Leaving the EU: implications and opportunities for science and research

CaSE response |23rd August 2016

Summary

The Prime Minister, Theresa May, has expressed her commitment to science stating "the government's commitment to ensuring a positive outcome for UK science as we exit the European Union[1]." In this submission we set out the role of science and engineering in a strong UK, how science and engineering can help shape the UK's place in the world, and emerging priorities for the EU negotiations and domestic policy to ensure a positive outcome for UK science.

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, science and innovation should be a pillar of the EU negotiations. In parallel, the government should be considering how domestic policy and funding can work together support a thriving science and innovation base.

In particular this submission considers three broad and overlapping priorities that are broadly shared across the science and engineering sector, talent, funding and regulation, exploring the risks and opportunities leaving the EU raises in each area.

Introduction

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 thriving science base in which all parts of this integrated system are well funded and performing optimally.

CaSE works to raise the political profile of science and engineering, and ensure that the UK has world-leading research and education, skilled scientists and engineers, and successful innovative business. 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].

In August CaSE convened a discussion forum bringing together around 45 CaSE members and key collaborators spanning academia, industry, charity and professional bodies from farming to pharmaceuticals and manufacturing to digital industries where we began the work of identifying shared priorities ahead of EU negotiations that will contribute to a positive outcome for science. This submission draws on the outcomes from that discussion forum.

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.

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[1] http://www.bbc.co.uk/news/science-environment-36915846

[2] Figures taken from latest available years of data

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]. 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[4].

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[5]. Government investment in R&D 'crowds-in' further private sector investment[6] 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[7].

The UK cannot compete on cheap labour, capital reserves, or natural resources. As the UK prepares to leave the EU, more than ever we must instead play to our advantages in science and engineering. In an increasingly competitive global economy, they will be the drivers of future innovation, productivity gains, and high-value job creation. 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.

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[8]. The same survey found that two-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[9].

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[3] The Science Council, The current and future UK science workforce, 2011

[4] Immigration: Keeping the UK at the heart of global science and engineering, CaSE (2016)

[5] "On the Robustness of R&D" , Kul, Khan and Theodorodis, Journal of Productivity Analysis, vol. 42 (2014), 137-155

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

[7] Ibid

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/348830/bis-14-p111-public-attitudes-to-science-2014-main.pdf

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

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, **science and innovation should be a pillar of the EU negotiations.**

In parallel, **the government should be considering how domestic policy and funding can work together support a thriving science and innovation base**. Doing so will support many of the government's wider aims of creating high-value jobs across the UK, increasing productivity, driving sustainable economic growth, along with wider aims in education, security and resilience, and health.

The UK's place in the world

Science is global. This is a phrase that has particularly resonated with 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[10] spent time at non-UK institutions between 1996 and 2012[11]. 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[12]. 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[13]. 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[14]. Across sectors, access to

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

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

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

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

[14] 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

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. We began this work by holding a discussion forum in August bringing together around 45 CaSE members and key collaborators spanning academia, industry, charity and professional bodies from farming to pharmaceuticals and manufacturing to digital industries to identify shared priorities across this broad group ahead of EU negotiations.

There are sector specific challenges, concerns and opportunities that leaving the EU raises. However, there was a high degree of consensus about the emerging top level priorities across the broad sector represented at the meeting.

- **Talent** – retention, access and movement of global talent
- **Funding** – access to EU funding and ambitious domestic funding
- **Regulation** – continuity and harmonisation of regulations and standards

Each of these is considered in more detail below, however, none of the three should be considered in isolation. They are not ends in themselves but work together to support vital collaboration, trade and influence that contribute to the UK being a strong, connected, global hub for science and engineering.

TALENT

Companies, universities, charities and research institutes alike see the ability to retain, access, move and attract skilled people as an essential pillar of securing a positive outcome for science as the UK leaves the EU. This came across strongly in our member discussion meeting.

Across all sectors, around 6% of employees in the UK are from the EEA[15]. Science and engineering tends to be far more international than the average. A quarter (26%) of academic staff in UK universities are non-UK nationals[16]. In 2013/14, there were more than 22,000 academic workers (12% of the total) from outside of the EU and more than 29,000 from within the EU (16% of the total). Looking specifically at those working in STEM, the percentages are slightly higher, with 13% from outside the EU and 17% from within. The numbers are more difficult to aggregate across industry, however, sectors that are particularly dependent on workers from the EEA include manufacturing, where over 10% of employees are from the EEA[17].

There is fierce global competition for talented people and an active transfer market of scientists, engineers and technicians across the world. Therefore as the UK goes through a period of substantial uncertainty and change there is no room for the UK to be complacent in assuming that global talent, including UK nationals, will continue to see the UK as an attractive place to work or study. Instead

[15] http://www.smf.co.uk/publications/working-together-the-impact-of-the-eu-referendum-on-uk-employers/
[16] Engineering Professors' Council analysis of HESA data from the Higher Education Database for Institutions (HEIDI), accessed September 2015
[17] http://www.smf.co.uk/publications/working-together-the-impact-of-the-eu-referendum-on-uk-employers/

negotiations and domestic policy must work together to create a migration system and environment that actively supports a healthy science and engineering sector.

Immigration was a major feature of the EU referendum debate, we therefore recognise that this will be a major area of consideration and contention as negotiations develop. We also know from the example of other nations that how the UK decides to manage migration will have knock on effects to other aspects of the UK's relationship with the EU including trade, access to research programmes and funding. An overly restrictive migration policy was therefore one of the major risks raised at the CaSE discussion forum, for the impact it would have on access to talent and how it could lead to a narrowing of the funding, collaboration and trade opportunities open to UK-based individuals and organisations in future.

We recognise the willingness of the Home Office to work closely with the sector to refine and develop migration policy in recent years to ensure it is fit for purpose. This has been very welcome and resulted in tangible improvement to processes and policy. We hope to build on this productive engagement during this period of substantial change. Regarding domestic migration policy, CaSE will be working with others in the sector to examine and articulate what principles would underpin a transparent, fair migration system and the types of movement it would need to support to contribute to a positive outcome for science.

Scientists in both academia and industry are motivated by the desire to work with great researchers and in institutions where the science is of the highest quality[18]. A 2013 study of more than 16,000 international scientists supports this conclusion, with career prospects, the quality of the faculty and colleagues, and the scientific excellence of the institution being the top three motivating factors for emigrating to another country for research[19]. These longer term moves are complemented by, and often contribute to, myriad cross-border collaborations on joint research programmes and projects.

Part of ensuring that the UK is a destination of choice for scientists of all nationalities (including British nationals) to build a career is to ensure this is a place where they can participate in the best science. Access and retention of talent therefore cannot be divorced from access to funding, regulation and ability to collaborate with the rest of the world, including Europe.

FUNDING

At the CaSE forum for most, discussion about funding was inseparable from discussing collaboration due to the collaborative nature of much of the EU funding and programmes. Overall the shared priorities in this area could be articulated as:

- continued access to EU funding programmes and collaborative opportunities
- conserving and growing overall investment in UK science and research in the longer term

Risks to mitigate

The most overwhelming result in a CaSE survey of scientists and engineers ahead of the EU referendum[20] was that 96% agreed that EU funding supported new academic collaborations (66% strongly agreed). 67% also agreed that EU funding supports new industry collaborations. These figures were backed up in the discussion at the CaSE forum where it was a strongly held view that

[18] DEMOS, Knowledge nomads: why science needs migration, 2009

[19] Chiara Franzoni, Giuseppe Scellato, and Paula Stephan, Foreign-born scientists: mobility patterns for 16 countries, 2012

[20] Survey undertaken October, 2015 by CaSE and the EPC. 403 respondents from UK HEIs and industry as part of 2015 report, The role of EU membership in UK science and engineering research

the collaborations formed and facilitated through EU funding were invaluable. This is a view held right across academia and industry. They leverage additional value above and beyond the funding itself. For instance, some industry members present raised that they indirectly benefit from academic collaborations as academics they work with in the UK are part of wider EU projects making UK academics more attractive as partners. There was a strong view that the **UK should look to negotiate continued access to EU programmes and collaborative opportunities.**

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. 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]. So for the UK to receive even a fraction of its current level of funding 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.

There is therefore a risk that without intervention by the UK Government the overall level of investment in UK science and innovation will decrease. Due to the benefits UK science brings to the economy and society the **government should ensure that the negotiations and subsequent domestic funding settlements result in conserving and growing the overall investment in UK science and research in the longer term.**

Attendees at the CaSE forum raised that leaving the EU poses the risk of losing access to certain types of funding if the UK no longer has access to EU research programmes, including Horizon 2020 and any future framework programmes. This also featured in the survey of individual scientists and engineers CaSE undertook ahead of the referendum where three quarters of respondents agreed or strongly agreed that EU funding fills a gap where other funding isn't available due to the research subject. Due to the intertwined nature of UK and EU funding streams in recent years, a situation has developed where some fields of research are more dependent on EU funding than others, both for competitive research funding but also for facilities and networks.

This is also true of some universities where up to two thirds of total research income is from EU sources, although most universities receive between 15-35% of their competitive funding from Europe[23]. Also, while all parts of the UK are reliant on EU research & development funding to some extent, the areas with the highest dependency overall are South West England, outer London and parts of North England and Scotland[24]. **In the negotiations and in developing domestic policy and funding, the government should assess and be mindful of the disproportionate dependence on EU research funding in some disciplines, sectors, universities and regions.**

[21] http://www.sciencecampaign.org.uk/resource/CaSEEPCEUReport2015.html
[22] Digital Science, Examining the implications of Brexit for the UK research base, 2015
[23] Digital Science, Examining the implications of Brexit for the UK research base, 2016
[24] http://sciencecampaign.org.uk/CaSEVATbriefing2015.pdf

Opportunities

In our survey[25], 78% agreed that EU funding and programmes bring a longer term perspective to research activity. At the CaSE forum, members raised that EU funding tends to be more long term in nature that UK funding and that the framework programmes spanning seven years and being agreed in advance mean that they provide some stability. This, in part, enables EU funding and structures to support research on a greater scale and to support higher risk research than a single government is able to. However, members at the CaSE discussion forum raised that **the creation of UK Research and Innovation (UKRI) if supported by additional funding could provide opportunities for new funding programmes that are more ambitious, that cross disciplines and support collaboration.** Alongside this**, the Industrial Strategy could provide a long-term, ambitious framework and programmes to support collaboration, knowledge exchange and build on the UK's competitive strength of its science and innovation base**.

REGULATION

Across science and engineering in academia and industry leaving the EU presents complex challenges for the future of regulations, standards and legislation that affects and governs our sector from data protection to environmental codes and clinical trials. This is an area where leaving the EU could provide real opportunities to create a distinctive, attractive environment for research and innovation in the UK. However, this is balanced by the need to first and foremost ensure continued alignment and compatibility with EU regulatory frameworks to support cross-border collaboration, participation in programmes and trade.

The risks and opportunities raised in the CaSE forum are outlined below. Overall, the appetite across the sector for taking the opportunity of leaving the EU to change regulation and legislation affecting the sector was mixed. Some expressed the view that they wanted to see all regulation continue as before to reduce disruption to working practices and trade. The majority wanted to see continued alignment and compatibility with EU regulatory frameworks where necessary and where beneficial but could also see leaving the EU as an opportunity to try new approaches. What is clear is that the process will require very careful management, communication and detailed working with experts within the sectors and industries involved to ensure that regulation is fit for purpose and to avoid unnecessary disruption and damage to the UK's competitiveness during the transition period.

Risks to mitigate

Regulatory divergence between the UK and the EU could be an opportunity but is also a significant risk. This is an area where there will be significant technical and sector/industry specific expertise required to ensure regulation is fit for purpose. **Appropriate structures and processes should be put in place by the UK government and parliament to ensure scientific and technical expertise and advice is appropriately accessed throughout the process.** This includes ensuring that appropriate structures, processes and appointments are built into the Departments for Exiting the EU and International Trade where regulation and standards will be a significant feature of their work.

EU regulation is and has been heavily influenced by the UK. In its position as a scientific leader within the EU, and as a nation with comparatively developed and embedded mechanisms and structures for accessing and using scientific advice, the UK's influence on EU regulations has arguably contributed to ensuring countries across the EU benefit from an improved regulatory environment. Concern was raised at the CaSE forum that on leaving the EU the UK will lose influence at all levels, including within regulatory bodies. As the UK is likely to still have to abide by EU regulation in a

[25] http://sciencecampaign.org.uk/CaSEVATbriefing2015.pdf

broad range of areas due to conditions of trade, collaboration or funding, this could negatively impact on UK science. As a result, it was considered **crucial for the UK to be able to continue to provide evidence-based input to shape the direction of EU regulatory development**.

The uncertainty created by the decision for the UK to leave the EU is also a risk to the UK's competitiveness in the short term. For instance if you are looking to start or move a business or project, uncertainty over what the regulatory environment will be once the UK leaves the EU will make the UK a less attractive place to locate while uncertainty persists. **The timeline, scope and process for reviewing and developing the regulatory environment in the UK as a non-member state of the EU should be clarified as soon as possible.**

Opportunities

Leaving the EU could provide an opportunity for the UK to become a regulatory 'sandbox'; a place for trying new approaches. In 2013 a group of companies sent a letter to the Presidents of the European Commission, Council and Parliament stating they were "concerned by the negative impact of recent developments in risk management and regulatory policy on the innovation environment in Europe[26]." Their view was that the balance had become tipped in favour of precaution rather than a balance of precaution and proportion, advocating the adoption of an Innovation Principle in risk management and regulatory practice. If appropriately balanced with the need for regulatory alignment in many areas, leaving the EU could be used as an opportunity for the UK to foster an innovative, forward looking approach to regulation.

In the UK we have a robust dialogue between the sector and government. This is a real asset. The UK also has a strong science dialogue and public engagement expertise which will need to be built on to ensure the UK public can feed into, and have confidence in the UK's regulatory environment. We've seen an exemplar of doing this for complex new regulation in the contentious area of mitochondrial donation. Through concerted public and parliamentary engagement as well as care to ensure the regulations were suitably robust and technically sound the UK was able to break new regulatory ground.

There is also an opportunity for regulatory refinement, finding more efficient ways to deliver EU regulation. A specific opportunity has been highlighted but academic and industry CaSE members regarding an aspect of the UK's VAT system as a current and significant barrier to research collaboration, particularly co-location within research institutes. In a recent CaSE briefing, the key issues and solutions to explore are set out in detail[27]. The primary issue is that publicly-funded research institutes are restricted to 5% commercial activity if they opt not to pay VAT or face costly tax bills to co-locate their researchers with industry colleagues. The Dowling Review[28] recommended that this be looked at as a matter of urgency. Leaving the EU provides an opportunity to do so.

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[26] http://corporateeurope.org/sites/default/files/corporation_letter_on_innovation_principle.pdf
[27] http://sciencecampaign.org.uk/CaSEVATbriefing2015.pdf
[28] See recommendation 12 of the Dowling Review of business-university research collaborations, 2015

This submission is on behalf of the Campaign for Science and Engineering. Please contact Naomi Weir, Deputy Director, if you would like to discuss any aspects of this submission further at naomi@sciencecampaign.org.uk or 0207 679 4995.