RSC Response to the Department of Business Innovation & Skills consultation on the strategic priorities for science and research funding

The Royal Society of Chemistry welcomes the opportunity to comment upon Strategic Priorities for Science and Research Funding. Britain's world-leading science creates both economic growth and jobs, and the mechanisms by which it is supported are of great importance.

The RSC is the largest organisation in Europe for advancing the chemical sciences. Supported by a network of 48,000 members worldwide and an internationally acclaimed publishing business, its activities span education and training, conferences and science policy, and the promotion of the chemical sciences to the public. This document represents the views of the RSC. The RSC has a duty under its Royal Charter "to serve the public interest" by acting in an independent advisory capacity, and it is in this spirit that this submission is made.

Royal Society of Chemistry

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Executive Summary

To continue to drive innovation, the UK needs to maintain its strong, broad scientific base coupled with its successful knowledge transfer systems.

However, funding for scientific research in the UK is currently undergoing a reduction in real terms, and our international competitors are outspending and out-innovating us.

In considering the priorities for science and research funding:

Focus should be placed on stability and long-term planning

A long term strategy for research funding would assist businesses and researchers in planning their commitments to the UK. Science funding has seen a real terms reduction, but if we are to remain competitive internationally, and if we want our economy to return to growth, then action is needed.

Excellence should be the primary criteria for funding research

Both pure and applied research have benefits, economic or otherwise, many of which cannot be anticipated in advance. Impact can provide a steer to researchers, but it is essential that societal and intellectual impact, as well as economic, is recognised. A breadth of our scientific base educating and training postgraduate researchers is important to ensure that we have the skills and knowledge to capitalise on breakthroughs.

Mechanisms for converting research to economic growth should be improved

Innovation was responsible for driving 63% of the economic growth between 2000 and 2008 and will continue to be an essential driver in returning the UK economy to consistent growth. The government has done a great deal to support this at a number of levels, but more coherence is required in the overall strategy, and a more joined-up approach taken to measuring success. Support for strategic areas will be important in assisting the growth of our economy, and a review of capacity in these strategic areas would assist in targeting resources.

Recommendations

- **A long term strategy for science funding should be published**
- **A target Government Expenditure on Research and Development of 0.7% GDP should be set for 2020**
- **Capital spending is essential and should be formally protected in the research base budget**
- **Excellence should remain the primary criterion for funding research**
- **The broader definition of impact, including societal and knowledge benefits alongside economic ones, should be emphasised**
- **A broad science base should be maintained**
- **SME access to government assistance should be simplified.**
- **The TSB's role should be broadened to allow coherence in the innovation landscape**
- **Systematic reviews should be commissioned for strategically important technologies**

Introduction

Funding for scientific research is undergoing a reduction in real terms.

The ring-fence placed around the science budget in the Comprehensive Spending Review (CSR) 2010, was enacted as a cash freeze on revenue spending. Capital, which was excluded, saw a predicted reduction of 41%.[1]

This 'freeze' is in real terms a reduction of greater than 10% over the spending review period, and has resulted in reduced numbers of grants awarded by research councils[2] - narrowing the research base upon which innovation can prosper - and reduced number of PhD students entering and performing research[3] – reducing the number of 'coal face' researchers.

Since 2010 the capital reduction has been largely reversed, through government investment in large-scale projects, and through the 'Eight Great Technologies',[4] but focus is still required. Indeed the change in RCUK policy to reduce their contribution to 'mid-range equipment' has placed a higher burden upon individual research institutions.[5]

Our international competitors are outspending and out-innovating us.

In 2010 gross investment in R&D (GERD) was 1.76% of the UK's GDP compared with an OECD mean of 2.4%. At the same time Germany's GERD was 2.8%, the USA's 2.9%, and South Korea's 3.74% with an annual growth rate of 4%. Since the mid-1980s our GERD has shrunk from the OECD average to well below that of the EU (Figure 1).

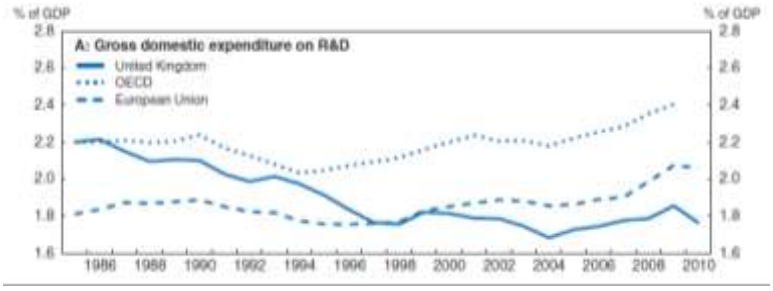

Figure 1 Gross domestic expenditure on R&D. Source: OECD Economic Surveys United Kingdom (2013)

Both public and private investment are lagging behind that of our competitors, but Government spending on R&D (GovERD) is directly addressable, and the two measures show good linear correlation internationally.[6] On this metric the UK is also behind our competitors, investing 0.6% GDP in R&D, compared with 0.7% for the EU-27 and 0.8% for the G8.[7] Within the G8 we are ranked behind all but Italy on this metric.

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[1] Allocation of Science and Research Funding, BIS (2010)
[2] Finances of Higher Education Institutions, Higher Education Statistics Agency (2012)
[3] Eight per cent drop in UK students entering postgraduate study, THE (2013)
[4] Public Funding of UK Science and Engineering, CaSE (2013)
[5] EPSRC equipment process, EPSRC website
[6] Main Science and Technology Indicators, OECD (2013)
[7] Main Science and Technology Indicators, OECD (2013)

This comparatively low funding has wider impact; when ranked by our capacity for converting invention into economic growth we are scored within the European Union as only an "Innovation Follower", behind the EU's "Innovation Leaders" including Germany and Sweden.[8]

The UK needs to maintain a strong, broad scientific base and successful knowledge transfer system to stay competitive in the global race and capitalise upon advances in knowledge.

Focus should be placed on stability and long-term planning

> "Given the longer-term implications of the R&D base, it is important that in the short-run the current level of R&D spending funded by the government is not reduced further as part of the fiscal consolidation measures. Over the longer-term the aim should be to increase this budget."[9]
>
> ***Economic Survey of the United Kingdom 2013, OECD***

To stay competitive in the global race it is essential that the government commits to funding R&D on an internationally competitive level. Government expenditure on R&D is linearly correlated with business expenditure,[10] and on both measures we are behind the averages of both the G8 and EU.

A target GovERD of 0.7% GDP should be set for 2020, so as to at least match the mean value in the EU. The RSC understands that in the coming Spending Review it is unlikely that the science budget will be increased from its current cash freeze at 2010-11 levels. However, it is important that on a longer timescale the Government commit to returning investment to internationally competitive levels. Because of this we propose that GovERD is returned to real terms growth, with a mid-term target of 0.7% GDP (i.e. that of the EU) set for 2020.

Sustained and predictable funding, as supplied by the science budget ring-fence, is highly valuable to the science base. It provides clarity to the longer-term research environment, helping investors to consider their UK investments in R&D, and is also important for institutions, research groups and individual researchers to plan their research commitments. Capacity in any one field cannot be swiftly switched on and off, and rebuilding capacity, once lost, is often prohibitively expensive.

The reduction in capital funding threatens the UK's position as a world leader.[11] Scientific endeavour requires both capital and revenue expenditure, and the RSC has heard from senior researchers about the importance of capital provision in their decisions to move or stay in the UK. A national strategic funding vision for the UK's research infrastructure must include the provision of modern laboratories and excellent teaching facilities. Facilities must be fully exploited and mechanisms put in place to maintain, upgrade or replace equipment in order to secure the UK's world class research infrastructure. Furthermore as both HEFCE and the research councils hold budgets for capital, some degree of coherence is required between their funding decisions.

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[8] Innovation Union Scoreboard 2013, European Commision (2013)
[9] Economic Survey of the United Kingdom 2013, OECD (2013)
[10] OECD Science, Technology and Industry Outlook 2012, OECD (2012)
[11] Science and Research Budget Allocations, Science and Technology Committee Consultation, RSC (2011)

Efficiencies can and have been made, but "low-hanging fruit" may have already been plucked. This includes the equipment sharing amongst regional groupings of universities (e.g. ScotCHEM,[12] the M5 universities[13], or the recently announced Science and Engineering South Consortium[14]), and the *Core Capability for Chemistry Research*[15] set up by the EPSRC to ensure that equipment beyond the investment capabilities of individual institutions remains available to maintain the UK's excellent research base.

Whether further efficiencies can be made without causing damage remains to be seen. As far back as 2010, a study performed by the RSC and Institute of Physics cautioned that "*chemistry and physics departments have made significant "efficiency gains" in recent years, with an increase in class sizes, better use of facilities and fewer technicians per researcher. However, there is likely to be only limited scope for further savings without negatively impacting on teaching quality, the capacity to conduct excellent research and the ability to train technicians."* [16]

Furthermore, it is essential that action to create savings are not embarked on too rapidly, for example whilst the Shared Services Centre for RCUK is now delivering a running saving, the manner in which it was set up has been heavily criticised by the National Audit Office, and it is not certain that it will ever recoup the initial costs.[17,18]

Excellence should be the primary criteria for funding research

It is essential that we continue to fund world leading fundamental research as it is only from a strong knowledge base that innovation can take root. It is important to recognise that not all research will have obvious impacts in advance. Many technologies ubiquitous today (for example lasers, semi-conductors, the measurement of nuclear spins as used now in MRI) did not see their value realised until many years after development.

Impact can provide a steer to researchers, but a distinction between this and 'economic impact' is essential. Asking researchers to consider the possible future 'impact' of their research can often be a valuable activity, and assists both funding bodies and the researchers themselves in steering strategy. However it is important that it is recognised (by both funding bodies and researchers) that impact does not always mean 'economic impact', and can often come in the form of societal benefits, or advances in the knowledge base itself.

The breadth of the UK's science base provides strength and agility. It is important that a broad scientific research base is maintained within the UK to ensure that we have the skills and knowledge to capitalise on advances, whether they originate in this country or elsewhere. Graphene is a well-trodden example, but following its discovery in Manchester in 2004 the UK was left behind in number of patents filed in this highly promising area.[19] In 2011 the government acted to address this shortfall, but whether this action is enough is yet to be seen.

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[12] http://www.scotchem.ac.uk/
[13] http://www.m5universities.ac.uk/facilities/
[14] http://www.ucl.ac.uk/news/news-articles/0513/130509-science-and-engineering-south-consortium
[15] http://www.epsrc.ac.uk/funding/calls/corecapability/
[16] Follow-Up Study of the Finances of Chemistry and Physics Departments in UK Universities , IoP & RSC (2010)
[17] Shared Services in the Research Councils, National Audit Office (2011)
[18] Shared Services Centre is 'below standard' and new tasks won't help it improve, says STFC head, Times Higher Education (2012)
[19] http://www.dw.de/uk-losing-out-in-graphene-patents-race/a-16576369

Mechanisms for converting research to economic growth should be improved

Innovation was responsible for 63% of the UK's economic growth between 2000 and 2008[20] and will be a valuable driver in returning the UK economy to consistent economic growth.

In the 2013 Innovation Union Scoreboard however, the UK is ranked as an *Innovation Follower* in Europe, falling behind seven countries including the Netherlands, Germany and Sweden, the latter two ranked as *Innovation Leaders*. [21]

In the scoreboard, the UK is ranked highest of all countries for "linkages & entrepreneurship". Small to Medium Enterprises (SMEs) collaborate well with others, but our weakest performance is in "innovators" - that is the number of SMEs successfully introducing innovations to the marketplace.

SMEs access to government assistance could be simplified. The government has a strong portfolio of support schemes for SMEs, and we welcome the recent announcements of a greatly increased budget for SBRI, and the £300m recently announced for SMEs to be delivered through the business bank. One of the primary concerns is the difficulty for SMEs in uncovering the options open to them for support. Great work has been done by gov.uk and the Technology Strategy Board (TSB) to consolidate some of this information, but there are still significant shortfalls and greater consolidation is required.

It is important to build upon the strength of linkages within the innovation ecosystem. The knowledge transfer process has benefitted widely from the introduction of Knowledge Transfer Partnerships (KTPs), and the TSB's initiatives more widely. Academics often do not have the skills required to take research to the market place, and bringing businesses together with universities is of huge value. On a more specific basis the RSC too is working to help bridge these gaps with our proposed Linked Fellowship Exchange Scheme, encouraging researchers working in drug discovery to engage with adjacent sectors and disciplines

The innovation system would benefit further from the expansion of KTPs to increase their engagement with SMEs. New ideas do not only arise from major universities and major companies and diversifying the innovation portfolio away from 'framework' universities and restricted company involvement in iCASE awards would reflect that.

The TSB's role should be broadened to allow coherence in the innovation landscape. There are a number of initiatives held by bodies, from a European to a local scale, to encourage innovation. The disparate nature of these schemes means that UK innovation lacks a coherent strategy and lacks a single set of metrics by which success is judged. The RSC proposes that the role of the TSB be broadened to cover coordination across innovation, and to put in place processes to follow up investment with specific metrics for monitoring success. In this manner the effectiveness of various innovation procedures could be maximised, and optimum growth for the UK economy realised.

Systematic reviews should be commissioned for strategic technologies.
The government's input of £600m for the 'Eight Great Technologies' as announced by the Chancellor at the Royal Society last year was very welcome, but an influx of money is not enough to ensure UK

[20] Plan I, Nesta (2012)
[21] Innovation Union Scoreboard, European Commission (2013)

success in these leading edge fields. The RSC suggests that a strategic review of the current capacity, deficits and opportunities within each of these technologies be undertaken to ensure success. These could be performed using a similar set of criteria as the Synthetic Biology Roadmap[22].

[22] A Synthetic Biology Roadmap for the UK, UK Synthetic Biology Roadmap Coordination Group (2012)