



# Science and Technology Committee

House of Commons London SW1A 0AA

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From Rt Hon Norman Lamb MP, Chair

Rt Hon Philip Hammond MP  
Chancellor of the Exchequer  
HM Treasury  
1 Horse Guards Road  
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12 September 2018

Dear Philip,

## **The National Quantum Technologies Programme**

Thank you for your letter dated 6 September 2018. We are grateful also to Sam Gyimah MP and to Professor Sir Mark Walport for attending to give evidence to our inquiry today. The Committee has now concluded its oral evidence sessions and we will be publishing our Report in due course. However, in advance of the Budget, we wanted to set out our findings and recommendations that are of relevance now, in order that they can be of use to you as you prepare for the Budget. The importance of maintaining the momentum built up by the first phase of the National Quantum Technologies Programme and of avoiding a 'gap' between activities in the first and second phases has been emphasised to us during our inquiry, and we urge the Government to confirm its plans for the next phase of the programme with the urgency that it requires.

As you stated in your letter, "quantum technologies and associated research represent a huge opportunity for the UK". Just as the first generation of quantum technologies—including computers, lasers and global navigation satellite systems—brought immense technological and social progress, we have heard that the second generation of quantum technologies has "the potential to transform modern life, promising revolutionary new products and services in fields such as communications, infrastructure and healthcare".<sup>1</sup> The Government Office for Science estimated in 2016 that quantum technologies could grow to cover a market comparable to the consumer electronics manufacturing sector, then worth £240bn per year worldwide.<sup>2</sup>

The Government rightfully decided to support the development of the UK's quantum sector with its £270m investment in the National Quantum Technologies Programme in 2014.

<sup>1</sup> The Institute of Physics ([QUT0010](#)), para 1

<sup>2</sup> Government Office for Science, '[The Quantum Age: technological opportunities](#)' (2016), p56

With initial funding for five years, this programme was due to come to an end next year. The anticipated impact of quantum technologies has not diminished over the past five years; indeed certain technologies, such as quantum computers, have made more progress than expected. We therefore welcome your intention to extend funding for the National Hubs by £80m. We hope that this goes some way to providing the assurance the National Hubs need to plan their ongoing work and continue their success.

We note with concern, however, that the £80m you have announced for the National Quantum Technology Hubs does not match the £338m that the National Programme's Strategic Advisory Board sought in their bid for phase 2 of the National Programme. We believe, based on the evidence that we have heard, that there are several reasons for the Government to prioritise its support for quantum technologies in its drive for increased investment in science and innovation, including:

- the substantial opportunity for economic and social benefit promised by quantum technologies, as endorsed during our inquiry by academia,<sup>3</sup> research and technology organisations,<sup>4</sup> learned societies<sup>5</sup> and industry,<sup>6</sup> and as recognised by other quantum technology programmes internationally;<sup>7</sup>
- the contribution a strong UK quantum technology sector can make to national security as well as prosperity, in line with the Government's 'fusion doctrine';<sup>8</sup>
- the wide-reaching applications of quantum technologies, meaning that their development could underpin advances in other emerging technologies such as artificial intelligence, robotics and next-generation batteries;<sup>9</sup>
- the connection between quantum technologies and photonics, an established UK sector that already contributes as much to the UK's GDP as the pharmaceuticals sector, with the consequent opportunity for mutually beneficial development;<sup>10</sup> and
- the investment placed in the first phase of the National Quantum Technologies Programme and the world-leading position this has put the UK in, which the Government should now seek to capitalise upon.

Through the course of our inquiry, we heard consistently that the first phase of the National Quantum Technologies Programme had achieved broad success and helped to put the UK in a world-leading position for quantum technologies. We therefore call upon the Government to capitalise on this groundwork and provide funding commensurate with the opportunity presented by quantum technologies and with the Strategic Advisory Board's aims for the next phase of the National Programme.

In particular, your letter from 6 September makes no reference to funding for the establishment of the 'Innovation Centres' first proposed by the Government Office for Science,<sup>11</sup> and for which we heard strong support from across the quantum technology

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<sup>3</sup> See, for example: Manchester Metropolitan University ([QUT0003](#)), para 33; and University of Sussex ([QUT0007](#)), para 11.1

<sup>4</sup> See, for example: Fraunhofer UK Research Ltd ([QUT0021](#)); and Q278

<sup>5</sup> See, for example: Institute of Physics ([QUT0010](#)), para 1; and Q77

<sup>6</sup> See, for example: Airbus ([QUT0001](#)); M-Squared Lasers ([QUT0024](#)); and Qq275–277

<sup>7</sup> For example, the EU [Quantum Technologies Flagship](#), the proposed US '[National Quantum Initiative Act](#)' and reported Chinese investment

<sup>8</sup> See, for example: Ministry of Defence ([QUT0026](#)), paras 20 and 26.

<sup>9</sup> See Qq36, 77, 97

<sup>10</sup> See: National Physical Laboratory ([QUT0017](#)), para 39; Dr Andrew Shields ([QUT0020](#)); and Q15–16

<sup>11</sup> Government Office for Science, '[The Quantum Age: technological opportunities](#)' (2016), p13

community. Professor David Delpy, Chair of the National Quantum Technologies Programme's Strategic Advisory Board, listed the establishment of Innovation Centres as one of three priorities for the second phase of the National Programme.<sup>12</sup> These centres would provide businesses working to develop quantum technologies with access to the specialist infrastructure that they require, but which is expensive and time-consuming for companies to each construct independently. Shared infrastructure will also provide a focal point around which different companies can cluster and interact to strengthen the supply chains and develop the skilled workforce that a successful UK quantum technology industry will require. Establishing Innovation Centres with a clear objective to drive the focus of the National Programme more squarely onto commercialisation will also accelerate this important transition. We understand the case for avoiding wasting time and money in the construction of new facilities if use can be made of existing infrastructure, but we encourage the Government not to let attempts to find efficiencies in this way result in a reduced ambition or sense of urgency. We agree with UK Research and Innovation that the establishment of Innovation Centres is a "priority" for the National Programme going forward,<sup>13</sup> and we ask you to ensure that the funding is in place to enable that to happen without delay.

In addition to the £80m you have announced for the National Quantum Technology Hubs, we note also the £20m that has been put into the quantum technology 'pioneer fund' as part of the Industrial Strategy Challenge Fund. Prototypes that can demonstrate the value of quantum technologies are critical to raising the awareness in wider industry of the potential of quantum technologies, which we have heard is currently below what it could be.<sup>14</sup> Challenge-based projects supporting the development of such prototypes can provide focused real-world applications around which new supply chains could develop. While the pioneer fund is welcome, it is of insufficient scale. For example, the National Physical Laboratory told us that it would fund "a small number of demonstrator projects" and that "a larger and more comprehensive investment is still needed, to allow quantum technologies to reach their full potential".<sup>15</sup> We were encouraged to hear this morning in our evidence that quantum technology proposals are being considered as part of the third wave of the Industrial Strategy Challenge Fund, and again urge the Government to reach decisions on these as soon as possible so that the momentum of the first phase of the National Quantum Technologies Programme is not lost.

Alongside the benefit of challenge-based funding, we flag also the opportunity for the Government to use its procurement processes to support the UK quantum technology sector. As advocated in the recent Connell Review on the Small Business Research Initiative, contracts awarded for the supply of technology-based solutions to real-world problems can be significantly more valuable to the businesses developing such solutions than the allocation of grants, while simultaneously also enabling Government departments to innovate and save costs.<sup>16</sup> We have heard that the Ministry of Defence has made good use of the mutual benefits offered by effective use of Government procurement, but that other departments have not sought to make use of such opportunities.<sup>17</sup> For example, we heard that quantum sensors could save costs in construction and improve environmental

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<sup>12</sup> Q67

<sup>13</sup> UK Research and Innovation ([QUT0023](#)), para 19

<sup>14</sup> For example, see Q302

<sup>15</sup> National Physical Laboratory ([QUT0017](#)), para 12

<sup>16</sup> David Connell, 'Leveraging Public Procurement to Grow the Innovation Economy' (2017)

<sup>17</sup> See, for example: Institute of Physics ([QUT0010](#)), para 9; Qq45–46 and 231

monitoring, which could benefit the Department for Transport and the Department for Environment, Food and Rural Affairs.<sup>18</sup> We therefore call on the Government to ensure that all departments actively seek opportunities to support the quantum technology sector through their procurement.

In summary, the recognised opportunities presented by quantum technologies should be harnessed through Government support for a coherent, multi-faceted second phase of the National Quantum Technologies Programme, with sufficient funding for each component of this programme to achieve 'critical mass'. The announcement of £80m for continuation of the National Quantum Technology Hubs will help to ensure that the UK does not lose the skilled research community it has developed. In order to sustain the momentum built up by the first phase of the programme, reinforce industry confidence in the UK's quantum technologies sector and to not lose ground against international competitor programmes, we urge the Government to provide certainty regarding the rest of the next phase of the National Quantum Technologies Programme in this year's Budget.

I would be happy to discuss this matter with you further. I am copying this letter to Sam Gyimah, Minister of State for Universities, Science, Research and Innovation, and Professor Sir Mark Walport, Chief Executive of UK Research and Innovation. I will also be publishing this letter on the Committee's website.



**Rt Hon Norman Lamb MP**  
*Chair*

CC: Sam Gyimah MP, Minister of State for Universities, Science, Research and Innovation;  
Professor Sir Mark Walport, Chief Executive, UKRI