ROYAL ACADEMY OF ENGINEERING

The Relationship between EU Membership and the Effectiveness of Science, Research and Innovation in the UK

House of Lords Select Committee on Science and Technology

Submission from the Royal Academy of Engineering

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About the Royal Academy of Engineering

As the UK's national academy for engineering, we bring together the most successful and talented engineers for a shared purpose: to advance and promote excellence in engineering.

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Introduction

1. The Royal Academy of Engineering welcomes the opportunity to submit evidence to the House of Lords Select Committee on Science and Technology inquiry on the relationship between EU membership and the effectiveness of science, research and innovation in the UK. This response builds upon the 2013 UK national academies' joint submission to the Department for Business, Innovation and Skills' call for evidence on research and development as part of the Coalition Government's Review of the Balance of Competences between the United Kingdom and the EU.[1]

2. The European Union offers significant funding to the UK research and innovation community, which facilitates, and is complemented by opportunities for international collaboration, interdisciplinary and multidisciplinary research and access to world-class facilities. The EU offers businesses the opportunity to collaborate, scale-up, contribute to standard setting and access the single market. The UK has a globally excellent and highly productive research base, to which EU support for research and innovation, both financial and non-financial, has contributed.

Funding

3. The UK has a strong track record in securing EU research funding as outlined in the most recent and final monitoring report of the European Framework Programme (FP7), which ran from 2007 to 2013.[2] The UK held 14.9% of all FP7 grants (17,561 grant holders) which equated to 17.2% of the total financial grant contributions, at a value of €6,940 million. The UK was second only to Germany both in terms of number of grant participants and budget share, with Germany having 15.4% of grant holders and 17.7% of the budget. UK Higher education institutions (HEIs) are particularly successful in winning EU funding, with UK universities holding the top 4 positions for institutions with the greatest number of signed grants and 70.7% of the UK's total FP7 funding being awarded to higher and secondary education institutes. EU research funding is of particular importance to engineering research conducted in UK HEIs, where the amount of EU research funding received has increased by 50% in value from 2007/08 to 2013/14.[3] We would direct the Committee's attention to a forthcoming report from the Royal Society for further analysis of the contribution of EU research and innovation funding to the UK.

4. In 2014, Horizon 2020, the EU's current research and innovation programme was launched. Horizon 2020 has a budget of nearly €80bn available over the 7 years from 2014

[1] Joint National Academies submission to the Department for Business, Innovation and Skills' call for evidence on research and development as part of the Coalition Government's Review of the Balance of Competences between the United Kingdom and the EU, August 2013
[2] European Commission, Seventh FP7 Monitoring Report 2013, March 2015.
[3] Campaign for Science and Engineering (CaSE) and the Engineering Professors' Council (EPC) submission to the House of Lords Science and Technology Select Committee Inquiry on the Relationship between EU membership and the Effectiveness of the Science, Research and Innovation in the UK, 2015.

to 2020, but has a more strategic, challenge-based approach than FP7. Horizon 2020 has a role in implementing the Innovation Union, a Europe2020 flagship initiative aimed at securing Europe's global competitiveness. The majority of Horizon 2020 funding requires collaboration between three or more partners, which can include businesses. In addition, Horizon 2020 has allocated €3bn for an instrument to support innovation in SMEs.

5. Horizon 2020 also includes the budget of circa €13bn for the European Research Council (ERC), the European mechanism to support investigator driven or 'bottom-up' frontier research. The premise of the ERC, as for the UK Research Councils, is to fund excellent research, although proposals that cross disciplinary boundaries are encouraged. The UK does exceptionally well from ERC funding, with 17% of ERC funded Principal Investigators during FP7 and 4 out of the top 10 host institutions, more than any other country.[4] The UK is also consistently the most successful country across every domain (life sciences, physical sciences and engineering, and the social sciences and humanities), for each of the ERC's Starting Grants, Consolidator Grants and Advanced Grants. UK-based academics working within the physical sciences and engineering domain win 19%, 22% and 23.4% of the Starting, Consolidator and Advanced Grants respectively, substantially more than those won by other participant countries.[5] The UK also received the largest number of ERC Proof-of-Concept grants at 17.8%.[6]

6. The ERC, as for the UK Research Councils, uses peer-review to assess grant applications. The Academy continues to support the peer review process, regarding it as a trusted and reliable way of ensuring that quality prevails in funding decisions. Nevertheless, as for the UK Research Councils, there is room for improvement.[7] Increased transparency would be welcomed, particularly to allay concerns of politically and geographically motivated decision making.

7. In comparison to UK universities the picture is more mixed for UK businesses. UK businesses received 18.12% of the UK's total FP7 funding, with Latvia as the only member state whose proportion of total FP7 funding for businesses was lower at 11.97%.[8] Nevertheless this equates with the UK being the third most successful country, behind France and Germany, when assessed by the financial contribution to businesses and by number of business participants in FP7. The UK's participation by businesses was comparable to France with 4544 and 4547 business participants respectively, but was considerably less than Germany at 6241.[9] In terms of financial contribution, both France and Germany, with €1416 million and €1912 million respectively, received significantly more than the UK at €1257 million.[10] Interestingly, SMEs accounted for 13.7% of the UK's total FP7 budget share, which is greater than France at 11.94% and similar to Germany at 13.54%.[11] Therefore it appears that it is big businesses that are particularly underrepresented in the UK's EU funded research and innovation portfolio, accounting for just 4.95% of the UK's FP7 budget, compared to 16.20% and 13.76% for France and Germany respectively.

[4] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[5] European Research Council website statistics page: https://erc.europa.eu/projects-and-results/statistics accessed on 9 November 2015
[6] European Research Council website statistics page: https://erc.europa.eu/projects-and-results/statistics accessed on 9 November 2015
[7] Royal Academy of Engineering's submission to the Nurse Review of Research Councils, April 2015
[8] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[9] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[10] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[11] European Commission, Seventh FP7 Monitoring Report 2013, March 2015

8. The UK also had the lowest success rate of business applicants, at 24.81%, compared to France at 28.14% and Germany at 27.30%, with the UK ranking 7th out of all 28 member states.[12] A relatively low success rate aligns with the feedback received from the engineering community, who feel that UK businesses are not adequately supported when they apply for EU research and innovation funding. Previously the UK's Regional Development Agencies (RDAs) provided support and guidance to businesses interested in applying for EU research and innovation funding. There are concerns that following the disbanding of the RDAs in 2012, the same high quality of guidance and support is no longer available, or as easily accessible, which hampers efforts to increase the participation of UK businesses. There is a sense that Innovate UK and the UK Research Councils could take a more coordinating and strategic role to support UK businesses to access and navigate the EU research and innovation funding landscape. Furthermore, the Academy is aware of efforts to simplify and strengthen local innovation support for UK businesses, but it is too early for any assessment of its effectiveness.

9. There are concerns among some in the engineering community that the application procedures and consequent administering and monitoring of EU research funding is particularly burdensome. The application procedure can be eased by dedicated staff, both in HEIs and businesses, who are familiar with the EU research funding landscape and are able to provide advice and support. However, given that the majority of Horizon 2020 calls require applications from consortia and are likely to involve international collaboration, a certain level of complexity in the application and administration of funds is understandable. Nevertheless, with Horizon 2020's focus on supporting innovative SMEs it is important that those schemes have satisfactory levels of visibility and low administrative burdens, as it is well reported that SMEs are under-resourced both in time and money.[13]

10. The seven year funding cycles characterised by the Multiannual Financial Frameworks, such as FP7 and Horizon 2020, provide stable, long-term funding in cycles longer than the UK's national programmes tend to provide. This stability, combined with policy consistency, enables UK researchers, institutions and businesses to deliver research excellence with long-term planning, and can impact upon leverage as the long-term visibility can give investors confidence. Furthermore, EU research and innovation funding can provide support for UK research activities beyond that supported by the UK's research and innovation funding portfolio.

11. The European research and innovation funding landscape is greater than just FP7 or Horizon 2020, with several other EU funding mechanisms also providing support for research and innovation. The European Structural and Investment Funds (ESIF) support growth and jobs across the EU. The fund includes money from the European Regional Development Fund (ERDF) which aims to support research and innovation, alongside SMEs and the creation of a low carbon economy. These funds are particularly important for building capacity in the least economically developed areas of the UK. The newly created European Fund for Strategic Investment (EFSI) will also support investments in infrastructure and innovation, as well as offering finance for SMEs.

[12] European Commission, Seventh FP7 Monitoring Report 2013, March 2015
[13] The Dowling Review of Business-University Research Collaborations, July 2015

Collaboration

12. There is widespread agreement across the engineering community that international collaboration brings huge benefits to engineering research and innovation in the UK. Collaboration gives UK researchers and businesses access to a broader range of knowledge, people and facilities than could be obtained in the UK alone. Collaboration facilitates innovation as new ideas are generated, shared, refined and challenged. Collaboration between EU member states is frequently a requirement of the EU research funding instruments. Consequently, the UK's membership of the EU makes collaboration with other EU member states relatively easy, much more so in comparison to collaboration with non-EU countries, where a lack of dedicated funding hinders engagement. The attractiveness of collaborating with the EU is highlighted by the presence of international cooperation partner countries - non-EU countries such as Brazil - which participate in the EU research and innovation programmes.

13. The EU provides support for collaboration at many different levels, from the Marie Sklodowska-Curie Action grants which enable individual researchers to experience training in different countries, starting at the PhD level, right up to large consortia projects to address the grand challenges of the day such as EUROfusion, a consortium of 29 partners representing 40 laboratories with the ambitious aim of realising fusion electricity by 2050. Although it is clear that substantial benefits can be reaped from collaboration, the benefits are perceived to be maximised when funding is focussed on research that requires collaboration to succeed. Furthermore, there is a sense that a tension can sometimes arise between the emphasis on research quality and the prioritisation of collaboration.

14. Collaboration between businesses and universities is an important part of the research and innovation ecosystem and can provide a myriad of benefits to the participants, as has recently been highlighted in the Dowling Review of Business-University Research Collaborations.[14] The review also recorded the lack of funding as one of the most frequently cited barriers to collaboration for both businesses and universities. Therefore, that much EU research funding requires or encourages collaboration between businesses and universities is welcomed by the Academy. However, as noted previously, UK businesses could do better at accessing such funds and participating in such collaborations.

15. Collaboration between industrial partners can also be facilitated by EU research and innovation funding as the creation of common funding frameworks increases the ease with which businesses can engage with each other. The EU could be regarded as a neutral convener, providing opportunities for industrial competitors to collaborate with each other and work together towards common goals, often for societal benefit. One such example is the Clean Sky aeronautical research programme, which was established in 2008 as a Joint Technology Initiative (JTI), and is now receiving support from Horizon 2020 as it addresses the key societal challenge of developing smart, green and integrated transport. Clean Sky is a public-private partnership and has brought together aeronautical industry leaders including Rolls-Royce and Airbus, along with their supply chains with the joint objective of creating cleaner skies through the reduction of carbon dioxide and nitrogen oxide emissions as well as noise reduction. Such pre-competitive collaborations often require public funds to de-risk the venture and incentivise the businesses, which are frequently competitors, to

[14] The Dowling Review of Business-University Research Collaborations, July 2015

work together.[15] Support for such large-scale and high-cost collaborations, which the UK is eligible to participate in, are relatively rare outside of the EU.

16. The free movement of people in Europe is of critical importance for the UK in maintaining its excellent research base. The combination of the UK's world-class universities, excellent scientific reputation and quality of life, as well as the fact that English is in practice the lingua franca of research, makes the UK a very desirable location for non-UK Europeans to study and pursue their academic careers. The benefits to the UK are clear: well-skilled individuals choosing to study, work and live in the UK bring with them knowledge, ideas and talent, as well as contributing to the national economy. Conversely UK nationals are also able to benefit from free-movement by studying and working in other EU member states to learn new skills, experience different cultures and gain access to facilities.

17. The free movement of people means that the ease of recruiting non-UK EU individuals is very straightforward and requires relatively little paper work or time. This is in direct comparison to recruitment, whether to work or to study, of individuals from non-EU countries. However it is felt that difficulties in recruiting students and employees from non-EU countries is due to the immigration restrictions as decided by the UK government, and are unrelated to EU legislation.

18. The UK faces an engineering skills crisis, needing more than a million new engineers and technicians by 2020.[16] While efforts to boost the supply of UK engineers are underway, inward migration to the UK of individuals who can fill the skills gap will also be essential. It is also noteworthy that non-UK EU nationals make up a significant proportion of engineering students. In 2013 16% of all postgraduate taught engineering degrees were awarded to non-UK EU nationals, falling to 14% for engineering doctorates, this compares to 39% and 26% of UK nationals respectively.[17]

19. Membership of the EU gives UK researchers access to excellent international facilities that are otherwise unavailable in the UK. The UK also hosts a number of international facilities that are supported by the EU. One such example is the Joint European Torus (JET) hosted at the Culham Centre for Fusion Energy (CCFE) in Oxfordshire. The JET facilities are collectively used by all European Fusion laboratories under the EUROfusion consortium. Around 350 scientists participate in JET experiments every year and the facility employs around 500 people.[18] Operation of the JET facilities is provided as an in-kind contribution to the consortium via a contract between the European Commission and the CCFE. However, there is a perception by some in the engineering community that more work is needed to increase awareness within the research and innovation sector of the international facilities available through EU membership to ensure that UK researchers are deriving the maximum benefit from them.

Regulation

20. Engineering is a pervasive force in almost every economic sector, from advanced manufacturing to software, from financial services through to the media and the medical sector. Consequently there are numerous regulatory frameworks that affect the

[15] Investing in Innovation, Royal Academy of Engineering, September 2015,
[16] The Universe of Engineering, Engineering the Future, Royal Academy of Engineering, October 2014
[17] Engineering UK 2015, The state of engineering, Engineering UK, 2015
[18] Culham Centre for Fusion Energy website

engineering community. Regulatory frameworks can help to improve and harmonise conduct across the EU, and have the potential to become internationally adopted. It is important that government and UK stakeholders maximise their engagement with all EU institutions to ensure that new regulatory frameworks deliver favourable outcomes with minimal risk of unforeseen consequences so that the UK remains competitive. For example, by being involved in the development of regulations UK stakeholders can help ensure regulations do not adversely affect the development and delivery of their products and services.

21. Standards can help drive innovation and the harmonisation of standards across the EU creates a common language which can aid multidisciplinary teams. Membership of the EU enables UK researchers and businesses to inform, influence and draw up standards that become harmonised across the EU and, in some cases become internationally adopted. In emerging fields of strategic importance to the UK it is vital to ensure first mover advantage in the creation of standards. For UK companies to not lose out against international competitors the UK needs to play a leadership role in developing international standards, as it has done in the past for standards relating to the telecommunications sector.

Science Advice

22. There is widespread agreement in the engineering community that if the UK is to reap the maximum benefit from its EU membership in terms of research and innovation, then it is also critical that the UK participates fully in informing and influencing relevant EU public policies. Although there are clear mechanisms for officials to engage in the public policy debate, it is less clear to the UK's science and engineering community how they are able to inform and influence decisions. Euro-CASE, the organisation of National Academies of Engineering, Applied Sciences and Technology in Europe, of which the Royal Academy of Engineering is a member, does co-ordinate and promote members' positions on critical research and technology policy issues to the EU, but there is the perception that UK scientists and engineers struggle to engage, in part due to limited opportunities for consultation offered by the EU institutions, and see little result from their efforts. This is in contrast to the situation in the UK, where scientists and engineers feel they have better representation and influence in the public policy debate.

23. The provision for science advice in the EU is complicated by the presence of three different institutions, the Commission, the Council and the Parliament, all of which should have access to independent scientific advice. The Council has no dedicated scientific advice service, the Parliament has access to the Science and Technology Assessment Panel (STOA) and the European Parliamentary Research Service (EPRS) while the Commission has access to the Joint Research Centre (JRC) and a new Scientific Advice Mechanism (SAM) which is currently under development following its announcement in May 2015.

24. The motivation behind the creation of the SAM is to be commended as the Commission has previously lacked provision of independent scientific advice. The JRC, the Commission's in-house science service, employs scientists to carry out research in 7 scientific institutes throughout the EU and although it is tasked to provide customer driven scientific and technical support to Union policies there have been long-standing concerns that the Commission lacks a mechanism to provide it with timely, independent, high level science advice. In 2009 the Commission addressed this concern by appointing a Chief Scientific Adviser (CSA) to the President, similar to the Government Chief Scientific Adviser role in

the UK where the role has, in general, been considered a success. Professor Dame Anne Glover FRSE, who had been the first CSA for Scotland, was appointed to the role in 2012. Unfortunately the role was abolished at the end of 2014, once again leaving the Commission without a satisfactory source of independent scientific advice. However, the need for the Commission to have access to independent science advice was made clear by numerous member states and, in part, contributed to the announcement of the SAM.

25. The SAM will draw on the wide range of scientific expertise available in Europe through a close relationship with national academies, as well as a high-level group of seven scientific advisors, including the UK's Professor Dame Julia Slingo OBE FRS. Five umbrella academies including Euro-CASE will employ the resources of 90 academies and more than 10,000 eminent scientists and engineers across the EU to contribute to the SAM. The Academy welcomes the opportunity to be involved in the formal administration of scientific advice to the Commission. By harnessing the power of the major European Academies including the French, Swedish and UK national academies, and the Leopoldina and Berlin-Brandenburg academies in Germany, the SAM has the potential to provide rich long-term advice with a European perspective. This requires the SAM to over-ride disciplinary silos and create new opportunities and audiences for interdisciplinary policy advice both on a European and national level. If successful, the SAM should also result in a more transparent process for sourcing scientific expertise and advice, and a simpler route for commissioning and making use of science advice across the Commission. As the SAM develops, careful planning and thought is required to ensure its full potential is realised.