Autumn Statement 2016

Representation from the Campaign for Science and Engineering

Science and innovation are an area of UK competitive strength, with the potential for contributing to the creation of quality jobs, economic growth and bringing wider societal benefits across the UK. The Chancellor himself has described the link between the strength of our research and future innovation, growth and productivity. There is currently great uncertainty and concern across the UK science and engineering sector in academia and industry about the future health of research and innovation in the UK due to a combination of Brexit and domestic funding and migration policy. The Autumn statement provides an opportunity for the Chancellor to renew confidence and send a signal of intent to the watching world by setting out ambitious, long-term investment in science and innovation.

Leaving the EU will present enormous challenges, along with some opportunities, right across the spectrum of science and engineering, including industry. The sector's clear priorities in the negotiations relate to people, funding and regulation. And cutting across all three of those is the importance of collaboration. We were pleased that the Prime Minister confirmed her government's commitment "to ensuring a positive outcome for UK science as we exit the European Union[1]." This will not only require a positive outcome in negotiations with the European Union but must be complemented by a supportive domestic policy and funding environment. For the purposes of this representation the focus is on the funding environment.

About CaSE

The Campaign for Science and Engineering (CaSE) is the leading independent advocate for science and engineering in the UK. CaSE believes the UK government should support a healthy and flourishing science base in which all parts of this integrated system are well funded and performing optimally. CaSE works to ensure that the UK has the policies, funding and skills to help science and engineering thrive. It is funded by around 800 individual members and 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[2].

Science & Engineering's place in the UK

The UK science base is an integrated ecosystem which encompasses all disciplines of science, engineering, innovation and technology, and a wide range of sectors including higher education, industry, Small and Medium Enterprises (SMEs) and investors.

Public investment in and support for science and engineering is essential for the future of the UK as a high-tech and knowledge-based economy. A wide range of industries, from manufacturing and agriculture to digital technology, rely on science and engineering to innovate, grow, and create high-value jobs[3]. Innovation was responsible for half of all UK labour productivity growth between 2000

[1] http://www.bbc.co.uk/news/science-environment-36915846
[2] Figure calculated in November 2015 from latest available data
[3] The Science Council, The current and future UK science workforce, 2011

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and 2008, with 32% of that attributable to changes in technology resulting from science and engineering[4].

The R&D-intensive aerospace and pharmaceutical industries, for example, generated a trade surplus of more than £5 billion and £3 billion, respectively, in 2013. And the higher education sector, where a large proportion of publicly funded research is performed, generated more than £73 billion of output and contributed 2.8% of UK GDP in 2011/12[5].

Investment and support for science and engineering is essential for the future of the UK as a high-tech and knowledge-based economy. R&D and human capital are universal drivers of productivity[6]. Looking at some of the R&D intensive sectors, they have considerably higher Gross Value Added (GVA) per worker compared with the average across the UK. For instance, the R&D-intensive pharmaceutical sector has one of the highest GVA's per employee, with £155k in 2014[7]. Over the last five years, aerospace sectors have together increased their productivity by 30% – compared with just 4% across the rest of the UK economy[8].

Government investment in R&D 'crowds-in' further private sector investment[9] as well as other productivity boosting effects such as contributing to raising the level of the skills base in the UK, boosting human capital. Research commissioned by CaSE has shown that every £1 of public investment in R&D raises private sector output by 20p each year in perpetuity[10].

The UK cannot compete on cheap labour, capital reserves, or natural resources. As the UK seeks to re-establish its place in the world, we must instead play to our advantages in research and innovation. In an increasingly competitive global economy, these will be the drivers of future innovation, productivity gains, and high-value job creation across the UK[11].

The fruits of science and engineering enrich all our lives in countless ways. Nurturing a strong science base is vital for preparing the nation for future challenges, from climate change, food security and future cities, to antimicrobial resistance, national security and meeting the needs of an ageing population. Technology helps make the air we breathe cleaner by using new energy sources and waste-filtration systems, machines leave us more leisure time by reducing domestic work, and a better understanding of our environment helps us preserve the woodland and animals that we treasure.

With all the benefits that it brings, it's no wonder the public are supportive of scientific research and value scientists and engineers. The UK public overwhelmingly see science as beneficial. Research by Ipsos MORI and commissioned by the Department for Business Innovation and Skills, found that over 80% of those asked agree that science will make people's lives easier, and around 90% believe that scientists and engineers make a valuable contribution to society[12]. The same survey found that two-

[4] Estimating the effect of UK direct public support for innovation, BIS, 2014
[5] Immigration: Keeping the UK at the heart of global science and engineering, CaSE (2016)
[6] "On the Robustness of R&D" , Kul, Khan and Theodorodis, Journal of Productivity Analysis, vol. 42 (2014), 137-155
[7] CaSE analysis of ONS Annual Business Survey, 2016
[8] ADS evidence submitted to the BIS Committee Productivity Plan Inquiry (2015)
[9] 'The Economic Significance of the UK Science Base: a report for the Campaign for Science and Engineering', Haskel, Hughes and Bascavusoglu-Moreau, April 2014
[10] Ibid
[11] http://www.sciencecampaign.org.uk/resource/whychampionscienceandengineering.html
[12] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/348830/bis-14-p111-public-attitudes-to-science-2014-main.pdf

thirds (65%) see investment in science as a priority for the Government and 81% think that the UK needs to develop science and technology in order to enhance its international competitiveness. The UK public also demonstrates this support for science and research through their giving. Medical research is the UK's favourite charitable cause, with 7.6 million people donating in a typical month[13].

Science and innovation should be a pillar of the EU negotiations as an area of UK competitive strength, as a feature of our relationship with Europe that currently works well and brings mutual benefits, and as an endeavour attracting broad support from the UK public. In parallel, the government must consider how domestic policy and funding can work together to support a thriving science and innovation base in this new landscape.

The UK's place in the world

Science is global. This is a phrase that has resonated around the science community following the EU referendum. It recognises the reality that those who work in academic research or science and engineering companies take for granted, science is a global endeavour.

The UK enjoys a central position in this global network of scientists and engineers. It is reflected in the nationalities represented in laboratories and research teams up and down the UK. Similarly UK nationals are working across the world. According to a study by Elsevier, almost 72% of UK-based researchers[14] spent time at non-UK institutions between 1996 and 2012[15]. This mobility is not because scientists and engineers are particularly fickle about where they live. It is because it is integral to their work; internationalism brings huge benefits to their own research and the productivity of science and engineering as a whole.

This global connectedness is also demonstrated in R&D funding nationally[16]. In just over 2 decades, there has been a change in the profile of how UK R&D expenditure has been funded. In 1990, £1.4 billion (12%) in current prices of R&D funding came from overseas. Since then, there has been a steady increase in the value of funding for UK R&D expenditure from overseas, from £2.3 billion (16%) in 1996 to £5.4 billion (18%) in 2014. The bulk of this overseas funding is for R&D performed in business, but around £1.5 billion is for R&D performed in universities or public research institutes.

Business is the largest investor in UK R&D, accounting for £19.9 billion of expenditure in 2014, representing 65% of total expenditure on R&D performed in the UK. The pharmaceutical industry was the largest business investor at £3.9 billion, computer programming and information service activities was second at £2.4 billion and the automotive industry was third at £2.3 billion[17]. These are global industries choosing to invest in the UK. And at present the UK is an outlier in the proportion of its funding for R&D that comes from overseas sources.

Our industry members tell us that the strength of the UK's research base is a defining attractor. The most direct evidence of this effect in the UK is that multinational pharmaceutical firms locate their laboratories near to universities with excellent chemistry research[18]. Across sectors, access to

[13] http://www.amrc.org.uk/blog/medical-research-the-uks-favourite-cause

[14] Includes UK and non-UK nationals. Only published researchers from academia and industry were able to be analysed.

[15] Elsevier, International comparative performance of the UK research base, 2013

[16] http://www.ons.gov.uk GERD 2014 (2016)

[17] http://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/2014#expenditure-on-rd-performed-in-the-uk

[18] The Economic Significance of the UK Science Base, Haskel et al for CaSE, 2014

expertise and world class facilities are repeatedly cited as key attractors along with the international reputation of the UK's research and innovation institutions.

Together this suggests that the UK is a connected, global hub for science and engineering.

Securing a positive outcome for science begins now

CaSE along with others in the sector will be working hard in coming months to evidence, develop and articulate priorities for science & engineering as well as potential risks to mitigate and opportunities to capitalise on as the UK leaves the EU. However, the Autumn Statement is an opportunity for the Chancellor to lay the groundwork for UK science to thrive in the coming years.

The government has a role to play in taking early-stage risks where the private sector will not, particularly where there is a long lag time from investment to benefit and where the benefit returns broadly across society more than to the investor. Over the long-term, taking these risks enables the creation of private sector jobs in entirely new markets, as well as delivering societal benefits. The science budget is such a risk and a bold commitment to our future prosperity.

Yet, the UK's persistent low public R&D investment is a lost opportunity, risking the breadth and depth of UK science excellence with implications both for the absorptive capacity of firms and on our ability to benefit from global investment in science and innovation[19]. Government investment in R&D has fallen both as a percentage of GDP and as a percentage of total Government spending in recent years[20]. The commitments by consecutive governments have provided relative protection and stability to the science budget and capital investment in BIS amid wider government funding cuts. However, continuing 'stability' in domestic public R&D investment will result in a sharp drop in the level to which our research base is funded following Brexit.

Overall, the UK is a net contributor to the EU, but it is a net receiver of EU funding for research; receiving €8.8bn between 2007 and 2013 compared to an indicative contribution of €5.4bn, a net gain of €3.4bn. Moreover, the importance of EU funding to research is growing, with half of the increase in UK university research budgets over this period coming from EU government sources. In an environment of financial strain it is clear that the EU has provided a valuable source of funding for the sector[21]. It is possible to participate in EU programmes as a non-member state, however the amount of funding received by all non-member states combined does not equal the current level of funding received by the UK. Only 7.2% of the research funding awarded by the European Union and the European Research Council has been allocated to non-member states in the last decade – a total of €3.5bn – mostly to Norway and Switzerland[22].

Therefore, for the UK to receive even a fraction of its current level of EU funding following Brexit would be a substantial shift in the balance of research funding going to members and non-members. It is also politically improbable that continuing EU member states would agree to a non-member state being a net receiver of funding for research as we are now[23]. The scale of the investment shortfall will become clearer as EU negotiations develop, but at present UK receives over £1billion a year in competitively won R&D funding from the EU. Increased domestic public investment is therefore needed in order to stand still.

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[19] Insights from International Benchmarking, BIS analysis paper, 2014
[20] http://blog.sciencecampaign.org.uk/wp-content/uploads/2015/04/CaSE-RD-investment-briefing-April-2015.pdf
[21] http://www.sciencecampaign.org.uk/resource/CaSEEPCEUReport2015.html
[22] Digital Science, Examining the implications of Brexit for the UK research base, 2015
[23] The Role of EU membership on UK science and engineering research, CaSE, 2015

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Increasing public investment in research would have beneficial knock-on effects. Research shows that Government investment in R&D 'crowds-in' further private sector investment as well as other productivity boosting effects such as contributing to raising the level of the skills base in the UK, boosting human capital. Research commissioned by CaSE has shown that every £1 of public investment in R&D raises private sector output by 20p each year in perpetuity[24,25].

An economic analysis paper published in 2008 on the optimal level of national R&D investment concludes that between 2.3% and 2.6% of GDP "maximizes the long-run impact on productivity growth and is the key to sustained productivity and technology improvements that are becoming more and more necessary to modern economic growth"[26]. A more recent 2014 BIS analysis suggested the UK should aim for 2.9%, the average of our competitors, commenting that "they do not appear to get poor returns on their investment"[27].

To put that level of investment in monetary terms, if the UK were to invest 3% of GDP in R&D, one would expect[28] a third of that to be from the Government, equalling approximately £8.8 billion per year more than is currently invested. This demonstrates that the level of investment in the UK science base could rise substantially without reducing return on investment. The impact of reaching this level of overall investment on the UK's research capacity and output would be transformational. For perspective, the Francis Crick institute at St Pancras will be Europe's largest research institute and has cost approximately £700 million in total.

Proposals for the Autumn Statement

Commit to ensuring that the total level of investment in UK science, from EU and UK government sources combined, will not decrease from the current level following Brexit.

The Government should use this Autumn Statement to provide reassurance that Brexit will not result in damaging cuts to the UK science base. There are many details underpinning that commitment which rightly would need to be worked out as part of the EU negotiations, such as precisely what involvement the UK will have with EU structures and programmes for research. This commitment would instead be much needed assurance that the total level of public investment in UK science will not suffer as a result of Brexit. Without this commitment it is difficult to see how the Prime Minister's commitment to ensuring a good outcome for science following Brexit could be achieved.

Research, research materials and some international subscriptions will be affected by changes to the exchange rate resulting in budget shortfalls. This commitment should include a commitment to mitigate against reductions in the purchasing power of research budgets due to reductions in the value of the Pound.

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[24] 'The Economic Significance of the UK Science Base: a report for the Campaign for Science and Engineering', Haskel, Hughes and Bascavusoglu-Moreau, April 2014

[25] For example, if government made a one-off increase in public spending on R&D (through the Research Councils and Quality Related funding stream) of £450m, market sector output would rise by £90m p.a. each year. Discounting at 5% p.a. gives a total boost of £1.8bn to business sector output over time.

[26] http://www.sciencedirect.com/science/article/pii/S0040162508000383?np=y

[27] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf

[28] Based on international splits between business and public R&D

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Set out the scale of this Government's ambition for UK public investment in science and innovation beyond the end of this parliamentary term.

Greg Clark has already stated that the government "must provide the research funding to keep us out in front[29]."The Government should use this Autumn Statement as an opportunity to reverse decades of decline and set out an ambition to increase investment in science and innovation over ten years to a level that will narrow the gap between the UK and its international peers.

The UK government's Industrial Strategy also provides a timely opportunity to create a long term framework to support a thriving business and innovation environment built on the UK's competitive strength of its science and innovation base.

This increased investment should not primarily be used for discrete projects with short term wins. In his Party Conference Speech the Chancellor made a principled statement on his approach to investment, "Making sure that it is long-term economics, not short-term politics, that drives Britain's vital infrastructure investment[30]". This same principle should be applied to investment in science. This principle is one with wide public support; 79% of the public agree that even if it brings no immediate benefits, scientific research which advances knowledge should be funded by Government[31].

As such, the Chancellor could commit to increasing the baseline level of Research Council funding and Quality-Related research funding as part of the long-term increase. There is good evidence of the return on investment each of these provide[32]. This commitment would back up the Chancellor's statement that he recognises that the much bigger prize than incremental productivity improvements requires early stage investment in research in universities and research institutes as well as company R&D facilities. As the Business Secretary and the Science Minister have both previously stated the UK research base leads the world in getting the greatest "bang for the buck". Announcing an increase in baseline investment would therefore be an uncommon win-win for the Government, a shrewd long-term investment in the UK's future, and an investment that attracts wide popular support.

Two budgets that are used for supporting early stage innovation and application of knowledge are Innovate UK and the Higher Education Innovation Fund. As set out below, these budgets to date have shown impressive return on investment. Increasing the budget for both of these areas would complement increasing research investment discussed above and support the Chancellor's aim of building on the UK's strength in the application of new ideas.

Innovate UK

A 2013 evaluation study showed its business impact is twice as high for projects with two or more academic partners, at £9.67 GVA per pound spent, compared to projects without academic partners, at £4.22 GVA per pound[33].

[29] https://www.gov.uk/government/speeches/the-importance-of-industrial-strategy
[30] http://press.conservatives.com/post/151284663940/hammond-an-economy-that-works-for-everyone
[31] Ipsos MORI, 2014
[32] 'The Economic Significance of the UK Science Base: a report for the Campaign for Science and Engineering', Haskel, Hughes and Bascavusoglu-Moreau, April 2014
[33] Evaluation of the Collaborative Research and Development Programmes, Innovate UK, 2013

Higher Education Innovation Fund (HEIF)

Every £1 of HEIF spending delivers an estimated £9.70 in benefits for the economy and society[34]. Increases could be used to support regional growth across the UK if it is continued to be distributed across a broad spread of institutions. HEFCE's research shows that HEIF helps universities to strengthen their local economic development infrastructure, to work constructively with SMEs, and to develop regional clusters of businesses.

[34] http://www.hefce.ac.uk/pubs/rereports/Year/2015/heifeval/