universities. The free movement of people within Europe means that this process is straightforward and simple to administer, and the University of Bristol has benefitted significantly from these schemes, recruiting and retaining many talented researchers. This greatly contributes to the quality of UK science by ensuring we are able to recruit and collaborate with the very best researchers from around the world.

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

EU membership does not inhibit collaborations with countries outside of the EU, and in fact H2020 has a number of schemes which are designed to facilitate non-EU collaboration such as the RISE scheme within the Marie Sklodowska Curie actions (international researcher exchange), and specific joint calls with non-EU countries such as Brazil, Japan etc. Participation in H2020 also enables us to access funds that wouldn't be available to us otherwise, e.g. NIH funding (there is a reciprocal agreement with the NIH whereby US researchers can access H2020 funds under the Health Societal Challenge and in return, EU researchers can access NIH funding).

Regulation

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

12. How is the innovation landscape affected by EU membership?

Scientific advice

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

14. To what extent does EU membership enable UK scientists to inform and influence public

policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

Participation in H2020 can give scientists a platform to influence policy at EU level particularly if they are the co-ordinator of a major research project, as research under the Societal Challenges of H2020 is directly linked to shaping EU policy and can lead to invitations to sit on policy and advisory groups.

20 November 2015

University of Cambridge – Written evidence (EUM0049)

The University of Cambridge and the European Union: some headline statistics

- From Framework Programme 7 (FP7, 2007-14) the University of Cambridge received €424M, approx. 24% of the University's research funding in that time period.
- From Horizon 2020 (2014-2020) the University of Cambridge received €68M (in the year to 20th August 2015).
- 23% of our academic and postdocs are EU nationals (as of Oct 2015, excluding UK nationals).
- As of the academic year 2014-15 16% of our undergraduate students are EU nationals (excluding UK nationals).

1. The University of Cambridge seeks to appoint and collaborate with leading researchers around the world. Our leading research institutions are internationally competitive in terms of both research outputs and the ability to recruit leading researchers globally. This position can only be maintained by engaging with international funders to help secure funding streams for researchers and by promoting international collaborations. The UK's relationship with the EU is vital to this process.

2. Funding from the EU is a valued and significant part of the academic community's funding portfolio. The UK has had an outstanding level of success in Framework Programme 7 (FP7), winning €6.94 billion. The UK has secured over €520 million in Horizon 2020 grants to date. ERC funding, in particular, is increasingly attractive to academics because of the perception that it is awarded on the basis of excellence alone. The UK hosts the highest number of European Research Council (ERC) grants of all Member States: 22% of all ERC grants. In addition to its funding for frontier research in the "hard" sciences, the ERC is also one of the key funders in Arts, Humanities and Social Sciences - providing one of the only routes to very substantial funding. The UK was awarded a third of the ERC grants in these disciplines between 2007 and 2014 (171 in total).

3. The UK has an exceptional track record in gaining ERC investigator awards at every level. The University of Cambridge has so far been awarded 155 ERC grants, more than any other HEI in Europe. ERC funding encourages novel, risky, researcher-led, ground-breaking research with a strong interdisciplinary focus. Schemes of this kind foster cross-, multi-disciplinary and international collaborations. They enable researchers to undertake innovative research which is not constrained by the need to produce immediately translatable results. This allows researchers intellectual freedom, which often produces unexpected, and highly valuable, results. Such schemes are also a vote of confidence in the virtues of scientific discovery as a principle, as well as in practice.

4. The University of Cambridge has hosted 147 Early Stage Researchers and 349 Experienced Researchers (since 2008) as part of the Marie Curie Skłodowska programme, which offers "*grants for all stages of researchers' careers - be they doctoral candidates or highly experienced researchers - and encourage[s] transnational,*

intersectoral and interdisciplinary mobility".[769] These. statistics amply illustrate Cambridge's role as an attractive destination for cross-EU research collaborations.

5. Outside the funding provided by the ERC and via the Marie Skłodowska-Curie programme, funding from the EU for research allows UK researchers to forge links in collaborative programmes with EU Institutes/Universities as well as UK and EU companies. These enable UK Universities and Companies to take part in large-scale collaborative research projects and gain access to materials, services and expertise that are often not available to individual organisations alone – or even within an individual country.

6. If the UK were to withdraw from the EU then we would no longer be a strong negotiating position. As a result we would minimise the ability we have to influence both the direction of travel and to form, and modulate, the regulations which would continue to govern how we behave. More broadly, we would be hampered in the exercise of the "soft power" which is a vital component of our relationship with the EU.

7. Looking more widely than the question of the direct impact on the research landscape in the UK, withdrawal from the EU would make it more difficult to attract researchers from outside the UK to work here both because the legislative framework and the climate of the UK post-withdrawal may not be welcoming to non-UK citizens.

8. In the area of research, the UK gets out more than it contributes to the EU budget (3.9% more between 2012 and 2014). We recognise that there needs to be a balance struck between support for excellent science and the wider demands the EU faces, both financially and politically. Any democratic system faces these challenges, but this strengthens the argument for the UK remaining within the EU and exerting the greatest possible influence on making the system work, rather than dismissing the project out of hand.

9. As matters stand, we have no clear picture of what is being renegotiated as part of the preparations for the EU referendum. With no real idea of what is "on the table" it is extremely difficult to assess the scale of the threat to our relationship with the EU, and correspondingly difficult to counter it in any level of meaningful detail. All we know is that the UK are negotiating on the basis of changes to the status quo in four areas: Economic governance; Competitiveness; Sovereignty; Immigration.[770]

10. EU research programmes provide both significant financial investment in, and a wider vision for, both the practice of UK research and the definition of what research itself should be. Collaboration without restriction across EU borders brings a richer landscape for the conduct for research in terms of access to the widest possible range of partners. But it also offers a powerful vote in favour of fundamental research, most obviously in the ERC, which amply illustrates the EU's determination the determination to put

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[769] http://ec.europa.eu/programmes/horizon2020/en/h2020-section/marie-sklodowska-curie-actions

[770] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/475679/Donald_Tusk_letter.pdf

money behind the possibilities of scientific discovery, rather than the "safer bet" of immediate translation into tangible benefits. The EU research programmes more widely aim to support the inherent interdisciplinarity of research – to recognise not only that there are global problems which need tackling across geographical borders (the challenges posed by an ageing population for example), but also that research itself is inherently interdisciplinary.

11. Research is, by definition, a global pursuit. International collaboration and the mobility of researchers are vital to the UK's future as a top-flight location for research, as both are the bedrock of a healthy research culture – one that challenges perceived wisdoms and makes new discoveries in an open dialogue with peers across the world. Despite our undoubted excellence, we cannot afford to be complacent. Cooperation, and collaboration, across the EU is essential.

12. A powerful counter to the argument that the UK can withdraw and renegotiate its relationship with the EU in the area of access to its research programmes is offered by Switzerland. As a result of its referendum (February 2014) on immigration quotas, the EU revoked Switzerland's access to Horizon 2020 and Erasmus+ programmes. In terms of research funding, the Swiss are now only able to access the "Excellent Science" portion of Horizon 2020 as an Associated Country (alongside "*actions under the specific objective "Spreading excellence and widening participation", the Euratom Programme and activities carried out by the European Joint Undertaking for ITER and the Development of Fusion for Energy for 2014-2020*".[771]) This negotiated access is only effective until the end of 2016. Swiss scientists are excluded from the full range of research programmes, except on a Third Country basis: this means that they are not automatically eligible for funding and their participation in other bids does not count towards the eligibility criteria for the minimum number of participants in a project. This has caused great damage to the ability of Swiss research groups and organisations to carry out internationally competitive research.

13. If we assume that a referendum would position the UK in a similar situation as Switzerland one must also consider that as an Associated Country, in whichever configuration that participation may be, we would lose the ability to actively influence decisions. Although associated countries are able to pay into the system and participate in certain research schemes, they have a very limited say on the decision process and on shaping the research funding landscape.

14. The reputation of the UK as a country at the leading edge of research and with an ability to translate that research is high. We attract some of the world's best researchers and scholars. We should avoid doing anything that makes it difficult for leading researchers to work here and that damages the ability of UK institutions to work at the frontiers of their discipline. Reputations are hard won and easily lost.

20 November 2015

[771] http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-hi-swiss-part_en.pdf

University of East Anglia (UEA) – Written evidence (EUM0026)

Author: Professor David Richardson, Vice-Chancellor, UEA

1. I am writing to convey the views of the University of East Anglia in a number of areas raised by the Committee under the above Inquiry.

EXECUTIVE SUMMARY

2. The EU provides vital funding for important, ground-breaking research, and to enable wide-ranging and diverse collaborations. A significant proportion of the research at UEA is supported by European funding, with a current portfolio of about £16m supporting around 50 different projects involving around 400 partners.

3. EU Cohesion Funds, such as the European Regional Development Fund (ERDF), also bring considerable benefits to the UK in terms of supporting enterprise development, jobs and economic growth. The new Enterprise Centre at UEA, which formally opened in October 2015, was built with the support of a £6.2m grant from the European Regional Development Fund (ERDF). In addition, the Low Carbon Innovation Fund was launched in 2010, underpinned by £20.5m of ERDF support. Managed by UEA, this venture capital fund has successfully drawn in around £35m of additional matched funding from private investors, adding significantly to the position of the East of England as a leader in low carbon innovation.

4. The UK does particularly well in EU research and innovation funding, and had the second highest share of Horizon 2020 funding of any EU Member State in its first year (2014), behind only Germany. Universities are a key driver of this performance. So far in 2015, UEA has secured around €9m from Horizon 2020.

5. The reason Horizon 2020 represents such a huge opportunity for UEA is that the EU's strategic research priorities closely align with our own areas of interest and expertise. Internationally relevant topics such as climate change; food and nutrition; antibiotic resistance; sustainable agriculture; the healthcare needs of ageing populations; water security; energy efficiency; and low carbon initiatives all represent a huge crossover with our work.

6. Being an active, EU research-intensive university also enhances our global academic reputation because EU-funded programmes have a truly global impact, and so give UK research much wider international reach. For example, 25% of UEA's highest rated 3* and 4* research impact case studies for REF2014 arose from EU collaborations.

7. With the policy agenda being increasingly set at an international level to deliver responses to global challenges, the role of the EU in research and innovation is crucial. The UK is far less likely to be able to 'punch above its weight' in EU funding programmes if excluded from the key decision-making processes.

8. If we left the EU, it is unclear as to whether the UK Government would put in place a domestic programme of research and innovation funding that offered the same scale of opportunity, or that it would be able to negotiate UK 'association' to Horizon 2020 that offered full access to funding. Switzerland, for example, has access to only around 30% of the available Horizon 2020 funding.

9. In our view, the option of bilateral agreements, arising out of a UK exit from the EU, is likely to create international dislocation; reduce access to European networks; introduce undue layers of cost and complexity; create uncertainty for current and future collaborators; and reduce UK influence in European science and research.

10. The EU will look to those Member States with expertise when deciding policy direction, and the UK's research excellence, science pedigree and infrastructures currently give us significant credibility and influence. It would be that much harder to position UEA, and many other world-leading institutions in our region, as international centres of excellence if we are perceived to be standing on the sidelines of Europe. For example, the Tyndall Centre for Climate Change Research at UEA was made the European Hub of the 'Future Earth' initiative in 2014. This would have been highly unlikely had the UK been outside the EU.

11. UEA would much rather see the UK embrace its leadership position in a reformed Europe, and use its hard earned influence to continue to play a fundamental role in steering the development of EU research and higher education policy, so as to maximise universities' positive contribution to society.

COMMITTEE QUESTIONS

What is the scale of the financial contribution from the EU to UK science and research, and vice versa?

12. The EU provides vital funding for important, ground-breaking research, and to enable wide-ranging and diverse collaborations to take place. The UK does particularly well from EU research funding, vying with Germany as the most successful host country in the EU. Whilst an extremely competitive funding environment exists in the EU – only the highest quality proposals are supported – this has had the effect of making the UK's already excellent academic institutions even stronger, driving higher quality, more cutting-edge, and more impactful, research proposals. For example, it was announced earlier this year that UK researchers won 20% of the European Research Council's flagship Advanced Grants in 2014, more than any other nationality (source: European Research Council).

13. So far in 2015, UEA has secured more than €9m from Horizon 2020, the EU's current Framework Programme for research and innovation, which runs from 2014 to 2020. This compares to c€6m per annum in EU funding won by UEA in 2012/13 and 2013/14. So we are seeing growth in EU funding activity at UEA.

14. Under the previous EU Framework Programme for research, FP7 - which ran from 2008 to 2013 - the UK received almost €7bn, or 15.5%, of the total funding allocated, ahead of France (11.5%) and behind only Germany (16.2%). Of this UK funding, over 70% went to

Higher Education Institutions (source: the UK Government Review of the Balance of Competences report on Research and Development, 2014). Indeed, under FP7, UK universities won more EU funding than French and German universities combined – providing a huge external uplift to UK research capability.

15. Although the UK represents just 3.2% of global R&D expenditure, it accounts for 9.5% of downloads, 11.6% of citations and 15.9% of the world's most highly-cited articles (source: 'International Comparative Performance of the UK Research Base – 2013', an Elsevier report for BIS). EU funding has been a key component of this; we believe that the UK's competitiveness in R&D will be threatened if the EU funding stream is not maintained.

16. Beyond innovative research projects, the EU also brings considerable benefits to the UK in terms of supporting jobs and growth. A significant proportion of the research at UEA that will underpin enterprise development and associated economic growth is supported by European funding, with some £16 million currently supporting around 50 different projects involving around 400 partners.

17. In addition to UEA, the East of England is home to a range of world class research organisations, industries and universities. Total EU funding won by the East of England under FP7 was £753m - nearly 11% of all UK funding secured, and the third most successful region after London and the South East (source: East of England Partnership).

18. This strong UK performance is continuing under the Horizon 2020 Programme. The UK has submitted more eligible applications to Horizon 2020 and achieved the second highest share of funding of any EU Member State (source: 'Horizon 2020: First results', European Commission). The UK also has the highest share of participations in signed Grant Agreements so far (source: 'Horizon 2020: First results', European Commission).

What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK?

19. There has been a move towards major simplification of research funding at the EU level in the last two years. Horizon 2020 has reduced red tape by providing a single research framework across all EU Member States, and the range of 'Associated Countries', such as Norway. By providing a single, consistent framework for collaboration, the EU has reduced much of the bureaucracy associated with bringing together players from different countries, all of which have their own rules and regulations.

20. This single set of rules is now applicable to the whole innovation chain, from basic research' through to 'close to market' applications. In addition, a single, flat rate of 25% of the total project's eligible direct costs applies in respect of claiming overheads, removing a major source of financial errors and complexity, and replacing the previous four separate methods of calculating overheads.

21. Of course, improvements can be made to any regulatory system. Firstly, we need to better protect the Horizon 2020 budget going forward, which has experienced reductions this year. Secondly, on certain key Horizon 2020 grants, headline success

rates have temporarily fallen to such a level that it begins to raise concerns about the cost/benefit of applying (e.g. the Marie Sklodowska-Curie ITN success rate in the 2015 call was 6.8%, meaning eleven out of every twelve applications for doctoral training programmes were turned down). We know the Commission is already 'on the case' in looking at how to tackle the consequences of over-subscription. Thirdly, some of the changes to the financial regulations governing Horizon 2020, when compared to FP7, will negatively impact Higher Education Institutions in Europe, reducing the costs UEA can claim in relation to personnel working on Horizon 2020 funded projects by an estimated 3.7%. This is not a positive regulatory change, particularly when the previous methodology was well established, robust and consistently applied within European universities.

22. On balance, however, we see no marked difference now between the process of applying for domestic funding and that which applies to EU funding. Indeed, some prestigious European Research Council (ERC) grants are currently more attractive in application terms than domestic equivalents, enjoying higher headline success rates for UK applicants (15-17%) than some of the UK Research Councils (for example, NERC 13%, ESRC 13%). Withdrawal from Europe will inevitably lead to increased demands on RCUK funding, further reducing success rates and imposing greater costs on both the Research Councils and Higher Education Institutions.

What are the benefits to UK science and research in terms of collaboration and funding programmes such as Horizon 2020 and the European Research Council?

23. We see collaboration across borders as crucial to generating world-class research, as truly outstanding research tends to be done by people working internationally. Multiple perspectives, complementary expertise and diverse approaches to problem-solving are all vital ingredients in confronting the complex, inter-disciplinary and global challenges faced by society. We expect that this trend will continue.

24. In 2014, UEA participated in more than 20 major Horizon 2020 collaborative 'societal challenge' applications, either as lead or as a partner in a consortium. UEA has also been involved in five successful Marie Sklodowska-Curie European doctoral training networks (labelled 'Innovative Training Networks' or 'ITNs'). In addition, we have been involved in a total of 18 'COST Actions' (which fund international networking amongst active researchers), five as Chair, one a Vice-Chair and the remainder as partner.

25. The European Union is the biggest knowledge-producing region in the world. The EU is also the body through which the bulk of European research and economic development funding is channelled and international collaboration marshalled. EU membership is, therefore, an important enabler of high quality cross-border collaboration on projects, enabling countries to achieve far more collectively compared to national projects. This offers a huge opportunity to UK universities, as EU research activity is one of the areas where the UK's interests align most closely with membership of the EU (source: 'UK Government Review of the Balance of Competences report on Research and Development' 2014). It is no coincidence that over 80% of the UK's internationally co-authored papers are written with partners from other EU countries (source: Universities UK).

26. For UEA, globally relevant topics such as climate change; food and nutrition; antibiotic resistance; sustainable agriculture; the healthcare needs of ageing populations; water security; energy efficiency; and low carbon societies – all areas of focus in Horizon 2020 – represent a huge crossover with our work and our areas of expertise. UEA, for example, is the lead partner in the €9m 'Aquavalens' healthy water EU consortium, which brings together 39 partners from small and medium sized businesses, universities and research institutes to protect European citizens from contaminated water. UEA leadership of this consortium would not have been possible had the UK not been part of the EU.

27. UEA is particularly recognised internationally for our work on climate change, which has benefitted from extensive EU support. For example, the Tyndall Centre for Climate Change Research at UEA is the European Hub of 'Future Earth', a global initiative to coordinate and support research on environmental change and the challenges of sustainability. It brings together scientists, economists, engineers and social scientists who are working to develop sustainable responses to climate change. Tyndall has had its headquarters at UEA since the centre was first established in 2000, and nearly all of its income is via the EU. This enables it to undertake more substantial, more ambitious and more policy-relevant research for the UK and internationally, than it would ever be able to do via the funding mechanisms of the domestic UK Research Councils. Tyndall works not just within the research community, but also with business leaders, policy advisors, the media and the public in general. UEA leadership of this European Hub would have been highly unlikely had the UK been outside the EU.

28. Being an active EU research-intensive university also enhances our global academic reputation because EU-funded programmes have a truly global impact, and so give UK research much wider international reach. For example, 25% of UEA's highest rated 3* and 4* research impact case studies for REF2014 arose from EU collaborations.

29. Furthermore, we firmly believe that being located within an EU Member State internationalises our outlook as an institution. UEA was recently ranked as the 78th most international university in the world in the Times Higher Education World Rankings, a climb of seven places from 2014.

How is the innovation landscape affected by EU membership?

30. The European Commission has recognised that investment in R&D, innovation and the digital economy are vital to allow Europe to capture new growth opportunities in terms of economic prosperity, jobs, competitiveness, and productivity gains. The Commission is also concerned that Europe is lagging behind when it comes to translating the wealth of knowledge and expertise within the EU into new products and services.

31. Horizon 2020 represents a step change in Europe's R&D budget, strategic focus and available tools. The seven-year budget of Horizon 2020 represents a 30% real terms increase on FP7, and has a much stronger emphasis on innovation and 'close-to-market activities' than was seen previously. Horizon 2020 aims to drive innovation alongside research. It puts increased focus on encouraging SMEs, on supporting the most important breakthrough technologies that offer the prospects for the highest economic

returns, and on funding activities such as studies of the technical feasibility and commercial potential of a breakthrough innovation, risk assessment, design or market studies, intellectual property exploration, prototyping, testing, demonstration, piloting, capacity-building, scaling-up, large-scale product validation and market replication. Many EU research funding streams are structured in such a way as to enable further support for the commercialisation and exploitation of the findings.

32. Beyond Horizon 2020, EU funding is also important in terms of innovation infrastructure. The high levels of support that the UK receives from the EU for regional economic development projects helps drive innovation which leads to local job creation, growth and wider cultural benefits. For example, the Low Carbon Innovation Fund was launched in 2010, underpinned by £20.5m of support from the European Regional Development Fund (ERDF). Managed by UEA, this venture capital fund has successfully drawn in around £35m of additional matched funding from private investors, adding significantly to the position of the East of England as a leader in low carbon innovation. In addition, the new Enterprise Centre at UEA, which formally opened in October 2015, was built with the support of a £6.2m grant in 2011. Purpose-built to deliver UEA's enterprise activities alongside teaching, the Centre actively encourages UEA students and graduates to interact more closely with local business and provides an innovation lab, a 300-seat lecture theatre, flexible workspaces, teaching and learning facilities and amenities to help foster collaboration. It is the region’s hub for entrepreneurs, innovators and businesses that are committed to building a low carbon future. The ERDF funding not only demonstrates UEA’s global reputation in the low carbon space, but also highlights the key role of UEA and the wider Norwich Research Park as a driver of the region’s economy and enterprise.

What contribution does EU membership make to the quality of UK science and research through the free movement of people?

33. Being part of the EU has acted to help cement the strong global reputation of UK universities, allowing student mobility, the building of networks and the absorbing of other languages and cultures. The EU doesn’t just help attract bright and talented people to come to the UK – it provides opportunities for our own students and staff to widen their horizons, enhance their opportunities and increase their understanding of other societies and systems.

34. Around 6% of students based at UEA are nationals of other EU Member States (source: HESA). However, a larger percentage of UEA research staff - more than 13% - are nationals of other EU Member States.

35. In addition, UEA currently has Erasmus (student and staff mobility exchange) agreements with over 76 partner institutions in 22 countries across the EU, which support more than 160 different mobility programmes. There are doubts over the UK’s continued participation in the Erasmus programme if the UK votes to leave the EU.

36. From the student perspective, such mobility enhances their experience, deepens learning possibilities, strengthens independent thinking, fosters entrepreneurship and boosts employability. All of these qualities are needed for students to become the global

leaders of tomorrow. But UK universities also gain hugely from hosting some of the most talented young students from other countries. During the 2014/15 academic year, a total of 125 Erasmus students from other EU Member States were hosted at UEA.

37. From a staff perspective, mobility is important for personal and career development; to learn from others; to share best practice; to develop the longer term strategic international partnerships that may subsequently lead to new student exchange programmes; for joint curriculum development and delivery; and for providing a platform for future research collaborations.

What is the influence of EU membership on bilateral collaboration between the UK and other EU Member States? Are collaborations with Member States stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with Member States inhibited by requirements to work through EU mechanisms?

38. Horizon 2020 does not exclude any country in the world from participating in the Programme. For example, UEA submitted a European Research Council Advanced Grant bid earlier this year, jointly with the Harvard School of Public Health in the US. Horizon 2020 will not directly fund participants from non-Horizon 2020 eligible countries, but they are free to participate in projects, and can be reimbursed for their contribution towards EU-led research.

39. In total, 65% of the UK's top 20 research partners are other EU countries (source: Universities UK). UEA's experience is similar to this; out of the 400 partners UEA works with on EU-funded projects, around 60 are non-EU, 'international' partners.

40. UEA has ambitious plans for internationalisation - expanding the reach of our graduates and researchers and bringing high quality students from across the world to Norwich. Membership of the EU is key to achieving our aims.

To what extent does EU membership enable UK universities/researchers to inform and influence public policy at EU or international levels?

41. With the policy agenda increasingly set at an international level to deliver international responses to global challenges, the role of the EU in research and innovation is crucial. The UK is far less likely to be able to 'punch above its weight' in EU funding programmes if it is not involved in the creation of science and innovation policy and strategy.

42. UEA would much rather see the UK embrace its leadership position in a reformed Europe, and use its influence to continue to play a fundamental role in steering the development of EU research and higher education policy, so as to maximise universities' positive contribution to society. For its part, UEA is a key adviser in a number of areas to the United Nations, including climate change, international development, and gender issues. Such global perspectives can add huge value within EU policy debates.

43. With the half-way review of Horizon 2020 underway now, and work likely to commence soon on the development of the next EU research and innovation framework programme (to come into effect from 2021), we would not want to see the UK absent from

important meetings that could so materially affect UK universities' future international opportunities.

If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research?

44. Whilst UK universities such as UEA would no doubt continue to engage in some research and innovation activities with other institutions in Europe, even if the UK withdraws from the EU, there are major uncertainties over the future shape of such engagement, and whether it would represent a backward step. For example, there is uncertainty as to whether the UK Government would put in place a domestic programme of research and innovation funding that offered the same scale of opportunity for universities, or that it would be able to negotiate UK 'association' to Horizon 2020 that offered full access to funding streams.

45. In our view, the option of bilateral agreements, arising out of a UK exit from the EU, are likely to create international dislocation; reduce access to European networks; introduce undue layers of cost and complexity; create uncertainty for current and future collaborators; and reduce UK influence in European science and research.

46. In terms of 'association' to Horizon 2020, it is pertinent to note that Switzerland is only associated, temporarily, to parts of Horizon 2020, most notably Pillar 1 of Horizon 2020 - 'Excellent Science' - which includes European Research Council grants and the Marie Sklodowska-Curie Actions. Switzerland retains the status of a 'Third Country' on most other parts of Horizon 2020, including the collaborative 'societal challenge' calls. This means it is locked out of c70% of the current Framework Programme.

47. The argument that the UK can far more effectively 'go it alone' is too simplistic and betrays a fundamental misunderstanding of the importance of collaborating in order to achieve scale, impact and global solutions to global problems. UEA works locally, regionally, nationally and internationally; the teaching that we provide, the research that we undertake and the partnerships that we forge, do not stop at the borders of the EU.

48. We are part of the Norwich Research Park (NRP), home to the UK's eighth largest hospital, several world-class centres for plant and microbial sciences, the country's premier food research institute and one of only two Genome mapping centres in the UK. This world-class concentration of scientific and research power in Norfolk, and the outputs it collectively produces, regularly makes headlines - and has a real-world impact – all around the globe. More broadly across the the East of England, there are EU grant holders working on a vast array of different international collaborative projects from combatting age-related diseases, to finding new energy solutions, to improving crop resilience. It would be that much harder to position UEA, and many other quality institutions in our region, as international centres of excellence, if we are perceived to be standing on the sidelines of Europe.

20 November 2015

University of Leicester – Written evidence (EUM0007)

Funding

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

No comment

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

Analysis of the University of Leicester annual research grant income indicates that about 10-12% of our total funding of about £50m a year is from EU although this varies widely with subject. For example, the College of Medicine, Biological Sciences and Psychology has benefitted from over £20m EU investment in the past five years, which is 19% of our total research awards or around the same level of investment as from UK charities and from UK Government/Health. This investment has helped several of our key areas including Cardiovascular, Respiratory and Neuroscience research (see examples below).

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

Much of the evidence is anecdotal but the application processes is felt to be time consuming and the burden of award management and nature of the audit process far more burdensome and less efficient than, for example, the UK Research Councils.

There is certainly an overhead in administration for EU schemes, which is generally higher than UK ones. The amount of paperwork, meetings etc. is larger and in some cases the flexibility of use to which the awarded money can be put is quite restrictive compared to some national schemes.

The decision making processes seem to be of suitable quality.

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

Some scientific endeavor is added by working in teams and international collaboration. EU programmes, on top of bringing funding, allow/force researchers based in UK to liaise, often

participate in consortia, with researchers from other European institutions, enhancing UK-based researchers' networks and increasing the opportunity for collaboration and dissemination on a larger scale.

As an example, in 2010 Leicester joined a major consortium as the genomics lead for a multi-partner EU-wide project known as BIOSTAT-CHF. This aims to identify patients with heart failure who have a poor outcome, despite currently recommended therapy using information on demographics, gender, existing biomarkers, genetics and proteomics. In BIOSTAT-CHF an index cohort of 2500 patients with worsening heart failure, was recruited. Identifying patients with a poor outcome on currently recommended therapy might lead to further development of targeted therapies, eventually leading to improvements in outcome for patients with heart failure in Europe. Likewise another major EU investment brought together expert academic partners including Leicester with a number of SMES for a project focussed on exploitation of genomic variants affecting coronary artery disease and stroke risk for therapeutic intervention; the CVgenes@target project (2013-16).

In another example, Leicester has led the EU–funded AirPROM project (Airway Disease Predicting Outcomes through Patient Specific Computational Modelling) (2011-2015). This brought together experts (34 partners) to build a multi-scale computational model of the lung as a new way of characterising asthma and chronic obstructive pulmonary disease. Asthma affects 300 million people worldwide, and causes around 239,000 deaths every year. 80 million people have moderate to severe COPD. It is now the 4th leading cause of death and predicted to become the 3rd by 2030. Asthma costs around 17.7 and COPD 38.8 billion euros a year in Europe.

The EU gives researchers, particularly those early in their careers, access to their own funding through schemes like the ERC or Marie Curie. This is beneficial.

If this funding stream were to stop without an alternative national scheme (the Swiss did this recently) that could be extremely damaging.

We have been involved in a number of early career initiatives, for example, NEUROACT which is a Marie-Curie Industry Academia Research Project, led by Leicester. It ultimately aims, in the field of neuroscience and neurotechnology, to design, implement and deliver "a collaborative training program to develop multi-electrode array (MEA) platforms to understand synaptic function and treat diseases of the nervous system." NEUROACT is carried out by a research consortium bringing together partners with complementary expertise in engineering, electrophysiology, molecular biology, cellular neuroscience, theoretical neuroscience, and advanced data analysis.

In addition, we have access to Europe-wide facility projects (the CTA - Cherenkov Telescope Array is an example) which can access specific funding calls designed to help the project start up and bring scientists together. CTA benefited greatly as did other projects. These are usually start-up schemes rather than full funding, but that can often be the hardest phase to get funding for. There are similar access routes into partial funding of studies for space projects; for example, we are part of one linked to the new ESA Athena mission via Horizon 2020.

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

It is clear that EU membership fosters better collaboration between EU member states. However, these are not necessarily stronger collaborations with non-EU countries, for example, with the US. EU membership does not seem to inhibit collaborations with non-EU states.

Intra-EU opportunities are numerically more than those calls that require collaboration with non-EU institutions. I wouldn't say that bilateral collaborations with member states are inhibited by requirements to work through EU mechanisms; if anything, the EU mechanism make it much simpler to establish such collaborations as they have set up a sort of "common language" for funding bids.

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU
membership affect the growth of research-intensive UK companies?

This is a growing feature of Horizin2020 and we are yet to see the outcomes of this new emphasis.

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

Research in areas such as Physics & Astronomy is based around Europe-wide projects funded/operated by major agencies such as ESA or ESO and not specifically through EU programmes. However, EU funding has been valuable in enabling data exploitation collaborations. There are no restrictions on creation of other activities outside the EU. The Europe-wide CTA - Cherenkov Telescope Array - is an example

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

It is clear that the UK benefits from the free movement of people in the EU, without visa restrictions. UK Universities have become very attractive to EU scientists, which has created a thriving outward looking research community to the benefit of our institutions. Many elite researchers from EU member states are now based in the UK thanks to the free movement

of people. Recruitment of non-EU scientists is more difficult but this is affected more by UK immigration policies than EU ones.

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

Recruitment of non-EU scientists is more difficult but this is affected more by UK immigration policies than EU ones.

Regulation

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

Regulatory frameworks affect our research directly through areas such as research ethics, genetically modified organisms, integrity in research, and open access and open data and regulation of clinical trials. EU policies relating to GMES and GNSS do create new research opportunities.

It appears that the EU increasingly wants a say, good or bad, in international science projects and policy. Not being part of that discussion but rather shouting through the door would not be ideal. The EU has also indicated it wants some say in other agencies, like ESA, which if that becomes more common is a reason for us to remain in the EU and would adversely affect us if we were to withdraw.

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

We do not feel that that membership of the EU prevents the successful operation of UK science & research although at times EU regulation can be a burden, at other times the application of common regulation across the EU can assist research (e.g. pan-European clinical trials).

12. How is the innovation landscape affected by EU membership?

Easier access to a greater diversity of funding and partners drives innovation.

Scientific advice

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

The UK has well-established routes for receiving and acting on scientific advice, particularly through the Chief Scientific Advisors, that are embedded in the various government

departments. The Select Committee system and the inquiries run under these also make an important contribution. At the moment it seems as if there is no mechanism whatsoever for generation of scientific advice for the EU, since the post of Chief Scientific Advisor was ended by the new President of the European Commission. This is very regrettable and no appropriate replacement mechanism is in place.

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

This is a difficult area. In the UK there are appropriate mechanisms in place (see above), which can be accessed by learned societies, individual organisations and even individual researchers. There are much more limited opportunities to influence policy in the EU, partly because of the absence of such clear mechanisms but also because of the distance from the seat of EU government.

A comment from a colleague in international economic law, sums up the experiences of many colleagues: UK membership in the EU has been the motor of a race to the top in terms of quality of research across the EU; the fact that UK-based researchers can easily disseminate their research across the EU is leading scholars in other EU member states to raise the qualitative level of their research in order to participate in conferences, workshops and other research events as peers (in practice and not merely in name).

12 November 2015

University of Manchester – Written evidence (EUM0044)

1. Introduction

This document is a response from the University of Manchester (UoM) to the Call for Evidence. It is based upon the University's experience as a participant in European programmes and upon studies of European research and innovation carried out by UoM staff. The University participated in 396 projects in the EU Framework 7 Programme, with a financial contribution of €175m in the period 2007-13. This included 38 fellowships from the European Research Council worth €66m. Over the same period UoM hosted 29 Marie Sklodowska Curie Initial Training Networks. Participation in FP7 projects resulted in over 4000 collaborations with partners from across Europe in HEIs, research institutes, small and large firms. We structure our evidence by the main headings given.

2. Funding

2.1 EU versus repatriation of funding

It is not surprising, given the strength of the its Science Base, that the UK should be the principal net beneficiary of EU R&D funding, to the tune of over €1bn during FP7. To this may be added investments in research and innovation from European Structural and Investment Funds. There is an argument put forward that if the UK were to leave the EU (and its research programmes) that these funds would be invested nationally without the transaction costs of routing them through Brussels. Three main arguments may be set to refute this view:

i) There would be no guarantee in a period of austerity that 'repatriated' funds would be allocated to research, particularly in the situation where the current level received exceeds the national contribution;

ii) Research thrives under conditions of plurality of funding sources. This is often cited as one of the reasons behind the success of the US system. Given the fallibility of peer-review and of priority-setting structures, having multiple and independent points of support increases the chance that important work will take place. Variety is also beneficial in terms of policy instruments;

iii) In certain areas greater value can be obtained from a research investment made at European level. We discuss this in more detail in the section on collaboration but here compare EU-funded support for collaboration with the bilateral or multilateral arrangements which could replace it. There is ample evidence of inefficiencies and delays caused by the need of national agencies operating under different rules, priorities and timescales seeking to co-fund a shared project. This has been a frequent complaint in schemes such as Eureka which have relied upon this approach.

A further option in the context of leaving the EU would be to remain in Horizon 2020 as an Associated Country under Article 7. Even if this were the case, there would be a substantial loss of opportunity to shape the strategic and operational priorities.

2.2 Reinforcement of national priorities

EU-research can also interact beneficially with national priorities. For example EU programmes have provided support for graphene research in Manchester at critical times. This includes a£1.8m ERC Starting grant for subsequent Nobel Laureate Konstantin Novoselov in 2008 as well as the further award to him and UK collaborators in Cambridge and Lancaster of a £13.3m Synergy grant – the most competitive within the whole EU set of programmes. The £38m funding from the UK Government for the National Graphene Institute was not sufficient to meet the building and facilities cost. Most of the balance was met by £23m from the European regional development Fund. Currently several graphene researchers at all levels benefit from EU funding and the Graphene Flagship project which has built up a community of 142 partners in 23 countries. Graphene Week, its main annual event, brought 600 delegates to Manchester this year.

Strategic fit with EU programmes is better than in the past when an ill-advised 'additionality' criterion attributed EU funding to the national agency most closely associated with it. The theory was that would avoid duplication but in practice it regularly excluded the build-up of national capability to take full advantage of European investment in an area.

2.3 Administration

There is no evidence to suggest that the selection processes for European grants are any less rigorous than those applied at national level. Peer review is applied in all cases with well-publicised scoring systems and in some cases such as ERC grants candidates are also interviewed. More contentiously it may also be said that the mean effort in making an application to Horizon 2020 is no more than for national funding. The work for the coordinating partner is quite considerable but for each of those there are several collaborators who have a relatively light burden. A cause for concern has been the falling success rate between FP7 and Horizon 2020 which of course increases the proportionate effort of application to reward.

Where there are remaining concerns it is in the subsequent stages after a project is approved. Despite a major initiative on simplification, financial regulations cause these to remain ponderous and a poor use of applicants' time and resources.

3. Collaboration

To address the benefits of collaboration, we will not discuss the general value of research which is well-evidenced and also applies to EU-funded research. Instead here we will consider the value-added which may be conferred through participation in EU programmes.

3.1 Benefits and costs of cooperation

EU countries are key partners for UK research. According to Elsevier[772], the UK's major co-authorship country partnership during the period 2008-2012 is with Germany, accounting for 45,250 co-authored articles in that period. Similarly strong partnerships exist with other scientifically strong Member States.

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[772] International Comparative Performance of the UK Research Base – 2013, A report prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS)

There are numerous studies on the benefits of collaboration which are i*nternal* to the research. Most of these rest upon either a cost-sharing rationale, as with large facilities but also in the case of combination of large datasets for example in epidemiology. The second set of arguments focus on complementarity – that the partner has skills or assets which would not otherwise be available. These could be scientific capabilities or access to populations, data, geographical features etc which are necessary for the research. European funding allows these advantages to be gained by providing a much larger choice set to find the right partner and then by enabling the costs of the collaboration to be covered.

Moving on to benefits which are *external*, these include providing exploitation pathways for the research – for example by UK firms finding appropriate continental scientific partners and vice versa, or through providing a channel for the research to influence social benefits such as better-informed regulations. At a higher level of aggregation, many of the societal challenges addressed by EU programmes require a transnational response because they address cross-border problems such as environmental pollution or climate change. Similarly, industry-focussed projects may be seeking to support the emergence of beneficial international standards or creating new markets with a wider base or customer-supplier linkages.

In terms of tangible benefits there are several examples in the REF impact cases where our research and that of other universities was supported by the EU and had impacts in the UK and vice versa.

Collaboration has also helped to shape the research community. EU mobility provides us with excellent researchers from other Member States without the delays and bureaucracy associated with non-EU appointments. This has been a clear benefit to the UK's profile of excellence. Schemes such as Marie Sklodowska Curie have provided important training channels for early career researchers, as have research staff positions on research projects. The influence of UK and others including the Nordic countries has exported best practices in merit-based appointments, gender mainstreaming etc to some countries where appointments were influenced by patronage.

Costs of collaboration are mainly transactional. Projects require more complex governance, team meetings involve more travel, decision-making may be slower. Normally these would be need to be outweighed by the benefits if a project is to proceed but there is an argument that EC projects may over-stimulate collaboration through the perception that projects are required to have partners from weaker scientific systems. Normally this is not the case and in basic research the ERC is not a collaborative programme.

3.2 EU versus Global Cooperation

It is a legitimate question to ask whether research which is performed better at European than at national level could gain still further by being open to global cooperation (for example with the USA and Japan). There are cases where benefits of scale and scope are greater at global level and where these outweigh any additional coordination costs and a test should be applied. However, in most cases a governance framework for a global approach is more complex to achieve. It is also the case that a combined European position can gain more influence than direct national participation. For applied research questions of

competitiveness and how the results are exploited are also likely to be more acute at global level as market and regulatory environments are more divergent.

4. *Regulation*

4.1 Deregulation opportunities

Scope for benefits in the domain of taxation (eg avoidance of certain VAT rulings) depends on what arrangements the UK would need to negotiate for trade. Looking at present relations between the EU and the EEA members or Switzerland and collective arrangements with other trade blocs, it seems likely that key principles such as non-discrimination would apply and limit the scope for variation in UK legislation. It seems unlikely that economic regulations would be varied specifically for the benefit of science.

Substantially greater benefits could be gained in areas such as data protection, avoiding concerns such as the risks to medical research posed by European Parliament proposed amendments seeking to restrict the use of personal data for scientific research purposes without specific consent.

4.2 Innovation landscape

Success in innovation is often dependent upon the demand conditions faced by companies. This is a combination of factors such as the scale and structure of the home market and the regulatory environment insofar as it structures demand. Demanding customers are able to pull through innovations at a critical point before scale-up is achieved. Both public and private procurement are critical to innovating forms, particularly SMEs – this contention is strongly supported by academic studies performed in Manchester and elsewhere.

Against this background it is clear that EU membership is potentially a major positive factor for innovation but only insofar as the Single Market is achieved. This supports the UK negotiating position to an extent but also pushes towards further standardisation of regulation. The reward is a home market comparable to that of the US and China. Evidence of our current disadvantage can be seen in the venture capital sector where the scale of investment in second and later rounds is five times larger in the US than in Europe and the number of deals three times larger. This in part explains why many good UK prospects are acquired by US investors and yield very limited benefits to our economy.

European procurement directives are also beneficial to innovation, particularly in the light of more recent rounds of revisions. They go a long way to ensuring that markets are open to UK firms with a competitive offering and similarly benefit users of innovation within the UK. Much more could be done in terms of aggregation of demand across the EU in certain areas of public procurement to increase the increase the incentive for firms to innovate.

Submitted by Prof. Luke Georghiou, Vice-President for Research and Innovation on behalf of the University of Manchester

20 November 2015

University of Oxford – Written evidence (EUM0040)

Following an internal consultation and call for evidence, the University of Oxford is pleased to submit the following response to the House of Lord inquiry.

1. Funding

1. *What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?*

EU funding makes up a significant proportion of research income to the University of Oxford. For some disciplines, the income is higher from the EU than it is from UK Research Councils and this funding is therefore a vital element for these departments and faculties.

As an EU-wide funding scheme, the Framework Programme brings a number of opportunities and positive impacts, which in many cases differ from those provided by national sources of funding: it provides access to large, transnational, multi-disciplinary projects as well as access to collaborative networks.The pooling of resources from Member States to create a programme for research and innovation allows researchers to address global challenges in a collaborative, multi-national and interdisciplinary way that would be beyond the scope of what could be funded by the UK alone. EU funding complements and expands the work done in the UK and participation in H2020 adds real value to national research endeavours.

The European Research Council (ERC) is particularly effective and efficient and is a crucial source of funds for Social Sciences and Humanities. The ERC budget for 2014-25 for SSH almost equalled the national funding from AHRC and ESRC. The ERC is an invaluable platform for Social Sciences and Humanities not only at the University of Oxford but across the whole of the UK. Of course, this is not to underplay the impact the ERC has on other areas of science and engineering. The flexibility and length of funding is critical to supporting the growth of new areas of science and to allowing early career researchers to establish themselves as leaders of research (securing ERC funding is seen as a gold standard). It would also be the case that losing ERC (and other EU) funding would place an increased burden on RCUK funding, resulting in a further decline in success rates.

Similarly, EU funding has been instrumental in the growth of Oxford's mathematics department with 30% of current funding from the EU compared to only 13% from RCUK sources. The EU gives strong support for fundamental mathematics and this funding is crucial to the progress and success of the mathematical sciences in the UK and beyond.

ERC grants and Marie Skłodowska Curie researcher mobility grants are individual grants awarded to the researcher and carry an administrative burden similar to that of UK domestic grants.

The larger, collaborative projects have a higher administrative burden but this is not

dissimilar to the UK requirements for long-term, multi-partner, inter-sectoral projects. The European Commission is committed to a programme of simplification for Horizon 2020 project implementation and reporting and the UK is playing a prominent part in steering this activity via individual institutions, UUK, UKRO, the Russell Group and LERU.

The UK is heavily involved in decision-making and advisory processes on research and Framework Programmes, both through the Research Councils and the UK Research Office and Universities UK making official representations and individual institutions and academics sitting on expert groups and serving as evaluators. The European Commission has shown itself to be very receptive to proposals on improving Framework Programmes and to wider research policy representations from UK actors.

The University of Oxford has robust systems in place to support the implementation and management of EU funded projects (as do all the research-intensive UK universities) and therefore participation in H2020 is not onerous. The benefits that come from the collaborations and opportunities far outweigh the challenge of aligning our systems to the requirements of the EU.

2. Collaboration

1. *What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?*

2. *How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?*

3. *What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?*

In his report *Ensuring a successful UK research endeavour* (Nov 2015), Sir Paul Nurse commented

Openness to scientific strengths beyond the UK is one of the defining characteristics of the UK research base, and both within Europe and other international fora, we should always look to leverage these strengths.

It is important for agility in response and for ensuring capability, that the nation maintains a wide breadth of research activity appropriate for a country the size of the UK, embedded within the larger endeavour provided by the European environment.

Science is a global activity and EU funding encourages and facilitates collaborations across disciplines and borders. The Framework Programme supports projects which could not feasibly take place on a national level and, as one of the leading scientific nations in Europe,

it is vital for the UK to be a key participant. It is extremely unlikely that national funding schemes, even if budgets were significantly increased, could compete with EU programmes let alone replace them.

When researchers collaborate they can pool resource, data, knowledge and infrastructure to tackle global problems and achieve more together than they could do alone.

It has been proven that research done internationally achieves more impact than research done at a national level, and that diverse teams achieve more than homogeneous ones. Knowledge is international by nature, and the best minds in the UK want to collaborate with the best, no matter where they come from. EU programmes bring together talented people from across Europe, and beyond, to tackle major challenges, recognising that today's global problems require global solutions.

There is a strong feeling amongst science and engineering researchers that having strong visibility of research in Europe helps to increase the recognition of UK strengths. The USA is something of a 'closed shop' (getting US colleagues to appropriately cite UK work generally requires publication in US-flagged journals or almost constant attendance at US learned society meetings). Withdrawal from the EU might generate similar difficulties.

Participation in EU programmes also supports our interaction with industries that are not present (significantly) in the UK and can lead to subsequent inward investment by those companies to fund additional research activities. In addition to supporting our economy, this is important to enable the UK to retain an expertise and knowledge base in industries/technologies that are needed by our country but from which we have otherwise de-coupled in terms of a UK industry presence. It also supports the possible re-introduction of industrial activities as needs arise. There are many situations in which the UK needs to be an informed purchaser of technology and where we no longer have our own industrial activity. Having researchers who work with the relevant industries in Europe helps to reduce the risk that we have no appropriate insights.

The Innovative Medicines Initiative (a public-private partnership with H2020 and EFPIA) leads to funded, near-market collaborative links with major Pharmaceutical companies on a scale that is unlikely to be achievable through national funding.

Whilst there is an understandable focus on the Research and Innovation Framework Programme as a significant source of income for UK universities, the opportunity to participate in exciting science across Europe is in many ways even more important. EU membership allows Oxford's (the UK's) researchers access to world-class facilities, research infrastructures and knowledge and this is fundamental to the continued growth in research excellence and the innovation that comes from it.

The UK is a key contributor to and a positive influence upon the European Research Area (ERA), and will benefit further from well-targeted efforts to enhance the ERA. The ERA initiative is about creating 'a European internal market for research, where researchers, technology and knowledge should freely circulate; effective European-level coordination of national and regional research activities, programmes and policies; initiatives designed for

implementation and funding at European level' (European Commission, 2007

A (2012) study of ERA found significant benefits from ERA for research, and benefits for economy and society as below.

Benefits for research

Benefits from efficiency gains:

- larger pool of selection
- gains from specialization
- visibility and critical mass

Benefits from reduction of efficiency losses:

- reduction of excess duplication

Benefits for economy and society

Direct effect on socioeconomic growth

- more R & D investment from the corporate sector
- faster growth of young innovative companies
- increase in productivity in services
- addressing Societal Challenges

In his foreword to the report, Robert Jan Smits, Director General DG Research and Innovation made a number of observations about benefits of actions at EU level. These resonate with our experience

- Europe wide schemes mean 'Stronger competition [which] leads to funding the best research, therefore boosting excellence'

- Cross border cooperation allows critical mass, a networked specialisation of research teams, better knowledge sharing and transfer, and better visibility of research results

- Solutions to societal challenges are tested across Member States

- Large-scale and virtual facilities not only improve access to state of the art research infrastructures by all researchers concerned, but also foster connectivity in science between all countries and regions

The free movement of people is crucial to our ability to attract the best researchers and sustain our internationally leading research profile.

For some disciplines, the mobility of the research community also means that deterioration in the funding environment that is expected to be associated with a UK withdrawal from the EU would result in the rapid movement of key researchers overseas.

At the University of Oxford, more than 40% of our academic staff hail from countries outside the UK as well as more than 30% of our students. This level of international engagement contributes to our success and should not be compromised by a limitation on the free movement of people.

3. Regulation

1. *What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?*

The main EU regulatory frameworks that affect science and research are free movement of people, data protection regulations and use of animals for research

None of these have a particularly detrimental effect on UK science and research and indeed, apart from the free movement of people, we are bound by very similar national regulation anyway.

By being an EU member the UK is able to influence how regulations are designed and introduced and, in the case of the EU Data Protection Regulation that is currently under negotiation between the Parliament and the Council, the UK has played a key role in preventing potentially damaging amendments being implemented by Parliament. It is vital that the UK continues to have a strong voice to protect the interests of the research and innovation communities and ensure that regulatory frameworks do not limit our ability to perform world-leading research.

4. Scientific Advice

1. *How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?*

2. *To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?*

Scientific Advice

The UK has a long tradition of scientific advice; we have had an official Chief Scientific Adviser (CSA) in place since 1964 and at present we have a relatively strong mechanism for providing scientific advice to government. The CSA is supported by the Government Office for Science, which has over 80 permanent staff. As well as coordinating cross-government science policy, the Government Office for Science also houses teams that focus on science capability across government and there are CSAs for each Government department.

Compared to the UK the EU has a much weaker track record of scientific advice. A pertinent example concerns the legislation adopted in January 2015 on Genetically Modified Organisms (GMOs), which will allow Member States to ban GMOs on non-scientific grounds, even after they have passed the EU's risk approval process and are deemed safe. This decision allows Member States to take action against the best scientific testing and advice, thus undermining the value of that advice.

Influencing policy

As a full member of the EU, the UK has a place on H2020 programme committees which advise on the content of the bi-annual work programmes

The UK plays a leading role in shaping EU research programmes, not only in terms of priority areas but also in ensuring that funding is allocated on excellence rather than used as a capacity-building fund for less well developed regions of Europe.

Individual UK scientists and their institutions can feed into these mechanisms by liaising with relevant research councils and other organisations engaged in influencing public policy.

In addition the UK's MEPs are involved in key committees and full plenary decisions that affect research and innovation policy across Europe. . Research and innovation do not occur within single national borders or 'national bubbles' – the UK would be affected by EU policy even if it was not a member of the EU; and as non-member, it would not be at the table to develop or influence that policy.

5. Any other comments?

Being an Associated Country is not the answer

Those in favour of the UK leaving the EU proffer the solution of the UK becoming an "Associated county" which would allow us to participate in Horizon 2020 on the same basis as Israel, Norway, Turkey, Moldova, Serbia and others. All of these countries negotiate an entry ticket to the programme through an international agreement with the EU and pay a contribution to the budget proportional to their GDP.

They participate in the programme only; they have no say in the discussions on the design or implementation modalities of the programme or on any priorities that may be defined, etc. However, by becoming an associated country, research organisations from the country concerned have the same legal rights and obligations as those coming from Member States.

These association agreements are carefully negotiated and *so require agreement from both sides*: the country concerned and the EU; so association is not automatic, as has been the case with Switzerland in Horizon 2020.

The situation with Switzerland and Horizon 2020 was elegantly (and brutally!) summarised in an article in the Guardian recently, see http://www.theguardian.com/politics/2015/nov/11/whatever-you-do-dont-become-switzerland-swiss-academics-tell-uk.

The partial association (see the article for more information) to the Excellence Science Pillar and the Widening Actions of Horizon 2020 was only a transition measure and will come to an end at the end of 2016, where, under the current state of affairs, Switzerland will be considered a 'third country' for all of Horizon 2020 once again.

Should this be the case, Swiss research organisations would not be eligible to be host institutions for ERC grants for calls from 2017 onwards, as was the case for Starting and Consolidator Grants in 2014.

Furthermore, at the moment there is no clear indication that the rest of the EU would be favourably disposed to enabling the UK to have full 'Associated' status – indeed it has been mooted that some of the Central and Eastern states would be more than happy for the UK to be excluded altogether (they think it would give them the opportunity to get more funding if they don't have to compete with the excellence of UK R & I)

When Switzerland was excluded from H2020, much was made of the fact that their government stepped in and funded their participation in projects (any 3rd country can participate in a project on a self-funded basis) and that the UK could do the same for universities here should we leave the EU. However, in discussions with Swiss institutions it became clear that it was not only their inability to host ERC grants that was the problem but also that they were prevented from co-ordinating H2020 collaborative research and innovation actions. There are real benefits to be gained from 'driving' the research agenda as the leader of major international collaborations rather than 'following' the agendas of others.The UK needs to remain at the heart of Europe in order to maintain its place in the world.

20 November 2015

Vote Leave – Written evidence (EUM0056)

Introduction

The EU has extensive powers over a range of issues relating to science and technology – from the policies that govern the use of new hardware, to the rules that guide the funding and process of research. Because the UK is a member of the European Union, UK taxpayers have to make large budget contributions to fund the things the EU deems its priorities – reducing the monies available to invest in our own priorities such as scientific research. The EU's technology-based regulations have had a substantial and negative impact on innovation and economic growth. Leaving the EU would allow the UK to make far greater investment in scientific research and give us greater freedom from the regulations which act as bureaucratic restraints on innovation.

Science research should replace EU membership as a fundamental priority for national policy. The creation of a civilian version of America's DARPA and its funding at an equivalent level to DARPA's would give British science and the high technology sector a huge boost and help us lead the world in various fields. This is easily affordable by diverting money now sent to the Brussels budget. This would be in the interests not just of Britain but of Europe and the wider world.

1. **What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?**

2. **What is the scale of the financial contribution from the UK to the EU that supports science and research activities?**

The first question is predicated on a false premise. Because the UK is a net contributor to the EU, any funds that it receives from the EU should not be seen as grants. Instead of comparing the funds directed to the UK to those received by other member states, any funds that the UK receives from the EU should instead be contrasted against the 'opportunity cost' of allocating such substantial sums to the EU budget, rather than investing in the priorities decided by the UK itself, such as scientific research.

In 2014, the UK's gross contribution to the EU budget was £19.1 billion and our net contribution was £9.9 billion. Over the last seven years, the UK's gross contribution to the EU budget has amounted to £115 billion (link). This should be contrasted against the main source of EU science funding - the Horizon 2020 programme - under which €78.6 billion will be disbursed to research projects across the EU over the next seven years (at current prices). It should be noted that this is the amount that will be distributed across the whole EU, not just the UK - funding for Horizon 2020 is allocated on the basis of competitive calls and is managed centrally by the European Commission and its executive agencies; there are no pre-allocated country quotas. This means there are no available figures to calculate how much the UK will receive from Horizon 2020.

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

There has been considerable criticism of the way that the EU manages funds for scientific research. The Horizon 2020 funds were recently drastically reduced by the European Commission, with scientists severely criticising the Commission's decision (link). When it produced the Balance of Competences report, the previous coalition Government claimed that there has been no detailed research (at least none that they could find) into whether EU funds allocated to research would get a better return if invested differently (link). However academic contributors to the Balance of Competences report, including the Vice Chancellor of Buckingham University, criticised the way the EU funds research (link).

It is also telling that HM Government has said that 'the UK considers that the time has come to revisit the role and shape of future EU research and innovation instruments within a streamlined portfolio of instruments' (link).

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

Because EU technology and research programmes are – for the most part – international in scope and designed to work with third countries, there is no reason why the UK would not still be able to access EU funding or collaborative projects if it left the European Union. The key benefits that come from EU collaborations are also open to non-EU member states.

The European Research Framework Programmes have been open to non-EU countries for many years. In addition to the EU member states, there were numerous associated countries in the last of these programmes, FP7: the EU candidate and potential candidate countries, members of the European Economic Area, Switzerland, Israel and Moldova.

It should also be noted that the UK would also retain membership of the many global and non-EU bodies and agencies that co-ordinate international technology and research cooperation. The UK would likely continue to be a member of EUREKA, which has a focus on 'facilitating the co-ordination of national funding on innovation aiming to boost the productivity & competitiveness of European industries – its network includes Israel, South Korea, and Canada' (link). Other members include non-EU countries such as Russia and Turkey. The UK would also be able to remain part of the European Organization for Nuclear Research (CERN) (link). In short, leaving the EU would not reduce the UK's standing in this field, nor would it undermine our ability to access funding or to work with other countries in developing innovative new technology.

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

Bilateral deals constitute an important aspect of international scientific collaboration. Leaving the EU would not hinder the UK's ability to strike agreements with foreign governments – or with other EU member states. The UK has a significant infrastructure for promoting technology and co-operation across borders. As HM Government itself has noted:

> *International collaboration in science and innovation is vital for meeting policy challenges on a global scale. Challenges such as pandemic disease, climate change and food security require the ability to engage other governments with, and through, science. The UK Science and Innovation Network (SIN) is made up of more than 90 staff, in 46 different locations in 29 countries and territories. SIN officers engage with the local science and innovation community in support of UK policy overseas* (link).

An example of the UK's success can be seen in the relationship that has been brokered by SIN officers between the University of Edinburgh and Peking University, enabling them to establish a laboratory for collaboration on stem cell research. Beyond the SIN, the UK also has bilateral deals with other countries to promote research: for example, in 2008 the UK signed a Memorandum of Understanding with Canada to conduct co-operation in polar research.

Through these bilateral agreements, collaborations with non-EU countries are just as effective as collaboration with EU member states. Proof of this is Switzerland which, despite being a non-EU member state, co-operates with EU countries on research programmes thanks to bilateral agreements. Switzerland receives a large amount of EU funding for its research and contributes to the EU's programmes (between 2007 and mid-2012, around CHF1.56 billion in grant funding flowed into Switzerland).

Switzerland's co-operation with the EU is managed via the EURESEARCH programme, which was founded in March 2004 and allows for Swiss research institutions to engage with EU programmes, including Horizon. The UK could seek to co-operate with EU research programmes via a similar bilateral agreement, or negotiate a better one.

Even after the Swiss referendum vote against free movement on 9 February 2014, Switzerland and the EU were able to agree a 'partial association', which came into effect on 15 September 2014 and runs until the end of 2016. Under this new scheme, Switzerland participates with an associated country status in actions under:

- the 'Excellent Science' pillar (the 1st pillar), containing the European Research Council, Future and Emerging Technologies, Research Infrastructures and the Marie Skłodowska-Curie actions;
- actions under the specific objective 'Spreading excellence and widening participation';
- the Euratom Programme; and
- the activities carried out by the European Joint Undertaking for ITER and the Development of Fusion for Energy for 2014-2020 (link)

This means that Horizon 2020 funds under Pillar 1 are still reaching Switzerland (link).

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

Despite often noble intentions, many EU laws have inadvertently created innovation-hindering problems for businesses and consumers. This has acted as a brake on private investment into UK science and research. EU policies often lack coherence or effectiveness, and frequently add to administrative burdens.

There are several ways EU laws can create problems, ranging from a failure by the Commission to engage properly with scientific issues, through to a comprehensive failure by policy-makers to fully think through the consequences of EU action. Complaints about EU bureaucracy on research matters are some of the main grievances that businesses have with the EU: unsurprisingly, this concern was expressed in the last Government's 'Balance of Competences' review (link).

The EU has also introduced bad laws that have had significant unintended consequences for companies that invest in scientific research. There are, for example, concerns about EU policies on data protection and the limits that the EU places on data-sharing. In the Balance of Competences Review, respondents warned that amendments on data-sharing proposed by the European Parliament could potentially have serious implications for the use of patient data for health research purposes (link). The University of Surrey agreed, saying that the current system could require medical practitioners and researchers to obtain patients' consent even for anonymous data. Concerns have also been raised that, following the European Court of Justice's decision in *Brüstle v Greenpeace* (2012), the future of UK stem cell research may be compromised because of the potential loss of private sector investment. State aid rules have also been highlighted as an extra deterrent to innovation.

EU rules for vacuum cleaners are another good example of how EU rules are placing a burden on technology firms. One of Britain's most celebrated entrepreneurs, Sir James Dyson, has argued that the EU was legislating in the interests of German manufacturers and ignoring sound scientific advice.

Outside the EU, the UK would be free to reconsider such harmful rules. This would put us in a stronger position to support technology firms and principles such as 'net neutrality'. There would be a valuable opportunity to look at existing laws, and either to seek to remove 'gold-plating' or even remove harmful EU rules from the statute books entirely, in line with the UK's other international obligations. There would also be opportunities for reducing overspend.

Outside EU and EEA competition rules, a future UK Government would also be able to favour promising British technology firms more strongly. Having left the EU, Britain might expect to support young companies in a variety of ways – through more state aid, targeted procurement, VAT or corporation tax variation, integrated technology clusters, and

favourable business zones. This holds the prospect of giving the UK Government wider options in developing initiatives such as Tech City in East London.

7. **How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?**

14. **To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?**

Today, numerous international bodies help to regulate research and the development of technology across the world. These bodies have many important roles, ranging from the management of international patents to the promotion of inter-state co-operation on technological issues. While the UK has a powerful voice in many of these bodies, the EU's role has been steadily growing and there is a risk that it could replace the UK's own representatives. A good example of this is the World Trade Organisation, where the UK has to take a common EU line rather than speak with our own voice. The WTO plays a major role in promoting research and innovation: the Ministerial Declaration on Trade in Information Technology Products was agreed at the Singapore Ministerial Conference in December 1996, and aimed to lower all taxes and tariffs on ICT products by signatories to zero. These rules now govern 97 per cent of world trade in information technology products. In addition, the WTO manages the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which sets down minimum standards for many forms of intellectual property (IP) regulation, and it is also looking at improving e-commerce across borders.

The UK's influence in key international bodies will not be weakened by a vote to leave the EU. By virtue of the fact that we would remain a member of the United Nations after leaving the EU, the UK would remain a member of the International Telecommunication Union, for instance. As well as co-ordinating the shared global use of the radio spectrum and satellite orbits, this body also promotes international co-operation in telecommunications, including worldwide technical standards. Its remit includes broadband internet, wireless technologies, aeronautical and maritime navigation, and space-based communication technology.

The UK would also remain a member of the World Intellectual Property Organization (which, in addition to administering the International Patent System, 'offers a range of global services for protecting intellectual property (IP) across borders, and for resolving IP disputes outside the courts'); the United Nations Educational, Scientific and Cultural Organization (UNESCO), which promotes scientific co-operation across the globe; and the World Meteorological Organization, the UN body which analyses the state and behaviour of the Earth's atmosphere.

In addition to UN work, joint initiatives to tackle global concerns are led by the G8 Heads of Research Councils, of which the UK would remain a member outside the EU. The G8 Research Councils Initiative on Multilateral Research Funding is described as 'a co-ordinated

effort to support multilateral research partnerships … aim[ing] to support excellent research on topics of global relevance which can best be tackled by a multinational approach.'

8. **What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?**

9. **Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?**

Net migration from the EU constitutes 55 per cent of overall net migration to the UK according to the latest Migration Statistics Quarterly Report from the Office for National Statistics (August 2015). As a member of the European Union, the UK Government therefore has no control over the majority of net migration to the United Kingdom. This means that any government seeking to reduce net migration has to place tighter restrictions on non-EU migration – even if that means restrictions on non-EU scientists and innovators. This is harmful for the science and technology sector. The importance of strengthening links to countries beyond the confines of the European Union cannot be overstated. According to the Government's report *Innovation and Research Strategy for Growth*, China is set to become the second largest recipient of foreign direct investment in the world, and is already the second largest investor in research and development after the USA.

The UK would have many opportunities outside the EU to develop these links. The internet has already proven to be a massive driver of trade and prosperity, and its continuing development could benefit the UK far more than others, as English-speaking countries are uniquely likely to gain. Almost 85 per cent of homepages and an estimated 55 per cent of all internet content is in English, meaning it has never been easier for British firms to reach the world and collaborate on research and innovation.

10. **What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?**

11. **If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?**

A number of EU regulations and directives have created serious problems for the research and science community in the UK. Specific EU laws which have been cited by the Government as specifically harmful on firms that invest in science and research include:

- ***REACH (Regulation on Registration, Evaluation, Authorisation and Restriction on Chemicals).*** The Government has been very critical of this, stating: 'The cost of registering chemicals under REACH is excessive. SMEs across the EU are hit disproportionately hard. REACH is forcing some smaller businesses to consider manufacturing outside Europe or stop manufacturing altogether' (link).

- ***The Clinical Trials Directive.*** The Government has described this as 'creat[ing] new burdens for business and allowed European states to introduce contradictory domestic rules, making the EU a less attractive location for clinical trials'. According to the Balance of Competences report, 'the Clinical Trials Directive was mentioned by many respondents as having acted as a disincentive to conducting such trials because of bureaucracy, inconsistent application and an inflexible regulation' (link).

Other laws that have had a burdensome impact on all companies, including those that invest in science and research, include:

- The Data Protection Regulation
- Proposed Directive on the disclosure of non-financial and diversity information by certain large companies and groups
- The Health and Safety Framework Directive
- The Quality Framework on Traineeships
- The Posting of Workers Enforcement Directive
- The Working Time Directive
- The Agency Workers Directive
- The Acquired Rights Directive
- The Environmental Impact Assessment Directive
- The Public Procurement Directives
- The Fuel Quality Directive
- The Waste Framework Directive

Further examples are provided in the 2013 report of the Government's Business Task Force, *Cut EU Red Tape* (link). In addition, the Government has pointed out that pharmaceutical businesses face a great deal of certainty about the EU legal regime, which 'holds them back' (link).

Outside the EU, the UK would have the power to reconsider these Directives and Regulations. As EU law would no longer be supreme, the UK Parliament would be able to revise them to reduce the burden. Open Europe has identified annual savings of £33.3 billion for the UK in reconsidering just 100 EU laws (link). The UK Government would also have a much larger say over the ethical considerations raised by research and technological developments. Today, the European Group on Ethics in Science and New Technologies (EGE) provides ethical advice to the European Commission, but it is opaque and unscrutinised. By contrast, the UK already has a high-profile position in the form of the Government's Chief Scientific Adviser.

12. How is the innovation landscape affected by EU membership?

The EU admits that it is poor at innovation. Today, the EU faces countries which are outcompeting it in research and technological terms, causing the Commission to admit that it faces an 'innovation emergency' (link).The EU has been aware of this gap for many years, warning in the 1980s that 'for the first time since the 18th century, the major formative initiatives of an industrial revolution are not originating in Europe. Europe is "missing out" on the third Industrial Revolution' (link). Today, the Commission remains concerned that the

EU is at risk of losing its position – in particular with the rise of Asian countries, including China and South Korea. It is right to be concerned: more than half the patent applications in Europe in 2014 came from outside the EU (link).

In addition, the EU has been suffering from brain drain as researchers and innovators move to countries where conditions are more favourable. The European Parliament has admitted that 'although the EU market is the largest in the world, it remains … not sufficiently innovation-friendly' (link).

13. **How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?**

Over the last year, it has become increasingly clear that the EU willing to operate before a clear scientific consensus has emerged, legislating in technological areas where there has been little understanding. One example is the EU's campaign against neonicotinoid pesticides, despite the National Farmers' Union pointing out that the scientific research does not back the EU's claims. A similar concern is the EU's determination to invest in particular types of technology (notably fibre optics) rather than being outcome-focused and willing to consider alternatives. The decision in November 2014 to sack the European Commission's Chief Scientific Adviser also raised concerns that the EU was moving away from evidence-based policy.

20 November 2015

Wellcome Trust – Written evidence (EUM0034)

Intoduction

1. The Wellcome Trust is pleased to contribute evidence to the inquiry. In responding, we consider the benefits and challenges of EU membership from our perspective as a global charitable foundation that opts to invest the majority of funding in UK research to achieve our goals.

2. We present this evidence from the perspective of UK research, not as a comment on the wider issues associated with the UK's membership of the EU. This submission responds to the four broad themes that the inquiry has set out, namely funding, collaboration, regulation and scientific advice.

3. If the UK leaves the EU, given the considerable strength of the UK's research base we expect there to be arrangements for continuing co-operation, as with non-EU countries such as Norway, but we also judge that there would be disadvantages. These include increased administrative hurdles or financial disincentives with the risk that UK research organisations could become less competitive or marginalised within EU partnership projects.

Funding

4. Although not without its challenges (applicants have commented on the level of bureaucracy in EU funding programmes[773]), UK research benefits financially from membership of the EU. The UK has traditionally been highly successful in securing EU research funding, including for health research, contributing to the diversity of funding opportunities available to UK based researchers. Under the European Union's Framework Programme 7 (2007-2013) the UK secured €6.1 billion[774], of which €947 million was for health research[775].

5. Maintaining this diversity of funding sources is important to ensure that research remains viable and dynamic, as well as being capable of responding to need as it arises. The diversity of funding helps to ensure that the UK remains an attractive location for excellent researchers, and helps attract further research investment. Unless the dynamism of the UK research environment is maintained the Wellcome Trust would find it more difficult to continue funding in the UK at its current level, which is approximately 80 per cent of our research expenditure.

Collaboration

6. Placing a tangible value on collaboration across EU borders is difficult to do. However, research is a global enterprise and both international collaboration and researcher

[773] European Commission, EUFORI Study (accessed Oct 2015)
[774] HM Government, Review of the Balance of Competences between the UK and the EU: Research and Development (2014)
[775] AMRC, How can charities make the most of EU research funding? (blog post 24/01/14)

mobility have been found to be correlated with high research quality[776]. The UK's involvement in the EU has enabled UK researchers to participate in infrastructure projects such as European Strategy Forum on Research Infrastructures (ESFRI), projects including ELIXIR, the pan-European infrastructure for biological information, and the European Molecular Biology Laboratory including the European Bioinformatics Institute (EBI) based at the Wellcome Genome Campus in Cambridge, which enables data sharing across Europe.

7. Membership of the EU also promotes UK science internationally. It facilitates access to broader alliances and partnerships in global policy and research activity on significant health challenges such as communicable diseases, drug resistant infection and the impact of climate change on health.

Regulation

8. The EU plays a significant role in shaping regulation of the research environment in the UK. Harmonisation of regulatory and legal frameworks within the EU can support international collaboration, offering certainty and consistency. This harmonisation is seen as a benefit to UK research and innovation, for example:

    - The Animals in Scientific Procedures directive ensured that the UK's strong regulation of the use of animals and high level of welfare were not undermined. It also contributed to the spread of best practice in animal welfare.

    - Effective European legislation on clinical trials is important given the increasingly global nature of research and the increasing numbers of multi-national trials now taking place. The Clinical Trials Regulation will streamline approvals processes for trials across the EU.

9. However, EU legislating can be bureaucratic and complex. There is also a lack of transparency and consultation in EU decision-making that inhibits engagement[777]. The potential benefits of harmonisation can be affected by inconsistent application of laws across the EU, for example implementation of the previous Clinical Trials Directive. In this, the UK implemented it fully and in doing so put itself at a disadvantage compared to other member states.

10. The increasing move away from Directives towards Regulations within EU legislation can reduce the flexibility of member states to implement legislation in a manner conducive to their cultural and ethical research environment. A further concern is the uncertainty that can subsequently derive from EU legislation – the length of time taken for proposals to pass through the legislative process could be a disincentive to undertaking research within the EU.

11. If the UK left the EU, while it could develop its own regulatory framework, which might have a national advantage, it would still be bound by some EU regulation, for example

[776] Elsevier, International Comparative Performance of the UK Research Base: A Report Prepared for the Department of Business, Innovation and Skills, (2013)
[777] HM Government, Review of the Balance of Competences between the UK and the EU: Health (2014)

for large scale clinical trials. This would also be without the same opportunities the UK currently has to shape the content of legislation.

Scientific Advice

12. Scientific and technological progress and innovation need to be underpinned by effective policy making and informed by the most robust up-to-date scientific evidence. It is also essential to require timely consultation of a cross-section of interested stakeholders and expert groups at the earliest stage possible.

13. The Trust was concerned that the removal of the Chief Scientific Adviser post from the Commission would undermine confidence in the development of evidence based policy at EU level. We understand that implementation of the new Scientific Advice Mechanism is anticipated before the end of 2015. It would be unreasonable to comment in detail at this stage, but it would be helpful to have a suitable review period to consider the impact of the new approach.

14. Membership of the EU allows the UK to collaborate in global policy and research activity on significant health challenges such as communicable diseases, drug resistant infection and the impact of climate change on health. Although this would be possible outside the EU, membership provides more certain access to natural allies and partnerships for us to facilitate discussions.

The Wellcome Trust is a global charitable foundation dedicated to improving health by supporting bright minds in science, the humanities and social sciences, and public engagement.

20 November 2015

Wellcome Trust, Met Office and Science and Technology Facilities Council (STFC) – Oral evidence (QQ 107-116)

Transcript to be found under Met Office

Wellcome Trust Sanger Institute – Written evidence (EUM0030)

Summary

1. The Wellcome Trust Sanger Institute is a world-leading genomics Institute, whose mission is to use genome sequences to *advance* understanding of the biology of humans and pathogens in order to improve human health. We employ scientists from around the world with expertise in a wide variety of disciplines. The Institute welcomes the opportunity to respond to this call for evidence on the relationship between EU membership and research in the UK and would be happy to provide additional evidence to the Committee if requested.

2. Awards from the EC form a significant proportion of third-party funding received by the Sanger Institute and are a strategically important component of the research portfolio. EC funding is highly desirable because it often covers more costs than grants from the UK, supports the full range of research and it can also help boost researchers' careers.

3. As a world-leader in genomics and genomic technologies, the Sanger Institute undertakes and leads numerous large-scale projects. EC funding strongly supports this type of collaborative research and the Institute views such funding as key to keeping UK science competitive.

4. The Wellcome Genome Campus is home to both the Sanger Institute and the European Molecular Biology Laboratory - European Bioinformatics Institute (EMBL-EBI), which is funded largely from European sources but has a variety of additional funding from the UK and world-wide. EBI and the Sanger Institute work closely together with strategically complementary research programs and in addition, EBI is host to numerous services and resources that are openly available to researchers around the world.

5. Research at the Sanger Institute is regulated by a number of pieces of UK legislation that stem from or are connected to European directives. UK science has a strong voice in debates in Europe which is frequently reflected in the finalised legislation. This ability to influence has often increased minimum standards and improved regulation which has not only benefitted UK and European science directly but has, at times, indirectly resulted in increased public support for science.

6. The Sanger Institute is part of a global network of research and innovation. EC funding and the harmonisation of regulation within Europe provides a framework for collaborative research that allows the Institute, in partnership with other UK and European organisations, to produce world-leading research.

Funding

7. The Sanger Institute is primarily funded by the Wellcome Trust however, in addition to this core funding the Institute's researchers also apply for third party funding from a range of funding sources world-wide, including from the US National Institutes of

Health, UK Research Councils, and medical charities. EC funding accounts for approximately 27% of the funding received from third-party sources. For a research institute such as the Sanger Institute (as opposed to a higher education institution), EC funding has several significant benefits over funding from UK research charities. Notably, the EC funds full costs plus 25% overheads, unlike many UK funding sources. In addition, UK funders often don't fund the full economic cost of the grant, instead working on the principle that any remaining indirect cost can be offset against support from the Higher Education Funding Council for England (HEFCE) in the case of universities, or other internal sources. For example, the Medical Research Council currently funds 80% of full economic costs, and for the Sanger Institute, which is not a higher education institution and receives no funding from HEFCE, the remaining 20% must come from the Institute's core funding.

8. Funding for junior and early-stage career researchers is always highly competitive, regardless of the funding source. EC-funded fellowships are particularly attractive to early-stage researchers at the Sanger Institute; between 10-20% of fellowships awarded to Institute researchers are from the EC. These fellowships are attractive because they are well-funded and the recipients become more competitive when applying for future funding including the prestigious European Research Council Starting Grant, which aims to keep the best talent in Europe regardless of nationality and helps support the establishment of new research teams.

9. The Marie Skłodowska-Curie Programme supports researchers at all stages of their careers regardless of their nationalities. There are currently 3 Marie Skłodowska-Curie fellows at the Sanger Institute; however, numerous Institute researchers have held these fellowships previously, either whilst at the Sanger Institute or elsewhere. These fellowships are internationally recognised, considered highly prestigious and improve researchers' prospects on future applications for funding (Case Study 1).

Case Study 1 – Career Progression with the Marie Skłodowska-Curie Programme

One member of faculty at the Sanger Institute took up an extremely prestigious postdoctoral position at The Broad Institute of MIT and Harvard and the Brigham Women's Hospital, Harvard Medical School after receiving a fellowship from the Netherlands Organisation for Scientific Research (NWO) which is supported by the Marie Skłodowska-Curie Programme. The training and experience she received has supported her career and she is now a Group Leader in the Sanger Institute Faculty and is working towards applying for European Research Council Funding. In her words,

> *"I think getting my own EU funding helped tremendously to make me an attractive candidate to work in the best labs in Boston. It also gave me a degree of independence when in Boston because I was supported through my own grant…*
> *…Importantly it also helped me apply for faculty jobs as I could show I was successful in the past in applying for grants. For some of the job posts it was explicitly stated that it would have been evaluated as a strength."*

Although overwhelmingly positive about the importance and benefits of the Marie Skłodowska-Curie programme, the researcher did comment that some of the conditions attached to the funding were unnecessarily restrictive and counterproductive. In particular, the condition limiting the time allowed to be spent outside the EU to two years was a key factor in her decision not to apply for the Marie Skłodowska-Curie Fellowship itself.

10. Although EC grants are highly attractive and desirable, EC grant management is complex, time-consuming and requires specialist knowledge. The Grants and Contracts Managers at the Sanger Institute noted that EC grants occupied disproportionately more of their time than UK grants and that the whole process could be better streamlined. Overall, the Grants and Contracts Managers felt that most of the bureaucracy had some justification and that any bureaucratic system that must cover the entire EU, which by necessity entails incorporating different legislations and financial systems, will always be more complex than that of UK funding bodies. However, they also commented that the significant benefits from EC grants made the extra effort worthwhile. They also suggested that although EC grants have a bad reputation for bureaucracy they were still significantly better than US federal grants, particularly those from the NIH, and that some criticism levelled against the EC funding system was unfair.

Collaboration

11. Funding from the EC strongly favours collaborative research projects. For the Sanger Institute such funding is strategically a good fit, as the Institute has a strong drive towards collaboration. Many of the big consortia projects that the Sanger Institute has been involved with and/or led have been EU funded (Case Study 2).

12. In addition to collaboration, another important aspect of EU funding is the range of activities that it funds. EC funding often supports innovation, and can help funding SMEs, start-ups and enterprise schemes. This type of funding is critical for taking innovative research through to marketable products and processes. Notably, Horizon 2020 funding has helped fund collaborations and partnerships between researchers and SMEs, something that can be difficult to acquire funding for from UK sources.

Case Study 2 – BLUEPRINT

Genes are made from DNA and they must be tightly regulated to ensure that they are switched on and off at the appropriate time. Regulation of genes occurs through small chemical modifications of DNA and the proteins associated with DNA known as epigenetic marks. Failure to regulate genes can lead to a variety of diseases and disorders including cancer and immune diseases. Understanding of epigenetics is key to understanding the mechanisms and dysregulation of disease.

The BLUEPRINT consortium was set up to create 100 reference "epigenomes" (all the epigenetics marks throughout the genome) as an openly available resource for the scientific community. The consortium is made up of 41 partner organisations, including 7 in UK, and includes 8 countries within the

EU plus Israel and Switzerland. Alongside, the Sanger Institute the consortium includes universities, independent research institutes and several companies. Training and capacity building in computational biology throughout the consortium network is a core component of the project and has been established by supporting visits and personnel exchanges between labs both within the consortium and outside. In addition, a user-friendly portal has been set up to allow researchers easy access to the data generated as the project progresses.
To date, the consortium has published 148 publications in peer reviewed journals over 5 years as well as establishing a database describing the antibodies used, making all epigenetic data freely available to other researchers through the well-established European Genome-phenome Archive (EGA), and creating a repository of all the protocols used in sample collection and preparation.

13. It has been suggested by some parties that the emphasis on collaboration in EC funding has reduced the competitiveness of individual organisations and even the UK. The Sanger Institute would argue that the UK and the EU are in competition with countries such as the US and China and increasingly countries such as Brazil, Russia and India, and that these large EU collaborations offer an excellent chance for UK research, in partnership with other EU organisations, to stay competitive and share knowledge on a broader scale. The BLUEPRINT project outlined in Case Study 2 is an example of a European consortia producing world-leading science that benefits research and medicine around the world.

14. The Sanger Institute is situated on the Wellcome Genome Campus which it shares with the European Bioinformatics Institute (EBI); part of the European Molecular Biology Laboratory. The EBI's mission includes providing freely available data and bioinformatics services to the scientific community, investigator-driven basic research, providing advance bioinformatics training at all levels, dissemination of new technologies to industry and coordination of biological data provision throughout Europe (Case Study 3).

15. Amongst its numerous activities, the EBI maintains the world's most comprehensive molecular databases, all of which are freely available to other researchers and in many instances the public. The databases span all aspects of molecular biology including genomics. Much of the genomic data generated by the Sanger Institute ends up in databases managed by the EBI.

16. The EBI is largely funded by governments of the European Member States, but because of the critical importance of the work they do they also attract funding from additional sources, including from the European Commission, the US National Institutes of Health, the Wellcome Trust and from UK Research Councils. They also receive funding from a number of commercial sources. The variety in sources of their funding reflects the global nature of their enterprise.

17. Crucially for the Sanger Institute, the EBI hosts the European Nucleotide Archive (ENA) and the European Genome-phenome Archive (EGA). Almost all the genomic sequencing and associated data produced at the Sanger Institute is deposited in either the ENA (non-human data under open access) or EGA (human data under managed access) where it is available to researchers from both academic and commercial organisations around the world. As of May 2015, over 6,000 users had accessed human data from the EGA from North and South America, Oceania, Asia, Europe and Africa. A significant proportion of the data held by the EGA are generated by organisations in the EU, including the Sanger Institute.

Case Study 3 - ELIXIR
The EBI is home to the ELIXIR directorate. ELIXIR provides and coordinates pan-European research infrastructure for biological information. Their role is to provide the facilities necessary throughout Europe for researchers from a wide variety of disciplines to make the most of the wealth of information about living systems which is fundamental to our understanding of life. Research across the UK, including the Sanger Institute, benefits from the provision of these facilities and services.
ELIXIR also participates in and coordinates a number of EU-based projects including, EXCELERATE – a €19 million HORIZON 2020 project to support ELIXIR in its provision of data services and pan-European training program in bioinformatics capacity and competency, CORBEL which aims to harmonise user access to resources, unify data management and create common ethical and legal services. BioMedBridges is developing a shared e-infrastructure to allow data integration in biological, medical, translational, and clinical domains. EMBRIC connects marine biotechnology initiatives to promote science, industry and regional growth. Finally, EMTRAIN establishes a pan-European platform for education and training, from basic science through clinical development to drug safety. The Sanger Institute provides support and expertise for a number of these projects.

18. The research at the Sanger Institute is highly interdisciplinary and requires a very wide range of researchers with highly specialist skills including, but not limited to, bioinformaticians, animal specialists, sample management specialists, clinicians, and scientists from all areas of the life sciences. Supporting such research likewise needs experts in grant management, policy, ethics, accounting, immigration, law, and science communication, to name a few. In order to recruit the best and more talented staff it is often necessary to recruit from outside the UK (Table 1).

Citizenship	**Research**	**Research Management/IT**	**Total**
Outside EEU	95 (12.5%)	7 (3.0%)	102 (10.2%)
EEU (excluding UK)	185 (24.4%)	12 (5.1%)	197 (19.1%)
UK	477 (3.0%)	215 (1.8%)	692 (69.8%)

Table 1. Citizenship of researchers and support staff at the Sanger Institute

Although the majority of the 991 employees at the Sanger Institute are from the UK (70%), 20% come from the EEU (excluding the UK) and the remaining 10% come from outside the EEU. The majority of researchers from the EEU (excluding the UK) are directly involved in research. The need to recruit from outside the UK is best exemplified in the Institute's Faculty, who are the most senior researchers in the Institute and are key drivers in the scientific strategy of the Institute. Of the current Faculty, including Clinical Faculty and Career Development Fellows but excluding Honorary and Associate Faculty, ~30% are from the EEU (excluding the UK). By comparison, ~50% of the Faculty are from the UK and 20% from outside the EEU. The Sanger Institute benefits enormously from the free movement within the EU and any move towards the more restrictive system for those from outside the EEU would make recruitment far more challenging and risks introducing skills deficits and reducing social capital. In addition, it would represent an extremely large bureaucratic burden for the Institute.

Regulation

19. Much of the regulation that UK research must adhere to stems from EU legislation or is compliant with it. For the Sanger Institute, key pieces of legislation includes the Directive on the Protection of Animals Used for Scientific Purposes, the European Union Tissue and Cells Directive, and the Data Protection Directive, shortly to be replaced by a Data Protection Regulation. The UK lends a powerful voice in the creation of EU legislation (Case Study 4), including the above Directives, and through its influence has often driven improvement in standards. This is particularly true in the case of the Directive on the Protection of Animals Used in Scientific Purposes. Researchers in the UK were already operating under a more stringent framework than the rest of Europe at the time the Directive was drafted and the UK was able to ensure that research in Europe using animals was required to operate under similar conditions, thus putting an increased emphasis on welfare and ethics, enshrining the principles of Reduction, Refinement and Replacement, limiting the uses to which animals could be put and improving standards across EU countries. The result has also benefited UK science with increased public support for the use of animals in medical research in the UK.

Case Study 4. The Data Protection Regulation

Any new legislation affecting research can and frequently does cause concern for researchers in the UK and European legislation is no different. The upcoming Data Protection Regulation has caused particular concern with amendments from Parliament proposing to broaden the scope of what constitutes Personal Data and severely limiting the conditions under which Personal Data can be processed for researchers.

The UK has been particularly active in representing the concerns of researchers across Europe, and the Sanger Institute has been involved in the Data Saves Lives campaign which aims to persuade the European Parliament of the harm that such limitations would inflict on vital research. It is too early to say if Parliament has understood and listened to researchers' concerns, as the legislation is still in the Trilogue phase, however it is clear that those representing UK research interests, such as

CRUK and the Wellcome Trust, have been able to directly address key policy-makers in the Commission, Council and Parliament and have successfully engaged with both UK and European MEPs to garner their support.

20. It is the Institute's view that the ability of the UK research community to influence EU legislation is of enormous significance and is of benefit not only to the UK but to the European research community as a whole. Should the UK leave Europe, any UK legislation would almost certainly still have to be compatible with EU legislation but the UK would lose its negotiating power, to the detriment of the UK and the wider research community.

Concluding Comments

21. The Sanger Institute is a world-leader in the use and development of genomics and genomic technologies for advancing the understanding of humans and disease to reduce the global healthcare burden. In order to tackle some of science and medicines most intractable problems, the Institute's takes a "big science" approach, and works on a scale beyond the capabilities of all but a few organisations world-wide. Critically, the Institute's mission fundamentally extends beyond the creation of data for itself and the Institute openly shares its data and resources with the global research community.

22. The ability of the Institute to fulfil its mission is in large part due to the global network of research and infrastructure that it has been able to join and build. Access to European consortia, EC funding and European infrastructure has been inextricably linked to the Institute's success.

23. The Institute believes membership of Europe has played a significant role in its success and in the competitiveness of UK science and that in order to continue and build on that success it is absolutely vital that the UK retains the ability to fully engage as an equal partner with the European Union and its legislative bodies.

20 November 2015

Professor John Wood, Association of Commonwealth Universities – Written evidence (EUM0021)

From: Professor John Wood in a personal capacity as current chair of Research Data Alliance-Europe and as a member of the European Commission's Research, Innovation and Science Expert group. Previously member and chair of the European Strategy Group for Research Infrastructures (ESFRI), Chair of the European Research Area Board and Chair of the High Level Expert Group on Scientific Data, the latter two on behalf of the European Commission.

1. I welcome this call for evidence since it is largely unknown the amount of interactions and influence both academic and industrial scientists and engineers have within the European Union

2. (Question 4). Having been involved in the setting up of the European Research Council with its focus on excellence of research from the beginning, it allows UK researchers to benchmark their ideas against the very best in Europe. The fact that the UK does very well in obtaining funding from both the ERC and H2020 attests to the quality standard of the UK research base and the attractiveness for encouraging the best researchers to come to the UK. According to the ERC statistics over the lifetime of the ERC up to 2014, the UK has been host to 571 grant holders which compares with 393 for Germany and 365 for France.

3. (Question 7). There are many ways in which the UK influences and participates in European research facilities, first as individual scientists at the inception, construction and operational phases and secondly in influencing both national and EU policy through ESFRI. In the latter case the creation of the first European Roadmap for European Research Infrastructures resulted in most Member States including the UK to create their own roadmaps and priorities. Although no European Research Infrastructure is to be built in the UK in the foreseeable future, the UK is invited to participate in the international negotiations from the start, As an example, I was asked to chair the International Steering Group on behalf of the Federal Republic of Germany to bring about the successful negotiations for the construction and build of the European X-ray Free Electron Laser in Hamburg. More recently I was asked to chair the review of the European Spallation Source on behalf of the Swedish Government and I currently sit on the advisory board of the Romanian Research Council on Research Infrastructures. While these are personal it is clear that the UK is seen as a key player in Europe for Research Infrastructures. The current chair of ESFRI is also from the UK.

4. (Question 13). When I was chair of the European Research Area Board one of our key recommendations was that scientific advice should be at the core of the European Presidency. This view was also supported by other institutions in the UK. This resulted in the creation of a Chief Scientist to the President. However this post was not integrated into the rest of the Commission unlike in the UK where departmental chief scientists are part of ministries and, in some cases, act as head of profession. The European Commission relies on multiple advisory bodies and the Joint Research Centre which lead to diffuse advice that is often not traceable. The recent creation of a high level scientific

advisory body to the President is welcome after the demise of the post of Chief Scientist.

5. (Question 14). The UK members of Commission Advisory Boards have a significant impact on policy. All the key recommendations of the European Research Area Board were adopted in H2020 and the most influential members of that board were the three UK members. The High Level Group on Scientific Data led to the creation of the Global Research Data Alliance with the collaboration and support of DG-Connect. A recent development with some Eiroforum members to develop innovation in the fields of sensors and instrumentation (ATTRACT) have turned to UK expertise to negotiate with both the EC, the European Investment Bank and Corporate Venture Funds since there is considerable experience within UK institutions and personnel in looking at novel approaches to innovation.

20 November 2015