Science and Innovation Strategy 2014 – Input to BIS

Note that text in italics below is a commentary by BIS on the consultation.

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3. Who are you representing?

	I am expressing my personal views
✓	I am expressing the view of my organisation
	I am expressing the collective view of a group of organisations

Name of organisation or group:

Imperial College London

4. What more could be done to improve the innovation performance of UK business and boost business investment in research and development?

In relation to business investment in university research specifically, outstanding underpinning research excellence has been shown to be the key factor in attracting the investment required to drive innovation and economic growth. For example, a recent CaSE report on the economic significance of the UK science base[1] found that pharmaceutical multi-national enterprises locate their research and development activities close to highly-rated university chemistry departments in the UK. It will, therefore, be important for the Government to continue to support the long-term sustainability of the UK research base, and in particular the core underpinning research infrastructure within universities. It should be noted that the same CaSE report also found that public investment in research increases rather than diminishes private sector investment. HEFCE's HEIF funding stream is vital in helping universities translate research ideas, knowledge and technology strengths into both economic and social impacts, with the flexibility of HEIF particularly important in enabling universities to adapt their innovation systems to best suit their local environment. HEIF should be maintained and targeted to support research-intensive universities where it can have the most effect (a recent HEFCE report[2] found that between 2003 and 2012 the top 6 most research intensive universities in England (a group that includes the College) generated £13.3 of gross additional knowledge exchange income for every £1 of HEFCE knowledge exchange funding, more than twice the sector average). The current cap on individual institutions' HEIF allocations should be removed so that more funding can be targeted to support research-intensive universities where it can have most effect. It should be noted that innovation is much broader than just R&D. For example, innovation in services has the potential to be one of the UK's major strengths and there are key opportunities in fields such as "smart cities", emergency and healthcare services, cognitive computing and finance.

Existing forms of Government support for innovation include schemes such as:

- *The R&D tax credit*
- *Seed Enterprise Investment Scheme*
- *Knowledge Transfer Partnership*
- *Knowledge Transfer Network*

[1] http://sciencecampaign.org.uk/UKScienceBase.pdf
[2] http://www.hefce.ac.uk/media/hefce/content/pubs/indirreports/2014/keperformanceandtheimpactofheif/2014_keheifimpact.pdf

- *Smart*
- *Collaborative R&D*
- *Small Business Research Initiative*
- *Innovation Vouchers*
- *Catapult Centres*
- *Design Leadership Programmes*
- *Growth and Innovation Fund and Employer Investment Fund*

5. What are the gaps in the capability of our people to develop science and deliver innovation in the UK and how should those gaps be addressed?

At school level, ensuring that STEM A-levels and GCSEs are challenging and globally competitive would help to increase the UK's STEM capability. 'Dumbing down' is not in the interests of either the students or their future employers. At university level, one of the key factors in this is the provision of an excellent intellectual and physical environment for both teaching and research in STEM subjects. Enabling institutions to recover the full costs of teaching and postgraduate research in STEM disciplines, and thus ensuring the financial sustainability of these courses, is therefore essential in achieving increased STEM capability in the UK. It is also essential to ensure that institutions' research capital requirements can be fully met. Perhaps the most serious gap in our capability is the relatively low number of female STEM graduates.

Access to people with skills and knowledge determines our ability to reap the benefits from science and innovation. The Government is investing to support science, technology, engineering and mathematics in higher and vocational education, including apprenticeships, and supporting widening routes into engineering careers. How do we ensure that the UK has the right capabilities in its workforce, including at technician level? How can we develop wider aptitude for innovative creativity, leadership and management? Do those working in science and innovation have the right blend of skills – if not, what is missing and how can we get the blend right?

Examples of initiatives supported by the Government include:
- *The Higher Apprenticeships programme*
- *The National Colleges call for engagement*
- *HS2 National College*
- *STEMNET (including the STEM Ambassadors programme)*
- *Your Life campaign*
- *National Science and Engineering Week*
- *Big Bang Fair*

6. How can we strike the right balance between our investment in curiosity-driven research and investment in solving societal challenges and other forms of applied research? And how can we encourage the interaction between these?

The dual support system helps to support the UK's science and innovation system by enabling institutions to carry out the type of blue skies research that is not always readily funded but can lead to significant innovation and impact. The balance between investment in curiosity-driven research and investment in solving societal challenges and other forms of applied research should be decided based on regular consultation with the sector. Additionally, Ministers should not disburse large amounts of capital funding without reference to expert independent advice, and demonstrable research excellence should be the primary criterion for funding. It should also be noted that the principle of institutional autonomy is vital in strengthening UK science and innovation, as any imposition of restrictions on institutions would be likely to put at risk their ability to carry out high-quality research and achieve impact in line with their strengths and missions.

The UK has great strengths along the spectrum of research and we need to maintain this broad based excellence. An important part of this is finding the right balance between investment in both applied research addressing societal challenges and business need, and curiosity-driven research. We also need to ensure that the new knowledge created in our labs is readily available so that researchers are able to draw on it across sectors and disciplines to create the greatest possible social and economic impact for the UK.

7. How can we support cross fertilisation of ideas, for example by encouraging interdisciplinary research and innovation? What are the risks and benefits of doing this?

Imperial College has an outstanding track record in fostering and exploiting interdisciplinary research. In the College's experience, collaborative clusters including both universities and large and small businesses are an excellent way to support innovation as they provide opportunities for networking and interaction between entrepreneurs, innovators, and researchers, encouraging them to combine their complementary strengths. We can provide many successful examples. Such clusters tend to be most effective when they spring up organically, stimulated by excellent research and interested businesses, rather than when 'top down' attempts are made to create them artificially using public funding as a stimulus. Existing mechanisms that are very effective in catalysing innovation, knowledge exchange and impact are HEFCE Business QR funding and the Impact Acceleration Accounts.

Emerging societal challenges, such as the ageing of the UK population and climate change, have a pervasive and interconnected nature and can only be resolved through interdisciplinary collaboration, across technological and sectorial expertise, involving both fundamental and applied research. Examples of Government support to interdisciplinary research and innovation are contributions to challenge-led prizes and interdisciplinary networks such as the UK Environmental Change Network.

8. In your view, what are the top 3 priorities for the UK science and innovation system by 2020 and beyond? Which criteria should we use to prioritise technologies for Government support?

1. It is essential that the core underpinning research base is funded in line with economic growth to ensure that the UK can maintain its competitiveness on the global stage. Years of 'flat cash' research funding and fees are now starting to seriously erode the research base, particularly in universities.
2. Research-intensive universities are major drivers of innovation and economic growth locally, nationally and internationally, and hence have a crucial role to play in maintaining and developing the science and innovation ecosystem.
3. The Government must ensure that research can be funded sustainably, through both recurrent and capital funding, to maintain UK competitiveness.

The criteria used to select the 8 Great Technologies continue to be relevant. Responsibility for maintaining the capability of the research base (criterion (iii)) is shared between Government and universities.

As an example, a robust analytical framework, drawing on expertise in business, science and innovation organisations was used to evaluate and select the 8 Great Technologies against key criteria: (i) the potential size of the global market, and its rate of growth (greater than £10 billion per annum); (ii) the range of applications for the technology across a number of economic sectors (over four); (iii) the capability of the research base to develop these technologies (number of published papers, active research projects); (iv) number and strength of UK companies and their supply chains relative to international competitors, and their ability to adopt and exploit the technologies; and (v) our ability to capture and protect the value we create (patenting, embedding and exploiting intellectual property).

9. Please feel free to add any additional comment or information that you consider important for the formulation of the Science and Innovation Strategy.