Following our oral evidence on quantum technologies, you wrote to Sam Gyimah MP on 3 October asking for further information on a number of points. Sam has responded to you on questions under points 3, 4, 5b and 5c; I am providing further information on questions regarding points 1, 2, 3 and 5a.

1. The ‘30%’ funding rule that pertains to Innovate UK funding (for research and technology organisations, in particular):
   
   a. What is the rationale for the 30% limit?
   
   b. Do you recognise that it can restrict participation by research and technology organisations (RTOs)?
   
   c. Would UKRI consider introducing more flexibility to accommodate greater participation by RTOs where this was felt to be beneficial?

The 30 percent funding rule refers to the maximum amount of total eligible project costs within a collaboration that are available to the different participants, such as non-profit RTOs. The role of Innovate UK, within UKRI, is to provide funding to support and stimulate innovation in the UK economy. Innovate UK’s funding rules were established in 2012 to encourage collaboration between commercial and research organisations. They provide enhanced incentives to small and medium enterprises (SMEs) and ensure that RTOs do not dominate the grant awards for each project, which had happened in the past. Innovate UK’s funding requirements are kept under review to ensure we support the widest and most appropriate combination of partners to deliver innovation in the relevant technology or business area.

In previous quantum technology competitions, RTOs could receive 50 percent of total eligible project costs, acknowledging the fact that the technology and industry capabilities were at an earlier stage of development. In contrast, the Pioneer Programme aims to support larger industry-led projects (in the range £3-10M) now that activities are more mature. We want to encourage greater industry commitment and investment to these projects as the endeavours become more sustainable. This is why we have set the maximum contribution from RTOs for projects in the Pioneer Programme at 30 percent of the total project. The Pioneer Programme is so far progressing well – we have seen a very high and broad level of demand for the competition for investment.

Nevertheless, we continue to keep funding rules for programmes supporting the development of quantum technologies under consideration and modify these for the specific funding route if necessary. If an RTO (or any other organisation) has a compelling proposal but cannot identify a suitable competition to seek funding, we would encourage them to talk to us, through one of our councils, so we could explore an appropriate funding route.

2. Innovation Centres:
   
   a. Despite the strong support we have heard for future Innovation Centres, some have also highlighted the need to ensure that a twin structure of Hubs and Innovation Centres does not contribute to problems associated with a ‘valley of death’ between academic research and commercial development. How does the Government intend to ensure that such problems are avoided?

Professor Spiller’s oral evidence suggested that there should not be a gulf between fundamental research and innovation. UKRI agrees. By working across the councils of UKRI, and in partnership
with industry, academia and other stakeholders, we strive to connect research and business, translate new ideas into commercial applications and bridge the ‘valley of death.’

There has been progress so far, both in the nature of UKRI’s investment and the action that universities themselves are taking. The structure of National Quantum Technologies Programme has aimed to address the ‘valley of death’. The Quantum Technology Research Hubs (the QT Hubs), National Physical Laboratory and the Fraunhofer Centre have a track record of catalysing industry-led activity and are actively working both with the research base and businesses. Universities are also taking the initiative: The University Bristol has already announced a Quantum Technologies Innovation Centre.

We aim to learn from experience. For example, the innovation centres concept originated as application demonstration centres as recommended by the Blackett Review’s panel. We recognised that as the technology developed and the technology readiness levels increased, the focus would move from ‘innovation in development’ to ‘innovation in application’, demonstrating the technology in the field. Since the Blackett Review, it has become clear that innovation centres are just one of several approaches to bridging the gulf.

That is why the Pioneer Programme has encouraged the formation of consortia capable of delivering larger scale industry-led projects. These focussed programmes will deliver many of the benefits of the envisaged application demonstration centres but avoid the need for new bricks and mortar.

We acknowledge there is still work to do, and we continue to refine our approach. Some industries have found it difficult to form consortia for the Pioneer Programme. We are exploring application-focused innovation centres to catalyse the formation of consortia and address this challenge. These could, for example, be based in existing test and evaluation facilities. For instance, the automotive industry has shared facilities (e.g. MIRA Technology Park) which could host a centre.

We will continue to monitor progress in quantum technologies, listen to and seek advice from others (for example, the national programme and key stakeholders) and look to make proactive interventions where issues are identified.

3. Skilled workforce:

   a. **What is the Government doing to ensure that a pipeline of workers with the relevant knowledge and experience in quantum technologies is developed at all the qualification levels required?**

   UKRI, through The Engineering and Physical Sciences Research Council (EPSRC), is already supporting a substantial body of PhD studentships in quantum technologies, via three Centres for Doctoral Training, three Training and Skills Hubs (funded through the 2014-19 £270M programme) and the Doctoral Training Partnership funding for the QT Hubs.

   Quantum technologies is also a priority in EPSRC’s 2018 call for Centres for Doctoral Training. We are considering several proposals with decisions on funding due to be taken toward the end of this year, and the first intakes of students in October 2019.

   Across UKRI, we are seeking to increase skills at all levels, to maintain a broad disciplinary talent base, and work with partners to identify key skills gaps and build capacity across disciplines. We have therefore committed to develop a longer-term talent strategy, working closely with our partners. This piece of work will look across all the sectors that we fund.
4. Additional areas where you and Sir Mark offered to provide follow-up evidence:

a. The 'wiring diagram' of hub interactions (see Q386) and work being undertaken on refreshing hub priorities.

We offered to write to you with further details on our work to refresh the quantum technology hubs. The current universities that form the QT Hubs and the training hubs are set out in a diagram enclosed with this letter.

EPSRC is currently running a process to award a further five years of funding for four QT Hubs, which will cover quantum computing and simulation, quantum communications, quantum sensing and timing, and quantum imaging. These will build on the current QT Hub portfolio by addressing priorities established through engagement with researchers and industry, taking account of where the UK has strength established in the first phase of the National Programme and the opportunities the UK has to grow its leadership position.

A competitive process identified new partners to join consortia involved in the current QT hubs. These consortia are developing proposals to address the priorities identified for each of the areas the QT hubs will cover. The announcement made on 6 September by the Chancellor of the Exchequer confirmed the £80M of resource funding for these refreshed QT Hubs, which will also benefit from a further £15m of capital funding to allow the QT Hubs to purchase equipment. The refresh process will conclude in April 2019, subject to the consortia putting together high-quality proposals. This will enable us to award this funding well ahead of the end of the current QT Hub grants.

I hope this is helpful.

23 October 2018
Supplementary written evidence submitted by Sir Mark Walport, Chief Executive, UK Research and Innovation (QUT0031)

Relationship of Quantum Technology Research Hubs, Centres of Doctorial Training and Quantum Training and Skills Hubs

- Quantum Imaging Hub: QuantIC, led by University of Glasgow
- Quantum Communications Hub, led by University of York
- Quantum Sensing and Metrology Hub, led by University of Birmingham
- Quantum Computing Hub: Networked Quantum Information Tech", led by University of Oxford
- CDT in Quantum Engineering and Training and Skills Hub in Quantum Systems Engineering: The Quantum Enterprise, led by University of Bristol
- CDT for Controlled Quantum Dynamics and the Training and Skills Hub in Quantum Systems Engineering: Imperial Centre for Quantum Engineering and Science, led by Imperial College London

Solid lines indicate institutions involved in the Hub grants but not as the lead.
Dashed lines indicate institutions involved in CDTs but not as the lead.