HOUSE OF LORDS

Science and Technology Select Committee

2nd Report of Session 2015–16

EU membership and UK science

Ordered to be printed 12 April 2016 and published 20 April 2016

Published by the Authority of the House of Lords

HL Paper 127

Science and Technology Select Committee

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See Appendix 1.

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Q in footnotes refers to a question in oral evidence.

SUMMARY

By a range of measures, the UK is one of the world's leading scientific nations, both in terms of fundamental and applied research. It is irrefutable that the UK's research excellence was established long before the inception of European integration in 1952. As European integration has developed, the UK has retained its leading position in the face of growing competition from around the world. Against this background, we have sought to examine the relationship between the UK's EU membership and its world-leading capability in science.

The overwhelming balance of opinion made known to this Committee from the UK science community valued greatly the UK's membership of the European Union. Science is a major component of the UK's membership of the EU. Nearly one fifth (18.3%) of EU funding to the UK is spent on research and development (R&D). In the period 2007–13, EU Framework Programme 7 funding for science and research in the UK amounted to 3% of the UK's total expenditure on R&D. We heard from universities that this funding is equivalent to having another Research Council.

The ease with which talented researchers can move between EU Member States and the UK, the EU's fertile environment for research collaboration, harmonised regulations, access to EU research facilities and the availability of substantial funding for research combine to make EU membership a highly prized feature of the research ecosystem in the UK. Furthermore, the UK plays a leading role in the development of EU policies and decision-making processes that relate to science and research.

While the UK science community was enthusiastic about EU membership, we have uncovered some qualifications. We heard mixed views on the impact of EU regulations. The benefits of harmonisation were widely recognised but some specific areas, such as genetic modification and clinical trials, were highlighted as causing UK business and research to be disadvantaged compared to competitors outside the EU.

Many assertions to this inquiry about the UK's success in winning EU research funding conflated performance in securing Framework Programme funds (the last being FP7) with the overall level of EU funding for R&D in the UK. The UK's strong science base makes the UK one of the top performing nations in the EU where scientific excellence determines success in funding competitions. But that is only part of the picture. When the total level of R&D funding is considered, the use of structural funds for R&D in less prosperous parts of the EU shifts the distribution of funding away from the UK, moving this country down the funding league table. It is important to note, however, that Framework Programme funds and structural funds serve different purposes.

Many businesses were unwilling to give evidence to our inquiry so our findings in this area are based on smaller volumes of evidence than for the academic community. Nevertheless, there are indications that, overall, UK businesses are less engaged than academics in EU R&D. We have no definitive explanation for this pattern, but EU bureaucracy and a relatively low level of support to business from the UK Government were cited as parts of the picture.

Access to many research infrastructures is available to non-EU Member States in continental Europe as well as to countries outside Europe. We found there to

be occasional confusion with regards to which infrastructures are EU-managed and which are European in nature. Major research facilities such as CERN, for instance, are not part of EU scientific infrastructure, while others, such as the ITER nuclear fusion facility, are. Although not a pre-requisite for involvement in research infrastructure, EU membership may facilitate influence and provide platforms to collaborate.

The scientific advisory system in the EU is in a state of flux as it transitions from testing the model of a single Chief Scientific Adviser to the recently created Scientific Advice Mechanism (SAM). The SAM is at a formative stage and its effectiveness is untested. We are, however, optimistic about its potential. The development of the SAM will be critical, as defective scientific advice will lead to inadequate policy and legislation being produced at the EU level.

The following chapter sets out our detailed conclusions and recommendations.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Regulatory framework

1. We are concerned by the apparent trend towards the development of overarching EU regulations. This move away from the use of EU directives may result in the loss of the flexibility currently afforded to Member States in transposing directives into national regulations. (Paragraph 18)

2. Despite some EU regulatory frameworks clearly having a detrimental effect on UK and EU science, we see value in the harmonisation of regulatory frameworks across Member States. In areas where regulation has had a negative effect, or the development of new regulations has had the potential to have such an effect, the UK has often played a key role in working to improve and formulate more appropriate frameworks. We view the development of the new clinical trials regulation and data protection regulation to be prominent examples of this. (Paragraph 39)

Scientific advice and influence

3. We welcome the development of the Scientific Advice Mechanism (SAM) and the presence of a UK scientist, Professor Dame Julia Slingo, on the membership of the High Level Group. The SAM, however, is in its infancy and it remains to be seen how effective and influential it will prove to be. It is vital that its early promise is fulfilled. The progress of the SAM must be monitored carefully and we will keep a watching brief in this area, and trust that others will do the same, not least the UK scientific community. (Paragraph 55)

4. We conclude that the UK plays a leading role in the development of EU policies and decision-making processes that relate to science and research. UK scientists in various EU fora act to ensure that the UK's voice is clearly heard and that the EU remains aligned with the advancement of UK science, particularly by shaping the balance between funding awarded on the basis of research excellence and that awarded for capacity building. (Paragraph 73)

Funding

5. The EU funding system for science and research is complicated and there are many ways in which the EU aims to fulfil its shared competence in research policy. This complexity means that UK researchers can struggle to navigate through the system. We welcome the efforts made by the European Commission to reduce the complexity and administrative burden, though their effectiveness to date is unclear. (Paragraph 102)

6. During the period 2007–13, the UK was a net contributor to the EU overall, but a net receiver of EU funding for research. Given that just under one fifth (18.3%) of the funds the UK received from the EU during this time were used to support science and research, we consider that science is a significant dimension of the UK's membership of the EU. (Paragraph 105)

7. Despite many assertions that the UK performs very well in terms of EU funding for science and research, it has proved challenging to define unambiguously the level of EU spending on R&D in the UK and how this compares with other Member States. We have been able to verify the UK's position as a high receiver of funds in terms of Framework Programme funding only. When the portion of the EU's structural funds designated

for research and innovation are taken into account, we have found it more difficult to assess the UK's position. (Paragraph 118)

8. The purposes of competitive Framework Programme funds and structural funds for research and innovation are different. By designating a portion of structural funds for research and innovation, the European Commission aims to boost scientific capacity across Member States and increase the success rate of applications for competitive Framework Programme funds from regions with weaker economies. While we commend this approach, we are concerned by the apparent lack of evidence as to whether this spending has actually raised the scientific competitiveness of recipients. We recommend that this evidence should be assembled by the European Commission. (Paragraph 119)

9. We are concerned that the participation of large UK businesses in Framework Programme 7 lagged behind that of key competitor nations such as Germany and France and was below the EU average. We recognise that participation in Horizon 2020 may be greater. However, we remain concerned, particularly in the light of the abolition of the Regional Development Agencies (RDAs) and introduction of the Local Enterprise Partnerships (LEPs), that UK Government support for businesses in engaging with EU funding schemes may be weaker than in some other Member States. The integrated approach adopted in other countries such as Germany could be viewed as a good model and a basis for a programme of benchmarking. For their part, however, we urge businesses to engage fully with the opportunities afforded by EU funding. We recommend that the UK Government benchmarks its level of support for businesses, large and small, wishing to participate in EU programmes with that available in other Member States and put forward proposals for improving UK performance. (Paragraph 135)

Collaboration

10. It was repeatedly put to us that one of the most significant aspects of the UK's EU membership is the provision of opportunities to collaborate. We view the EU to have three main influences: the provision of collaborative funding schemes and programmes; ensuring researcher mobility; and facilitating and fostering participation in shared pan-European research infrastructures. (Paragraph 157)

11. Many would maintain that the provision of collaborative opportunities is perhaps the most significant benefit that EU membership affords science and research in the UK. These collaborative opportunities are not just between Member States but can extend to non-EU and non-European countries. (Paragraph 158)

12. The researcher mobility afforded by the EU's fundamental principle of freedom of movement is of critical importance to the UK science community, including academia, businesses and charities. It is vital that the flow of researchers—both coming to the UK and UK nationals working overseas—is not restricted. We conclude that researcher mobility must be protected if UK science and research is to remain world-leading. (Paragraph 171)

13. Our report on international science, technology, engineering and mathematics (STEM) students, published in 2014, highlighted concerns about the negative impact of Government immigration policy on international recruitment from outside the EU. We are concerned that this situation appears to have

changed little since the publication of our report and we recommend that the Government reviews its policy in this area. (Paragraph 172)

14. The UK gains significant value from being involved in a number of pan-European Research Infrastructures (RIs), both as a host country and as a user of facilities hosted outside of the UK. We conclude that such European based, but non-EU, RIs, although formally independent of the EU, are in fact interlinked to varying degrees. (Paragraph 207)

Scenarios

15. The UK might wish to become an Associated Country in the event of Brexit. We heard, however, strong views that the UK would lose its influence and roles in setting strategic priorities and in decision-making. If Associated Country status were to be pursued, further investigation would be required in order to ascertain to what extent, and at what expense, the UK's currently influential position would be diminished. (Paragraph 235)

16. Even those who were most in favour of continued membership of the EU—the university sector—criticised aspects of the UK's relationship with the EU. We therefore conclude that, in the event that the UK chooses to remain part of the EU, there would be scope for the UK Government to advance reforms to enhance the interactions between the EU and UK science and research. We suggest that a particular areas of focus should be the influence of the EU on the UK's regulatory environment and the support available for UK businesses in order to facilitate engagement with EU funding schemes. (Paragraph 250)

EU membership and UK science

CHAPTER 1: INTRODUCTION

The context for our inquiry

1. During the previous Parliament, the Prime Minister, Rt Hon David Cameron MP, pledged that if the Conservative Party won the 2015 general election, he would seek to re-negotiate the UK's relationship with the European Union (EU) and then hold an inout referendum on the UK's continued membership by the end of 2017.

2. The UK's membership of the EU has wide ranging influence on UK science and research. The UK's level of engagement with EU funding programmes, for instance, is considerable. EU membership also has significant bearing on scientific collaborations, the mobility of researchers, regulatory frameworks and research and development (R&D) undertaken by businesses, to highlight just some of the interactions between EU membership and the vitality, or otherwise, of science and research in the UK.

3. It was against this background of a forthcoming referendum and the scale and diversity of EU influence on UK science and research that we decided to pursue this inquiry.

4. We have made no attempt at any stage to recommend whether or not the UK should remain in the EU—that question is much wider than the scope of this inquiry.

The goals of our inquiry

5. Understanding the intricacies of the relationship between EU membership and the effectiveness of science and research in the UK is difficult. Its exact nature is uncatalogued and the extent of UK-EU interactions is substantial. Our inquiry aimed to understand and characterise the principal linkages between EU membership and the effectiveness of science and research in the UK, acknowledging that there would necessarily be limits to how much ground we could cover.

6. Our inquiry did not focus on higher education policy, immigration policy, undergraduate student numbers, intellectual property, non-research related innovation, or the generality of the single market and business competitiveness. We recognise that these issues are of great interest to many people but they would have expanded an already wide scope to unmanageable proportions. In this report, we use the term 'science' broadly to cover research, development and applications in all disciplines.

7. We gathered, assimilated and scrutinised evidence from a spectrum of practitioners, commentators and campaigners, and we compared and contrasted evidence from different sources to identify areas of consensus and inconsistency.

The UK science community and EU membership

8. The evidence we received suggested overwhelming enthusiasm for EU membership.[1] A number of the organisations that submitted evidence to us are mandated to participate in public engagement and education in relation to science. We look forward to seeing these organisations interact with the general public and promote understanding of the implications of the UK's EU membership for science and research. We take heed, though, of the comments of Professor Sir Leszek Borysiewicz, Chair of the Russell Group's EU Advisory Group, and Vice-Chancellor, University of Cambridge, when he suggested to us that the relationship between the EU and UK science may not be one of the crucial issues considered within the wider population:

> "We will make the case, but of all the factors that might influence voting, I suspect the impact of the large terrestrial telescope in Chile is not going to be the vote-winner in a referendum."[2]

Identifying witnesses and evidence

9. We received valuable responses from national academies, professional institutions, universities, research institutes, funding bodies, campaign groups, Government departments and agencies, scientific advisers and individuals with experience of leadership roles in the EU. We also received notable contributions from some businesses and charities. We invited further contributions from these sectors, but we found businesses, in particular, reluctant to submit evidence, perhaps for fear of offending customers or shareholders. Overall, the business community was reticent in engaging with our inquiry. Many businesses chose not to provide a written submission and declined invitations to give oral evidence. Similarly, we were unable to attract evidence from many individual medical research charities so cannot do justice to their perspective.

10. Our inquiry has naturally been shaped by the specific portfolio of respondents and witnesses who have been willing to engage with our investigations. In certain areas, the evidence we received is likely to be representative of a larger population due to interaction with a range of membership organisations who speak for large sectors within the research community. In other areas, reflecting thinking accurately has been more challenging. It has been so, in particular, with regard to the business community, due both to the lack of engagement noted above, and the appearance of differences of opinion between the small number of witnesses. It was simply not feasible to hear evidence from all business sectors active in research and development in the UK.

11. Our Call for Evidence, issued in September 2015, invited answers to questions grouped under four themes: regulation, scientific advice, funding and collaboration. In the chapters that follow we take each of these themes in turn. We conclude by noting some of the scenarios that were put to us were the UK to leave the EU, and, in addition, we highlight some issues for consideration if the UK chooses to remain in the EU.

12. We repeatedly encountered difficulties on account of the conflation of the European Union with the continent of Europe. On occasion, we suspect the terms were simply used interchangeably. On other occasions, however, we

1 Evidence from Scientists for Britain (EUM0075) and Vote Leave (EUM0056) were notable exceptions.
2 Q 64 (Prof Sir Leszek Borysiewicz)

could not tell whether arguments related to the UK's EU membership or to the UK's geographical location. We make every effort in the chapters that follow to address this important distinction. Equally, we also try to explain the differences between EU membership and Associated Country status.

13. We thank everyone who provided written evidence to our inquiry, and all those who gave oral evidence in sessions which we held between December 2015 and March 2016. All the evidence we received is available on our website and it provides a rich source of information and opinion which we would encourage all those who are interested to view. Finally, we would like to thank our specialist adviser, Professor Graeme Reid, Chair of Science and Research Policy, University College London, whose expertise was invaluable throughout our inquiry.

CHAPTER 2: REGULATORY FRAMEWORK

14. We begin with the regulatory framework as it sets the broad context in which UK science and research operate within the EU. The influence of EU regulatory frameworks on UK science and research is vast and spans the spectrum of scientific disciplines. As such, our investigations in this area have been necessarily high-level and heavily influenced by the sectors and subject areas of those who engaged with our inquiry. We have thus explored regulation in a general and overall sense and have only considered specific examples in cases where they were repeatedly highlighted to us.

15. The far-reaching influence of the EU regulatory system was aptly summarised by the Campaign for Science and Engineering (CaSE):

> "EU-directed regulation affects the UK research environment in diverse ways, across the breadth of scientific disciplines, from animal research to vacuum cleaner design."[3]

The EU regulatory environment

16. The balance of competences[4] between the EU and Member States, as set out in the Treaty of the Functioning of the EU (TFEU), means that a large number of EU regulatory frameworks influence UK science and research. These frameworks, termed directives, are constructed at the EU level and it is then for Member State governments to transpose them into national law.

17. However, it was highlighted to us that there have been moves towards the development of over-arching EU regulations, as opposed to directives. We heard from the Wellcome Trust:

> "The increasing move away from directives towards regulations within EU legislation can reduce the flexibility of Member States to implement legislation in a manner conducive to their cultural and ethical research environment."[5]

18. **We are concerned by the apparent trend towards the development of over-arching EU regulations. This move away from the use of EU directives may result in the loss of the flexibility currently afforded to Member States in transposing directives into national regulations.**

19. As mentioned previously, a number of EU directives and regulations were repeatedly highlighted to us. The frameworks brought to our particular attention included:

- Protection of animals used for scientific purposes directive 2010/63/EU;

3 Written evidence from the Campaign for Science and Engineering (EUM0047)

4 Competences refer to the balance of powers between the EU and Member States. The EU may only act within the limits of the competences conferred upon it by Member States in the Treaties to attain the objectives provided therein. Competences not conferred upon the EU in the Treaties remain with Member States. The Treaty of Lisbon clarifies the division of competences between the EU and Member States. These competences are divided into three main categories: exclusive competences; shared competences; and supporting competences. See Division of competences within the European Union: EUR-Lex Access to European Union Law, *Division of competences within the European Union* (January 2016): http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV%3Aai0020 [accessed 12 April 2016]

5 Written evidence from the Wellcome Trust (EUM0034)

- Clinical trials directive 2001/20/EC;
- Protection of personal data directive 95/46/EC, soon to be replaced by a new data protection regulation;
- Deliberate release of GMOs directive 2001/18/EC; and
- Registration, evaluation, authorisation & restriction of chemicals (REACH) regulations EC 1907/2006.

20. We will briefly consider each of these regulatory frameworks in turn. Again, we recognise that our analysis is high-level but, due to time and scope constraints, we could not conduct in-depth investigations.

21. The protection of animals used for scientific purposes directive 2010/63/EU is the regulatory regime that governs animal research across the EU with the aim of harmonising animal research standards and practices. The Academy of Medical Sciences was positive about the influence of this framework and highlighted the UK's involvement in its development:

> "[the UK science community made] substantial efforts across the sector to inform its development and transposition into UK law. A number of Fellows noted the leadership shown by the UK on this issue, and the wider impact it had on animal welfare across the EU."[6]

22. The clinical trials framework 2001/20/EC was drawn to our attention a number of times as an area of the EU regulatory environment that has not best served UK science and research. The Association of Medical Research Charities (AMRC) suggested to us that its implementation had resulted in an increased administrative burden on researchers as well as an increase in the cost of running academic trials. They also observed that it has led to a reduction in the number of global trials taking place in Europe.[7]

23. Professor Angus Dalgleish, representing Scientists for Britain, conveyed strong views regarding the clinical trials directive and asserted that its implementation had resulted in the termination of a successful research programme that he was involved in.[8] He did, however, concede that some of the problems stemmed from the UK Government's transposition of the framework.

24. A new clinical trials regulation has been developed and is expected to come into effect in 2017. AMRC consider this to be a considerable improvement on the current clinical trials directive, citing the introduction of a streamlined applications process and proportionate approach to the monitoring and safety reporting of clinical trials as key developments. They emphasised the UK's role in influencing the evolution of this new regulation:

> "The UK health and research community, including AMRC members, played an important role in influencing these improvements."[9]

25. The regulatory framework for data protection was also mentioned repeatedly to us. Data protection and copyright affect a variety of areas of scientific research across a wide spectrum of disciplines. One such area of UK science

6 Written evidence from the Academy of Medical Sciences (EUM0029)
7 Written evidence from AMRC (EUM0052)
8 Q 128 (Prof Angus Dalgleish)
9 Written evidence from AMRC (EUM0052)

and research that is affected by data protection regulation is medical research. Parkinson's UK provided an explanation of the importance of access to patient data for research:

> "Personal health records are a valuable resource, revealing the most effective ways of caring for patients and allowing us to better understand the causes and frequency of conditions."[10]

Furthermore, they insisted that ineffective regulation in this area would mean that "health and scientific research will be severely threatened."[11]

26. A new data protection regulation will replace the protection of personal data directive 95/46/EC. If implemented as first drafted, the new regulation could have significantly inhibited science and research. Universities UK (UUK) suggested that the removal of scientific research from the legitimate exemptions for the processing of personal data, as proposed by the European Parliament, would have had a substantial negative impact on UK research.[12] The UK science community played an active role in improving the final version.

27. During the course of our inquiry the regulatory environment for genetically modified organisms (GMOs) was repeatedly highlighted as having had a negative impact on UK science and research. This is an area that we are familiar with from our previous inquiry on genetically modified insects.[13]

28. The deliberate release directive 2001/18/EC covers all transgenic GMOs including crops and insects. Sense About Science provided a concise summary of the problems associated with this regulatory system:

> "The regulations are based on an over-statement of the significance of this particular plant-breeding process. The assessment system is unbalanced. The regulations look only at risks, not at benefits. The end point of the European safety assessment process is not governed by any kind of scientific measure but by political factors … The expensive and complex regulatory system is a barrier to the conduct of research on GM [genetically modified] foods in the UK."[14]

29. The registration, evaluation, authorisation & restriction of chemicals (REACH) regulations were another frequently cited regulatory framework. Professor Ric Parker, Director of Research and Technology, Rolls-Royce plc and representative of the Royal Academy of Engineering, suggested that implementation of this framework had been to the "detriment of the competitiveness of some UK companies".[15]

30. Felicity Burch, Senior Economist, EEF—The Manufacturers' Organisation, highlighted the impact of REACH on EEF members' innovation activities:

> "We have had a lot of anecdotal evidence from members saying that, because they are innovating to respond to REACH, they are not able to do as much innovation in other areas as they might like to do, and

10 Written evidence from Parkinson's UK (EUM0003)
11 Written evidence from Parkinson's UK (EUM0003)
12 Written evidence from Universities UK (EUM0054)
13 Science and Technology Committee, *Genetically Modified Insects* (1st Report, Session 2015–16, HL Paper 68)
14 Written evidence from Sense About Science (EUM0073)
15 Q 38 (Prof Ric Parker)

> indeed, we see that more generally with regulation as well. As I have said, innovation is extremely resource-intensive and for businesses there is only so much you can do, particularly at the smaller end. So I think regulations can impact the type of innovation companies do."[16]

31. Common to all of the EU regulatory frameworks discussed above is evidence of UK influence in mitigating some of the potentially detrimental aspects of the frameworks. Dr David Hughes, Global Head of Technology Scouting in Syngenta, highlighted this and issued a warning regarding the loss of this influence:

> "The real key for us [Syngenta] is that, if Britain went its own way in Europe, we would lose the most powerful, most influential, significant voice pushing for a rational, science-based regulatory system governing our technologies. If Britain went its own way, Europe would be in a pretty desperate situation, from our point of view. The chances of actually achieving a continent-wide, rational, functioning regulatory system for our technologies would be distant."[17]

32. Some witnesses suggested that problems with the development of EU regulation were exacerbated by "interference" in technical matters by the European Parliament. Professor Kurt Deketelaere, Secretary-General, League of European Research Universities (LERU), was one of the proponents of this viewpoint. In reference to the development of the data protection regulation he asserted:

> "It went completely wrong when a number of people in the European Parliament—in a very maniacal way, I must say, because of this discussion with the United States on privacy—came up with all kinds of amendments changing the text and introducing all kinds of obstacles to research. Obviously, at the end of the day the lesson is that perhaps we have to elect better people to send to Brussels and to Strasbourg. In that case, the problem was not in the European Commission."[18]

Harmonisation

33. Although witnesses highlighted several grievances with the EU regulatory environment, the majority of evidence suggested that the regulatory harmonisation brought about by the EU was of benefit to the UK. Such harmonisation can provide a strong platform for collaboration and commercialisation in science and research. The Academy of Medical Sciences (AMS) corroborated this perspective and suggested that the collaborative potential brought about by harmonisation warrants the "burden" of engaging with regulatory processes.[19]

34. The Royal Academy of Engineering noted the value in widely recognised standards for businesses and suggested that it is important that the UK plays a role in determining them:

> "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

16 Q 84 (Felicity Burch)
17 Q 71 (Dr David Hughes)
18 Q 8 (Prof Kurt Deketelaere)
19 Written evidence from the Academy of Medical Sciences (EUM0029)

> to not lose out against international competitors the UK needs to play a leadership role in developing international standards."[20]

35. Of course, regulatory harmonisation is detrimental when the regulations being harmonised are ineffective. Dr David Hughes expressed such a perception in relation to the EU's regulatory systems that govern agricultural biotechnologies. He stressed that Syngenta agree with the principle of regulatory harmonisation but that:

> "I think in our particular case the argument is more nuanced, because for agricultural technologies—at least, some of them—the regulatory systems that are defining those technologies in Europe are not fit for purpose. They are non-scientific, scientifically unjustifiable and dysfunctional. It is a bit of a mess, quite frankly."[21]

36. Juergen Maier, Chief Executive Officer, Siemens UK, indicated that Siemens view regulatory harmonisation as advantageous. However he outlined the difficulty often encountered in achieving this harmonisation:

> "Of course, regulation and trying to get 28 countries to achieve a common standard, whether in electromagnetic field regulation or whatever it might be, is going to be difficult, but when you have achieved it, it makes processes in design and manufacture a lot simpler."[22]

37. The increasingly global nature of science and business means that international harmonisation is becoming more relevant. Arguably, moves towards global harmonisation could override the need for EU-level harmonisation. However, in this scenario, Professor Siegfried Russwurm told us that the EU acts as an "aggregator" rather than a "transmitter" and boosts the role of Member States in the development of global standards.[23]

38. The opposite of regulatory harmonisation is, of course, the development of individual national frameworks. The submission from the Royal Society of Chemistry warned against this and highlighted reservations made by their members:

> "The ability for the UK to set its own regulation was not viewed positively due to the perception that businesses would still need to comply with EU regulation, as well as any newly-developed UK regulation."[24]

39. **Despite some EU regulatory frameworks clearly having a detrimental effect on UK and EU science, we see value in the harmonisation of regulatory frameworks across Member States. In areas where regulation has had a negative effect, or the development of new regulations has had the potential to have such an effect, the UK has often played a key role in working to improve and formulate more appropriate frameworks. We view the development of the new clinical trials regulation and data protection regulation to be prominent examples of this.**

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20 Written evidence from the Royal Academy of Engineering (EUM0066)
21 Q 71 (Dr David Hughes)
22 Q 98 (Juergen Maier)
23 Q 101 (Prof Siegfried Russwurm)
24 Written evidence from the Royal Society of Chemistry (EUM0051)

CHAPTER 3: SCIENTIFIC ADVICE AND INFLUENCE

40. The provision of authoritative scientific advice is central to the formulation of effective, evidence-based policy. A defective system of scientific advice will be likely to result in sub-optimal policy-making and legislation. We therefore sought views on the EU system of scientific advice in order to determine whether it was appropriate. If the system of EU scientific advice is inadequate, then it could mean, for example, that the UK is faced with transposing ill-conceived EU directives into UK law. Moreover, given the widely admired system of scientific advice in the UK, it would be perverse if the UK were to suffer at the hands of a less mature EU system.

Scientific advice for EU policy-making

41. The UK has been, and continues to be, a leading voice in the EU striving for the provision and use of scientific advice. The UK system and the system that operates within the EU are different. In the UK, there is a Government Chief Scientific Adviser (GCSA) with responsibility for: providing scientific advice to the Prime Minister and the Cabinet; advising the Government on matters of science and technology policy; and ensuring and improving the quality and use of scientific evidence and advice across government. The GCSA is also head of the Science and Engineering Profession and is charged with leading the profession within the Civil Service, encouraging good practice and ensuring the development of professional skills. The role of GCSA has existed since 1964.

42. The GCSA is supported by a network of departmental Chief Scientific Advisers (CSAs). CSAs are a vitally important voice for science and engineering in the formulation, operation and evaluation of government policy. They provide independent challenge and seek to ensure that policy decisions are informed by authoritative science and engineering advice and evidence.

43. A model somewhat similar to that in operation in the UK was tested in the EU during the closing years of José Manuel Barroso's tenure as President of the European Commission (2004–14). A UK scientist—Professor Dame Anne Glover—fulfilled the role of Chief Scientific Adviser to the European Commission. This role, however, was not renewed when President Juncker assumed the role of European Commission President in 2014. Instead, after a period of uncertainty, during which widespread concerns were expressed by the UK science community, a new method of scientific advice, termed the Scientific Advice Mechanism (SAM), was devised.[25]

44. The purpose of the SAM is to provide authoritative, timely and independent scientific advice to the European Commission. The SAM will draw on a wide range of scientific expertise through close relationships with national academies and other bodies, as well as the expertise of a High Level Group of independent scientific advisers. This High Level Group (HLG) is fundamental to the SAM. Established by a Commission Decision of 16 October 2015,[26] the HLG is composed of seven experts, appointed in their

25 European Commission, *Scientific Advice Mechanism* (March 2016): https://ec.europa.eu/research/sam/index.cfm [accessed 10 March 2016]. Much of the information that follows is drawn from this source.

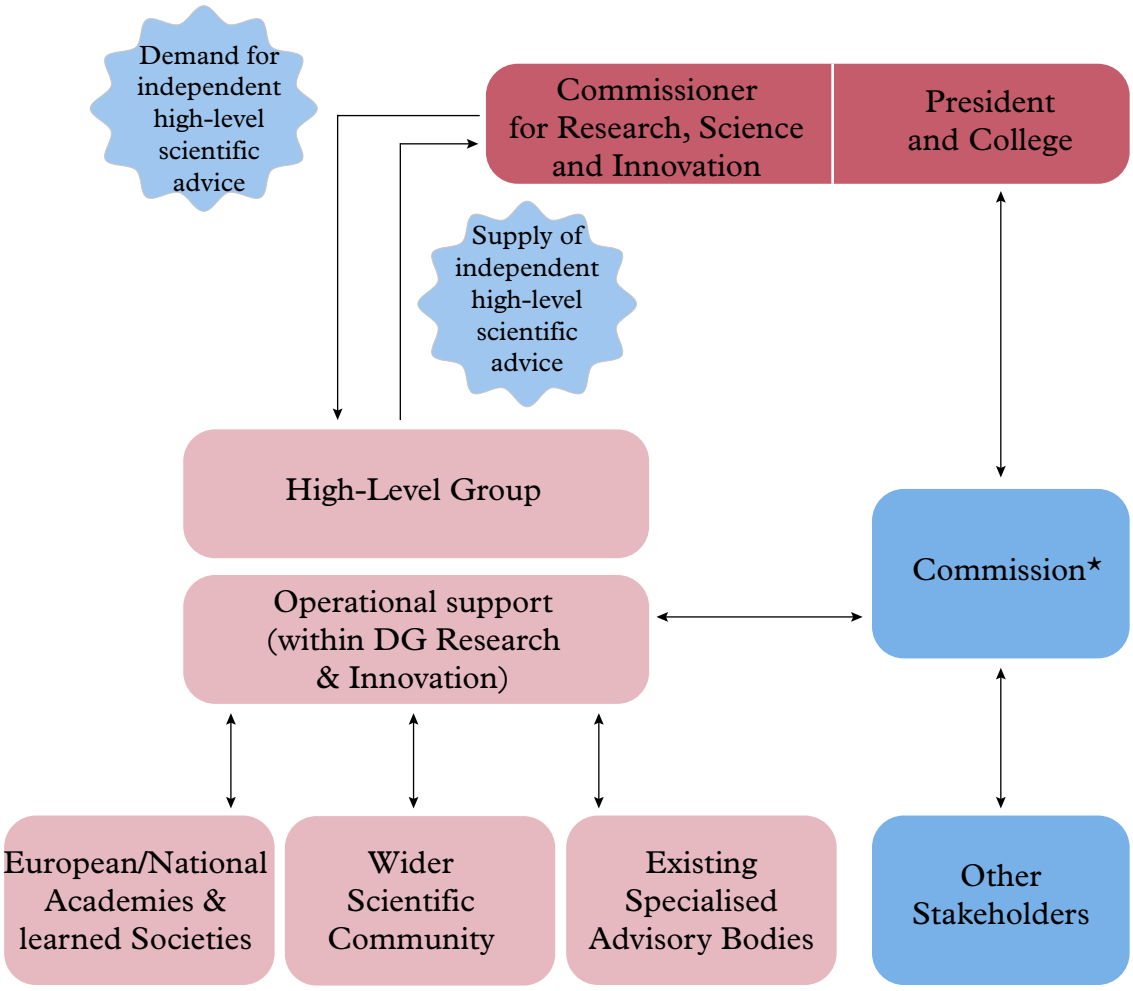
26 European Commission, *Commission Decision of 16.10.2015 on the setting up of the High Level Group of Scientific Advisers C(2015) 6946 final* (October 2015): https://ec.europa.eu/research/sam/pdf/c_2015_6946_f1_commission_decision_en_827417.pdf#view=fit&pagemode=none [accessed 10 March 2016]

personal capacity, who act independently and in the public interest. The group is expected to meet between four to six times per year, but may also be convened for additional meetings if urgent advice is required. The HLG will designate, on an annual basis, a chairperson and a deputy chairperson. One member of the HLG is from the UK, Met Office Chief Scientist, Professor Dame Julia Slingo. Dame Julia summarised the HLG's fundamental purpose as follows:

> "The Chair of the HLG will represent our views to the Commission; they will be the views of the HLG, they will be published and then it is up to the Commission to use them in the best way they can."[27]

45. Figure 1 below sets out how it is intended that the SAM operates.

Figure 1: Operation of the Scientific Advice Mechanism



*Including the Joint Research Centre which provides in-house scientific support

Source: European Commission, About the Scientific Advice Mechanism (November 2015): https://ec.europa.eu/research/sam/index.cfm?pg=about [accessed 12 April 2016]

46. The SAM secretariat will facilitate the HLG's access to scientific evidence. Crucially, the SAM will have greater staffing and financial resources than

27 Q 108 (Prof Dame Julia Slingo)

Professor Dame Anne Glover was equipped with during her tenure at the European Commission.

47. It is certainly a positive move that the Joint Research Centre and the SAM will be brought together. The European Commission described its plans in this area:

> "The Joint Research Centre (JRC) has a mission 'to support EU policies with independent evidence throughout the whole policy cycle'. It does this through a diversity of science and research-based activities to support and advise fellow policy departments in the Commission in areas like environment, energy, transport, finance, health, security, agriculture and food …
>
> Practical arrangements are being put in place to ensure strong complementarities between the independent advice from the SAM and the in-house expertise of the Joint Research Centre. To support this aim, a number of staff have been seconded into the SAM Secretariat."[28]

48. Clare Moody MEP told us that the prospects for the SAM were positive, not least because it will be appropriately staffed and integrated:

> "While there were considerable concerns about the announcement of the abolition of the post of CSA the SAM is better placed to be embedded more deeply into the work of the Commission. Firstly SAM is fully staffed with a Commission department; it will provide a broader scope of scientific input and it is properly integrated into the institutional framework of the Commission's policy development process."[29]

49. The UK science community seemed to be broadly optimistic about the prospects for the SAM, albeit that it is a body in its infancy and presently it is almost certainly the case that "the jury is out."[30] Professor Robin Grimes, Chief Scientific Adviser at the Foreign and Commonwealth Office (FCO), told us: "I am very positive that this is going in the right direction."[31] Professor Alex Halliday, Vice-President, Royal Society, argued that the SAM: "does offer some strategic advantages for the UK. Apart from anything else, we have Julia Slingo sitting on it as one of the seven members of the Committee."[32] The Minister of State for Universities and Science, Jo Johnson MP, was also positive about the development of the SAM:

> "It is good that EU policy-making is going to be informed by the best possible scientific evidence. We welcome this direction of travel. Commissioner Moedas is taking lots of positive steps in this respect, and a lot of his work should be warmly welcomed."[33]

50. We harboured some concerns initially, especially about the extent to which the HLG would be a purely reactive body. These concerns, however, softened as our inquiry progressed. Professor Dame Anne Glover told us that the HLG "will absolutely have the ability to identify areas that are not brought

28 Written evidence from the European Commission (EUM0081)
29 Written evidence from Clare Moody MEP (EUM0062)
30 Q 37 (Prof Sir Robert Lechler)
31 Q 118 (Prof Robin Grimes)
32 Q 37 (Prof Alex Halliday)
33 Q 153 (Jo Johnson MP)

to them that they identify independently and understand need attention."[34] Professor Dame Julia Slingo herself reported to us, shortly after the first meeting of the SAM on 29 January 2016, that:

> "For the bulk of our work we will be tasked by the Commission to provide scientific advice based on the work programme of the Commission. We also have the opportunity to put forward topics ourselves, and we will do so where we believe there is a need for some horizon-scanning or maybe a Foresight-type of report on what we believe to be the emerging big issues around science for the European Union."[35]

51. We sought explicit assurances on this issue and the role of the HLG from the European Commission. The Commission told us that the task of the HLG is to:

> "provide the Commission with independent scientific advice on specific policy issues where such advice is critical to the development of EU policies or legislation and does not duplicate advice being provided by existing bodies and;
>
> support the Commission in identifying specific policy issues where independent scientific advice is needed …
>
> The Commission may consult the group at any time on any policy field, defining the timespan in which advice is needed and;
>
> The chairperson of the group may advise the Commission to consult the group on a specific policy issue.
>
> The SAM HLG may thus advise the Commission on the identification of specific policy issues requiring independent scientific advice."[36]

52. This offers some reassurance; it is imperative that the HLG is not just a creature of the Commission and that it is empowered to identify areas where advice is required. And yet, at this very early stage in the SAM's development, it is impossible to foresee how relations will unfold. As the British Academy told us:

> "It remains to be determined how in practice it [the HLG] will operate and what the balance will be between work in response to requests from the Commission and 'own initiative contributions'."[37]

53. We are not concerned that the Commission has selected a scientific advice model different to the UK model; we accept that there are many ways in which the provision of scientific advice might be organised. As Professor Dame Anne Glover put it to us: "If you look across the European Union, there are 28 Member States and probably about 26 different mechanisms for provision of science advice."[38] Professor Robin Grimes informed us that:

> "Other countries, Germany and France for example, have different structures for carrying out science and a different emphasis on where their research is carried out, and as a consequence it is not necessarily

34 Q 60 (Prof Dame Anne Glover)
35 Q 108 (Prof Dame Julia Slingo)
36 Written evidence from the European Commission (EUM0081)
37 Supplementary written evidence from the British Academy (EUM0076)
38 Q 53 (Prof Dame Anne Glover)

> true that a mechanism like the [UK] chief scientific advisers' network would be appropriate for those countries."[39]

54. Whilst it is very welcome that the Commission seems to have made sound initial progress with ensuring that it has access to authoritative, independent scientific advice, it is certainly not before time. Indeed, it is puzzling that the issue of the provision of formal scientific advice has only been taken up so recently. Nevertheless, we are greatly encouraged by the eminent membership of the HLG, and are particularly pleased to see that a social scientist has been appointed. Furthermore, we extend our congratulations to Professor Dame Julia Slingo and wish her well on the HLG.

55. **We welcome the development of the Scientific Advice Mechanism (SAM) and the presence of a UK scientist, Professor Dame Julia Slingo, on the membership of the High Level Group. The SAM, however, is in its infancy and it remains to be seen how effective and influential it will prove to be. It is vital that its early promise is fulfilled. The progress of the SAM must be monitored carefully and we will keep a watching brief in this area, and trust that others will do the same, not least the UK scientific community.**

56. In addition to the provision of advice to the Commission, we also briefly explored whether the other EU institutions, the European Parliament and the Council of the European Union (sometimes still referred to as the Council of Ministers) had access to appropriate scientific advice. Professor Dame Anne Glover explained to us that:

> "At the moment, the Council of Ministers does not have formal science advice. What it relies upon is science advice from its own Member State, and whatever mechanism that happens to be."[40]

57. The European Commission confirmed that:

> "There is at present no formal structure which provides scientific advice to the Council of the European Union. However, in many Member States the Academies and Learned Societies play an important role in advising governments and the SAM will also engage these bodies."[41]

58. We have given consideration as to whether the remit of the SAM should be extended to include the provision of scientific advice to the Council of the European Union. With the SAM so newly established and unproven, however, it would be unwise to transform its remit at this juncture. Moreover, it seems to us to be a perfectly appropriate arrangement that national ministers attending the Council draw on their national systems of scientific advice. It will be imperative that the SAM engages with Academies and Learned Societies across Member States, and as such, can ensure that Member States are aware of the SAM's activities.

59. As regards the provision of science advice in the European Parliament, the European Commission explained to us that:

> "The European Parliament has a number of formal structures which enable Members, committees and other bodies to benefit from scientific

39 Q 122 (Prof Robin Grimes)
40 Q 53 (Prof Dame Anne Glover)
41 Written evidence from the European Commission (EUM0081)

> advice. These include the Science and Technology Options Assessment Panel (STOA). Parliamentary committees may also obtain scientific evidence from the Policy Departments, within the Directorates-General of committee secretariats for Internal and External Policies, and individual MEPs may request briefings from the Members Research Service."[42]

60. We received evidence suggesting that the environment in the Parliament was not necessarily conducive to the sober consideration of scientific advice. Stuart Pritchard, EU Affairs Manager, Wellcome Trust, elaborated:

> "The Parliament has a number of structures already in place to provide advice to members. Whether that advice always cuts through, I am not sure, because it is a very noisy environment in the Parliament, with a lot of lobbying activity going on and a lot of conflicting advice. For me, one of the challenges for parliamentarians is how they find evidence that is sufficiently robust to inform discussions when they are being bombarded by huge amounts of information. Having some further strengthening and rigour in the advice provided to members to counteract that would be a helpful addition to the discussions, if it is organised in the right way."[43]

61. We merely note these observations. Any change or new initiatives in this area are a matter for the European Parliament.

UK influence on EU policy for science

62. Throughout our inquiry, it was repeatedly argued that UK scientists have considerable influence on EU groupings and decision-making bodies, and therefore played a considerable role in shaping EU policy for science.

63. Clare Moody MEP argued that she had "seen first-hand the direct and substantial contribution made by UK scientists to EU scientific advice in policy making."[44] Professor Paul Boyle, President and Vice-Chancellor, University of Leicester, asserted:

> "Our voice is very strong in the discussions prior to the decision-making around what the different priorities should be. We have had a very influential role in helping to shape those decisions."[45]

64. Professor Dame Anne Glover told us:

> "The UK voice is very welcome, very loud, very credible, and it is acted upon [in the EU]. We chair many of the influential committees and, regarding identifying members of the council of the European Research Council, we have members on that council. We help to deliver policy in science funding and where it is spent."[46]

Dame Anne added that:

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42 Written evidence from the European Commission (EUM0081)
43 Q 109 (Stuart Pritchard)
44 Written evidence from Clare Moody MEP (EUM0062)
45 Q 10 (Prof Paul Boyle)
46 Q 58 (Prof Dame Anne Glover)

> "We have probably more than our fair share of chairs of committees, which are opinion-forming. We have a large membership of committees."[47]

65. Professor Robin Grimes, Chief Scientific Adviser FCO, reported that:

> "We work hard to ensure that the scope of Framework Programmes is in line with UK priorities; and because the UK has many world-recognised scientists, UK scientists occupy key positions in a range of EU research and advisory bodies."[48]

66. The European Commission told us that while there is no quantitative analysis produced on the UK's percentage share of committees and positions, examples of UK nationals participating in key advisory bodies and expert groups, including those where the UK itself proposes the nominations, included the following:

> "Professor Dame Julia Slingo, Chief Scientist of the UK Met Office, is one of the seven member strong high level group for the Commission's new Scientific Advice Mechanism (SAM);
>
> Prof Dame Athene Donald, Professor of Experimental Physics at the University of Cambridge, is one of the current 18 members of the Scientific Council of the European Research Council;
>
> Sir Leszek Borysiewicz, Vice-Chancellor of the University of Cambridge, is the Chair of the ERC [European Research Council] Identification Committee for identifying potential new members of the ERC Scientific Council;
>
> Dr Claire Craig from the Royal Society is a member of the Governing Board of the Joint Research Centre;
>
> Of the 31 in total members of the high level expert group RISE [Research and Innovation Staff Exchange] for research, science and innovation, five are from the UK or currently working at UK institutions;
>
> 46 UK nationals are currently members of Advisory Groups (AGs) which provide input for the preparation of the Horizon 2020 work programme. This is out of a total of 446, or equal to just over 10%. This is the highest number among Member States—Germany has 43. The AGs have recently been re-appointed and are just in the process of selecting their Chairs;
>
> Richard Fowler Pelly from the UK was one of the 12 member High Level Group of experts for the recent ex post evaluation of the Seventh Framework Programme;
>
> The UK has been a significant contributor to the work of the European Research Area and Innovation Committee (ERAC). The current co-Chair, David Wilson of the UK Department for Business Innovation and Skills (BIS) has been instrumental in preparing the ERA [European Research Area] roadmap and the ERA governance document."[49]

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47 Q 59 (Prof Dame Anne Glover)
48 Q 117 (Prof Robin Grimes)
49 Written evidence from the European Commission (EUM0081)

67. The UK plays an important role in ensuring that excellence remains a key criterion in the allocation of EU funding for science, research and innovation and that there is an appropriate balance between funds awarded on a competitive basis and those awarded on the basis of capacity building. Professor Dame Anne Glover stated that the:

> "ERC [European Research Council] funds research purely on the basis of excellence of science. The reason that there is such a strong commitment to that is through ministerial meetings, where the UK has been very active in order to highlight the importance of having a funding instrument which is purely based on excellence. The cohesion Member States may be less keen to see that it is based on excellence because they will have an imperative for capacity building. If there were a Brexit, the voice of one of the most important science Member States of the European Union would not be there influencing how ERC funding was distributed. The top three science Member States are the UK, Germany and France, and we do have a very big voice in all things science at EU level."[50]

68. The European Commission confirmed the UK's commitment to excellence:

> "The UK has been amongst the leaders in terms of support to the key policy principles for Horizon 2020 including the defence of excellence as the principal criterion for the allocation of funding, the need for simplification and greater efficiencies with programme implementation including funding models, and the need to ensure open access to publications and data generated by EU funded projects."[51]

69. Furthermore, the European Commission told us that: "the UK has been an active contributor through the Horizon 2020 Programme Committee in terms of proposed topics for funding, many of which have been taken up."[52]

70. We also heard from Professor Dominic Tildesley, President, Royal Society of Chemistry, that "there is a good alignment between the major research priorities that you see in Europe and in the UK—for example, research into climate change, energy, antimicrobial resistance and healthcare."[53]

71. The evidence presented to us clearly argued that the UK plays an influential role in the development of EU policies and decision-making relating to science and research. We would wish to acknowledge, however, that it is difficult to be definitive when assessing influence. Nevertheless, it certainly appears that the UK has a strong voice when it comes to putting a firm UK imprint on EU policy for science. It would seem hard to agree with the view put to us by the Scientists for Britain spokesperson, Professor Angus Dalgleish, that "we get drowned out in the EU."[54]

72. Interestingly, however, Dame Julia Slingo, did sound a note of caution vis-à-vis the balance between EU and national priorities:

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50 Q 56 (Prof Dame Anne Glover)
51 Written evidence from the European Commission (EUM0081)
52 Written evidence form the European Commission (EUM0081)
53 Q 10 (Prof Dominic Tildesley)
54 Q 129 (Prof Angus Dalgleish)

> "I think we have to be very cautious that our own science agenda and our own strategy for science is not taken over too much by what Brussels would like to see done …
>
> Because our science base is so strong nationally and we are excellent in a number of science areas, we want to be careful not to risk weakening our core areas of excellence because we are trying to fit to somebody else's agenda. For me, it is always about getting the right balance between national interests and the quality of our science base versus what we gain by working more collaboratively in Europe."[55]

73. **We conclude that the UK plays a leading role in the development of EU policies and decision-making processes that relate to science and research. UK scientists in various EU fora act to ensure that the UK's voice is clearly heard and that the EU remains aligned with the advancement of UK science, particularly by shaping the balance between funding awarded on the basis of research excellence and that awarded for capacity building.**

EU influence on UK international scientific relations

74. Though not a prominent strand of our inquiry, we also heard about the international scientific diplomatic opportunities afforded by our membership of the EU. The UK's EU membership has an impact on our participation in international fora, including the variety of United Nations' (UN) bodies that have a scientific dimension.

75. Professor Robin Grimes highlighted how EU membership gave the UK additional purchase when international scientific issues were under discussion:

> "There is no formal EU programme called EU Science Diplomacy at the moment, but there are areas where our science evidence will underpin diplomacy that we have carried out bilaterally and as part of the EU, and we are more powerful as a result. A good example of that would be climate diplomacy."[56]

76. Professor Grimes highlighted the benefits of being able to negotiate as part of a bloc and the added value that accrued from being able to draw on bilateral, EU and UN approaches:

> "I think we gain tremendously from being able to negotiate as part of an EU bloc. We were specifically part of that bloc for the negotiations for COP21, for example, which gave us considerably more clout, and the negotiations were very successful.
>
> However, as I said, we can also have separate negotiations with countries and come to bilateral relationships, and we can act through the UN. I have no doubt that we will continue to make the most of those three areas together, and being part of those three areas gives us a synergy that we are able to exploit more readily. We are also able to gain information from being part of those three groups and to compare and contrast."[57]

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55 Q 113 (Prof Dame Julia Slingo)
56 Q 117 (Prof Robin Grimes)
57 Q 118 (Prof Robin Grimes)

CHAPTER 4: FUNDING

The EU funding system supporting science and research

77. Research policy is a shared competence between the EU and Member States, as outlined in the Treaty of the Functioning of the EU (TFEU). Both the EU and Member State governments legislate and adopt legally binding acts in this area. A number of mechanisms have been established by the EU to support science and research. Researchers and organisations within the 28 Member States (MS) of the EU[58] are able to apply and participate in these mechanisms. In addition, some non-EU countries are able to participate. A total of 13 Associated Countries[59] contribute to Framework Programme budgets in proportion to their Gross Domestic Product (GDP) which enables their researchers and organisations to apply for Horizon 2020 (H2020) projects with the same status as those from EU Member States. We return to consider Associated Country status in Chapter 6.

78. Furthermore, a number of Third Countries[60] participate via individual Science and Technology Cooperation Agreements with the EU. This group of countries includes the industrialised and emerging economies and several developing countries. These countries participate to a lesser extent than Member States and Associated Countries.

79. The EU funding system for science, research and innovation is complex. We heard a number of times about the bureaucracy that is encountered when applying for EU funds or engaging with EU programmes. The submission from the Pirbright Institute expressed such concerns:

> "The demands of the EU in terms of record keeping are onerous and require full original records of every aspect of the costs associated with the grant. This level of record keeping seems to be proportionately more important than the actual science achieved when reporting back to the EU progress and especially in agreeing the final provision of funds to support the science."[61]

80. We were told that EU grant management can be time-consuming and require specialist knowledge. The Wellcome Trust Sanger Institute stated:

> "The Grants and Contracts Managers at the Sanger Institute noted that EC grants occupied disproportionately more of their time than UK grants and that the whole process could be better streamlined."[62]

They also commented, however, that the significant benefits from EU grants made the extra effort worthwhile.

58 See Appendix 6 for a list of Member States.
59 Thirteen counties have Associated Country status, including Norway, Israel and Switzerland (see Appendix 6 for a list of Associated Countries). A bilateral agreement is in place between each country and the EU; some are seeking to become EU members while some have chosen not to be.
60 Countries that have signed S&T cooperation agreements with the EU (correct March 2015): Argentina, Australia, Brazil, Canada, Chile, China, Egypt, India, Japan, Jordan, Mexico, Morocco, New Zealand, Russia, South Africa, South Korea, Tunisia, Ukraine (an Associated Country December 2015), United States.
61 Written evidence from the Pirbright Institute (EUM0057)
62 Written evidence from the Wellcome Trust Sanger Institute (EUM0030)

81. The Royal Society of Biology pointed out that:

> "UK Government and EU research funding streams are not readily comparable. EU funds are managed across many large scale projects and therefore incur increased administrative burden."[63]

82. A simplification project has been underway across EU funding schemes in order to streamline the processes involved. There was broad consensus that efforts being made by the EU to simplify engagement are to be encouraged.

83. The timeframe and recognition of interdisciplinary research within EU funding frameworks both received praise. The Association of Medical Research Charities (AMRC) suggested:

> "It is important that long-term recovery in Europe, including the UK, is accompanied by a long-term plan for investment in research and innovation. Long-term Framework Programmes offering consistent, long-term funding like Horizon 2020 are an important part of this picture."[64]

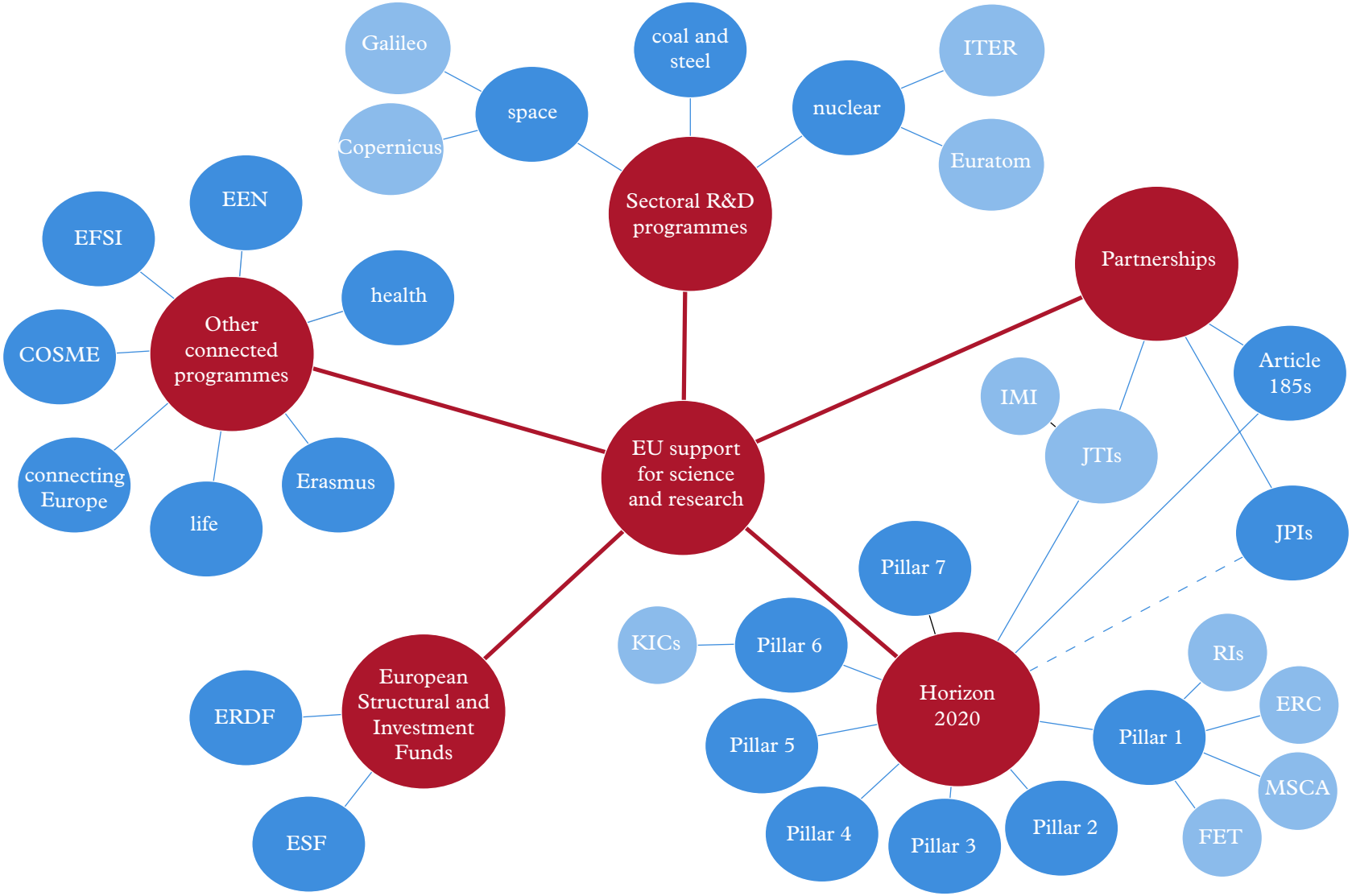
84. The University of Cambridge indicated that interdisciplinarity is dealt with efficiently within EU funding frameworks:

> "The EU research programmes more widely aim to support the inherent interdisciplinarity of research—to recognise not only that there are global problems which need tackling across geographical borders (the challenges posed by an ageing population for example), but also that research itself is inherently interdisciplinary."[65]

85. In order to inform our investigations, we sought a diagrammatic representation of the main ways that the EU supports science and research. However, we could not find such a figure, so we have created Figure 2 below from the evidence we received, European Parliament briefings[66] and informal discussions with the UK Research Office. This figure attempts to capture the principal mechanisms established by the EU to support science and research. We are aware that some specific research areas are not shown. Environmental research is an illustrative example. In this case, funding can be found throughout H2020, particularly the Societal Challenges pillar. A number of EU partnerships, including Joint Programming Initiatives (JPIs) and Article 185 initiatives, also address environmental issues.

63 Written evidence from the Royal Society of Biology (EUM0068)
64 Written evidence from the Association of Medical Research Charities (EUM0052)
65 Written evidence from University of Cambridge (EUM0049)
66 European Parliament Briefing, *Overview of EU Funds for research and innovation* (September 2015): http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568327/EPRS_BRI(2015)568327_EN.pdf [accessed 12 April 2016]

Figure 2: An attempt to capture the principal mechanisms established by the EU to support science and research



Note: in some cases, only key subsets have been included for clarity. An explanation of acronyms can be found in Appendix 5.

86. The EU supports science and research through five main mechanisms, as highlighted in Figure 2, namely:

- The Horizon 2020 programme (formerly the series of Framework Programmes 1–7);
- European Structural and Investment funds (ESIF);
- Sectoral research and development programmes;
- Other connected programmes; and
- Partnerships.

87. Some of these programmes involve grants, some are methods of financing and others are platforms designed to facilitate collaboration and connections.

Horizon 2020

88. Horizon 2020 (H2020) is the EU's flagship programme for science and innovation. It replaced a series of Framework Programme funds (the last being Framework Programme 7) in 2014. It will run from 2014–20 and has a budget of approximately €74.8 billion. As shown in Figure 2 above, H2020 consists of seven main pillars:

(1) Excellent Science, including:

- European Research Council (ERC);
- Marie Skłodowska-Curie actions (MSCA);
- European Research Infrastructures (RIs), including e-Infrastructures; and
- Future and Emerging Technologies (FET).

(2) Industrial Leadership, including:

- Leadership in Enabling and Industrial Technologies;
- Innovation in Small-Medium Enterprises (SMEs); and
- Access to risk finance.

(3) Societal Challenges, including:

- Health, Demographic Change and Wellbeing;
- Secure, Clean and Efficient Energy;
- Climate Action, Environment, Resource Efficiency and Raw Materials;
- Secure societies—Protecting freedom and security of Europe and its citizens;
- Smart, Green and Integrated Transport;
- Europe in a changing world—Inclusive, innovative and reflective societies; and

- Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy.

(4) Spreading Excellence and Widening Participation

(5) Non-nuclear direct actions of the Joint Research Centre (JRC)

(6) European Institute of Innovation and Technology (EIT)

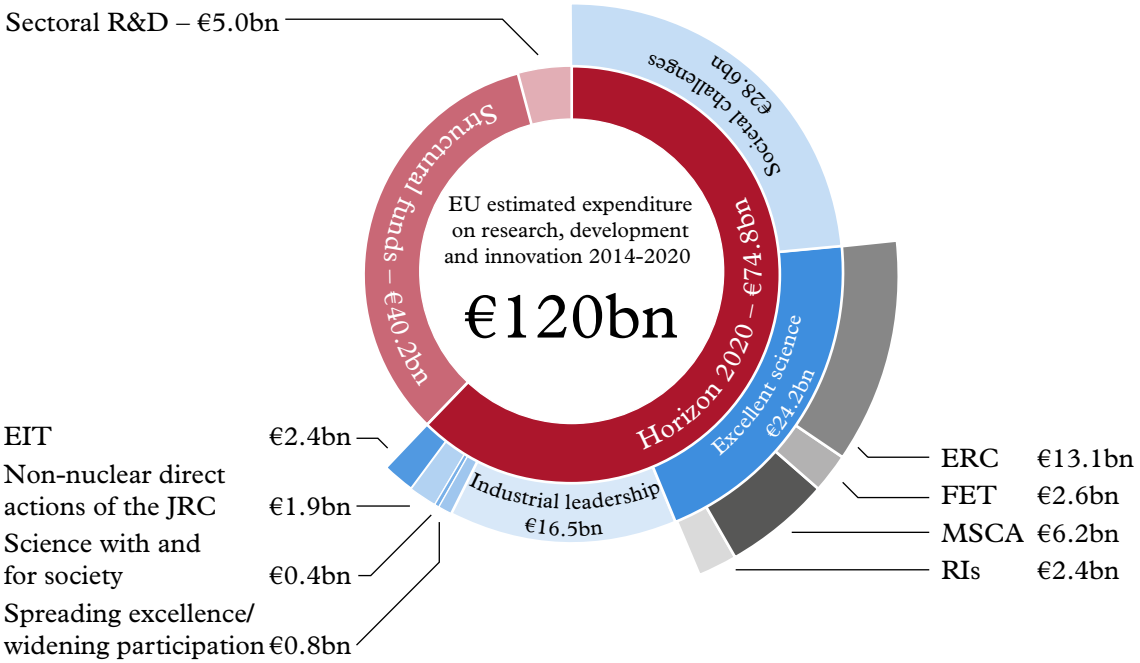
(7) Science with and for Society

89. H2020 is managed by the European Commission's Directorate-General for Research and Innovation (DG RTD). There are seven other DGs with a research dimension (Energy, Communication, Agriculture, Education and Culture, Growth, Home Affairs and the Joint Research Centre (JRC)) that share ownership and responsibility for the Programme with DG RTD.

90. Funding is mostly allocated competitively through calls for proposals to which researchers and organisations can apply. Criteria for allocating funding vary and include scientific excellence, alignment with a number of strategic objectives (grand challenges), geographical and disciplinary diversity and potential for commercialisation. European Research Council (ERC) funding, part of the Excellent Science pillar, is unique as it is awarded solely on the basis of excellence—grants have neither thematic priorities nor geographical quotas.

91. Figure 3 below shows EU estimated expenditure on research, development and innovation for the period 2014–20, including a breakdown of expenditure within Horizon 2020 as well as a breakdown of the Excellent Science pillar of Horizon 2020. Funding for other connected programmes and partnerships is not included as many of these operate on different timescales and/or are funded via aspects of H2020.

Figure 3: EU estimated expenditure on research, development and innovation 2014–20 including a breakdown of expenditure within Horizon 2020 and a breakdown of the Excellent Science pillar of Horizon 2020[67]



Source: Written evidence from the Royal Society (EUM0067)

Structural and Investment Funds

92. Some of the EU's Structural and Investment Funds (ESIF) are used to support research and innovation. Although a large proportion of these funds are spent on projects such as building infrastructure, support for research and innovation activities is now also one of their priorities. Of the five types of ESIF (hereafter referred to as structural funds)—the European Regional Development Fund (ERDF), European Social Fund (ESF), Cohesion Fund (CF), European Agricultural Fund for Rural Development (EAFRD) and European Maritime and Fisheries Fund (EMFF)—only the ERDF and, to a lesser extent the ESF, are eligible for funding research and innovation. Activities funded include the construction of research infrastructure, support for technology transfer and research intensive businesses and skills programmes. An estimated €40.2 billion of structural funds will be allocated to research and innovation activities over the period 2014–20.[68]

93. Structural funds are allocated via a different process than that for H2020 funds. Allocation criteria include GDP per capita and applications from individual Member States are also considered. As will be discussed in paragraph 112, we have found the topic of structural funds supporting science and research to be complex.

67 The sum of the funding as part of the Excellent Science pillar does not exactly correlate to the constituent figures due to rounding.

68 Royal Society, *UK research and the European Union: The role of the EU in funding UK research* (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 12 April 2016]

94. We heard that synergies between H2020 funds and structural funds for research and innovation capacity are being increasingly explored by the European Commission. Professor Dame Anne Glover told us:

> "On the structural funds, what the Commission has asked all Member States to do is to develop a smart specialisation policy. In order to support that, they have a smart specialisation panel."[69]

95. The European Commission provided us with some clarification on the purpose of smart specialisation:

> "Smart Specialisation can be defined as 'place-based approach to innovation, rooted on knowledge assets'. In other words it is 'a strategic approach to economic development through targeted support to research and innovation'. It gives priority to investments in research and innovation activities that play to the regions' (or country's) existing or potential strengths, and thus ensures a more effective use of public funds while stimulating private investment. It focuses on the real growth drivers of the country/region."[70]

They continued:

> "The ultimate goal of smart specialisation is to achieve improved innovation ecosystems and a higher impact of the funds."[71]

We will return in paragraph 112 to the topic of structural funds for research and innovation, and the amount that the UK receives.

Sectoral research and development programmes and other connected programmes

96. Alongside H2020 and structural funds, there are a number of sectoral research and development programmes as well as other connected programmes that are related to science and research.

97. Sectoral research and development programmes involve space research, nuclear energy and coal and steel production. The total research budget for these programmes is about €5 billion over the period 2014–20, of which the majority (€4.5 billion) is for research into nuclear energy.[72] [73]

98. Other connected programmes include initiatives such as Erasmus Plus (the EU's student exchange programme) and the Enterprise Europe Network (EEN). The latter aims to help small and medium-sized enterprises (SMEs) make the most of business opportunities in the EU.

99. Also included in other programmes that support science, research and innovation is the European Fund for Strategic Investments (EFSI). EFSI is a new addition to the system. We are aware of concerns within the science

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69 Q 57 (Prof Dame Anne Glover)
70 Written evidence from the European Commission (EUM0081)
71 Written evidence from the European Commission (EUM0081)
72 Royal Society, *UK research and the European Union: The role of the EU in funding UK research* (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 12 April 2016]
73 These numbers are not exact because these programmes do not all run within the same timeframe.

community in the UK regarding the repurposing of H2020 funds in order to finance EFSI.[74]

Partnerships

100. The last of the five mechanisms outlined in Figure 2 is partnerships. The EU has established a number of strategic partnerships in order to further science and research. These include collaborations across Member States such as the public-public partnerships termed the Joint Programming Initiatives (JPIs) and collaborations across sectors such as the public-private partnerships termed the Joint Technology Initiatives (JTIs). A notable example of the latter that was brought to our attention is the Innovative Medicines Initiative (IMI); the IMI brings together academic researchers and the pharmaceutical industry. JTIs receive part funding from H2020 and JPIs are able to apply for H2020 funds.

101. A further type of partnership is the so-called Article 185s. These are named in reference to a section of the TFEU and are another type of partnership that brings together Member States. Again, these are part funded by H2020.

102. **The EU funding system for science and research is complicated and there are many ways in which the EU aims to fulfil its shared competence in research policy. This complexity means that UK researchers can struggle to navigate through the system. We welcome the efforts made by the European Commission to reduce the complexity and administrative burden, though their effectiveness to date is unclear.**

UK funding for science and research in the EU

103. According to data provided by the Campaign for Science and Engineering (CaSE), the Royal Society and others, between 2007 and 2013, the UK received €48bn from the EU; of this, €8.8bn was for research, development and innovation. Over the same period, the UK contribution to the EU was €78bn, of which €5.4bn has been indicated[75] as being for the EU's R&D budget.[76]

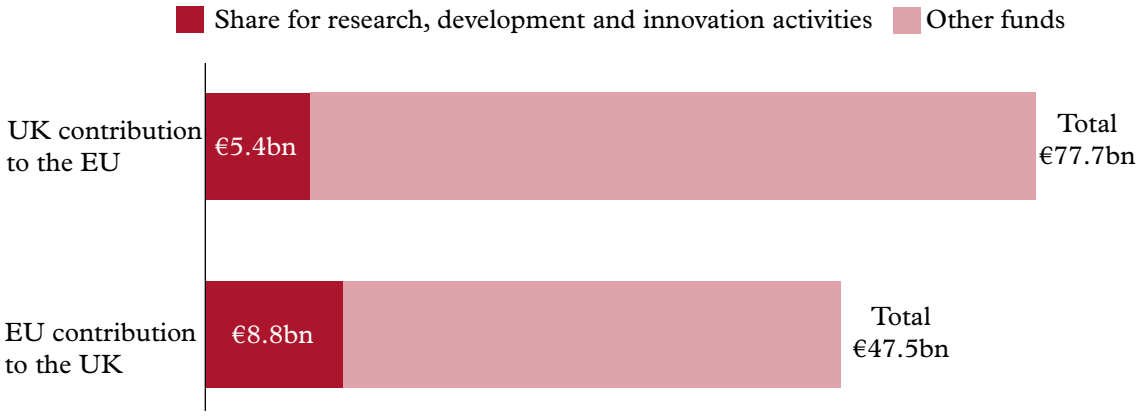
104. The UK can be considered as a net contributor to the EU overall, but a net receiver of EU funding for science and research. Figure 4 below show the flow of funds between the UK and the EU between 2007–13.

74 Horizon 2020 funding was set to be cut by €2.7bn to support EFSI, with no guarantee that the equivalent funding would be spent on research and science through EFSI. However, successful representations from across Europe ensured the impact of the cuts was reduced, with €500m being ring-fenced. Hence, €2.2bn was deducted from the initial Horizon 2020 budget to help fund EFSI.

75 The financial contributions from the UK to EU science and research cannot be determined definitively because the UK's contribution to the EU contains no formally hypothecated amount for research and development (R&D). The contribution can, however, be inferred by calculating the proportion of EU expenditure devoted to R&D and assuming that the UK contribution includes the same proportion of spend.

76 Written evidence from the Campaign for Science and Engineering (EUM0047) and the Royal Society (EUM0067)

Figure 4: Flow of funds between the UK and the EU (2007–13)



Source: Written evidence from the Campaign for Science and Engineering (EUM0047) and the Royal Society (EUM0067)

When these figures are considered, it can be determined that a little under one fifth (18.3%) of the funds the UK received from the EU between 2007–13 was used to support science and research. Clearly, science and research are a significant dimension of the UK's membership of the EU.

105. **During the period 2007–13, the UK was a net contributor to the EU overall, but a net receiver of EU funding for research. Given that just under one fifth (18.3%) of the funds the UK received from the EU during this time were used to support science and research, we consider that science is a significant dimension of the UK's membership of the EU.**

EU funding for science and research in the UK

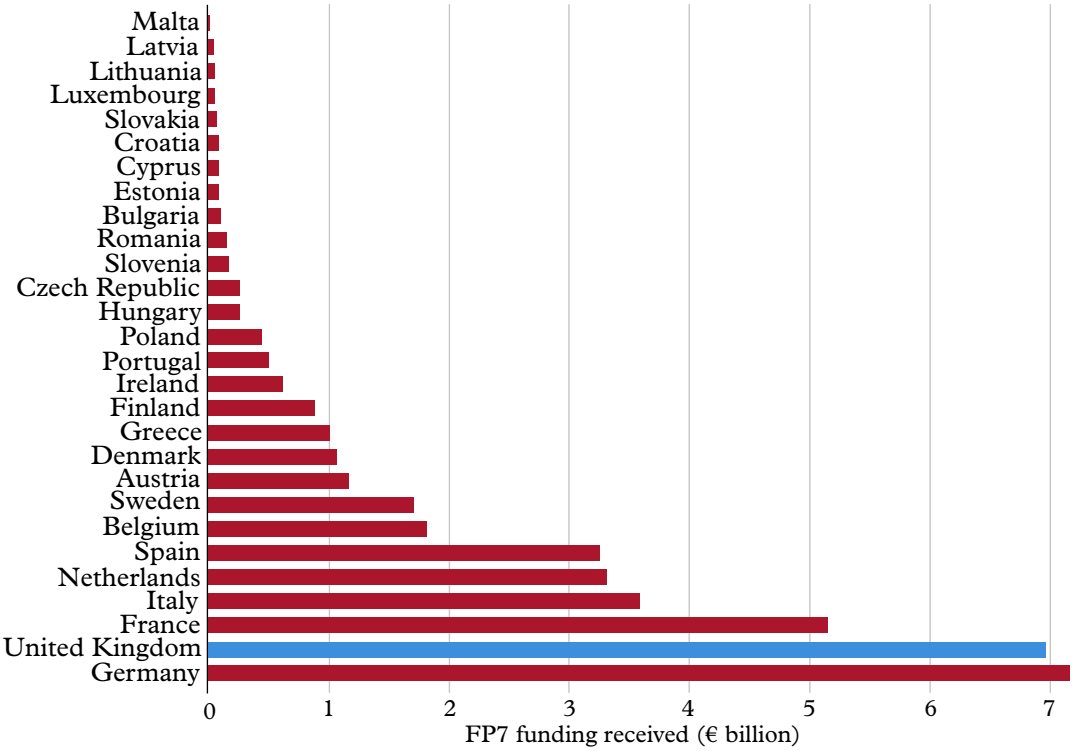
106. Data on allocations under Framework Programme 7 (FP7), which ran from 2007–13 as the precursor to H2020, are almost complete and offer a reliable indication of comparative performance (in terms of competitive funds for research) across Member States. Most respondents to our inquiry quoted data from this time period and thus we will do the same.

107. The UK's comparative performance in terms of funds received for science and research varies depending on whether only Framework Programme (FP) funds are considered or whether the sum of FP funds and structural funds (those designated for research and innovation) is considered. In the case of the former, the UK performs very well; both in absolute terms and when adjusted on the basis of national GDP.

108. The process by which FP funds are awarded has a high level of transparency whereas that which decides the allocation of structural funds for research and innovation is less clear. The evidence with regards to excellence-based FP funding was consistent; however this was not the case for the evidence received in relation to structural funds.

109. We received data regarding the total EU funds for R&D awarded to Member States presented in a variety of ways. These included: total FP7 monetary values; FP7 funds normalised for GDP, population and Field-Weighted Citation Impact (FWCI);[77] the sum of FP7 funds and structural funds for research and innovation; and the sum of FP7 funds and structural funds normalised according to the factors previously outlined. Figures 5–11 below illustrate a variety of ways in which the data can be displayed.[78]

Figure 5: Total FP7 funds awarded against member states

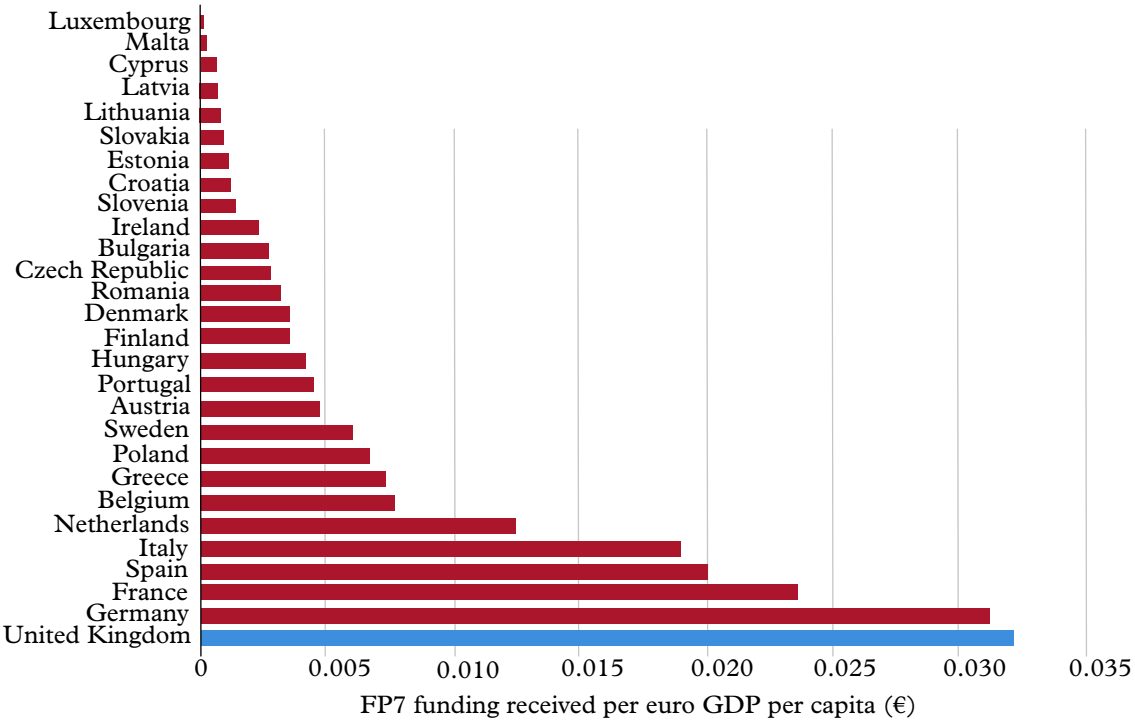


Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016]

77 Field-weighted citation impact divides the number of citations received by a publication by the average number of citations received by publications in the same field, of the same type, and published in the same year. The world average is indexed to a value of 1.00. Values above 1.00 indicate above-average citation impact, and values below 1.00 likewise indicate below-average citation impact.

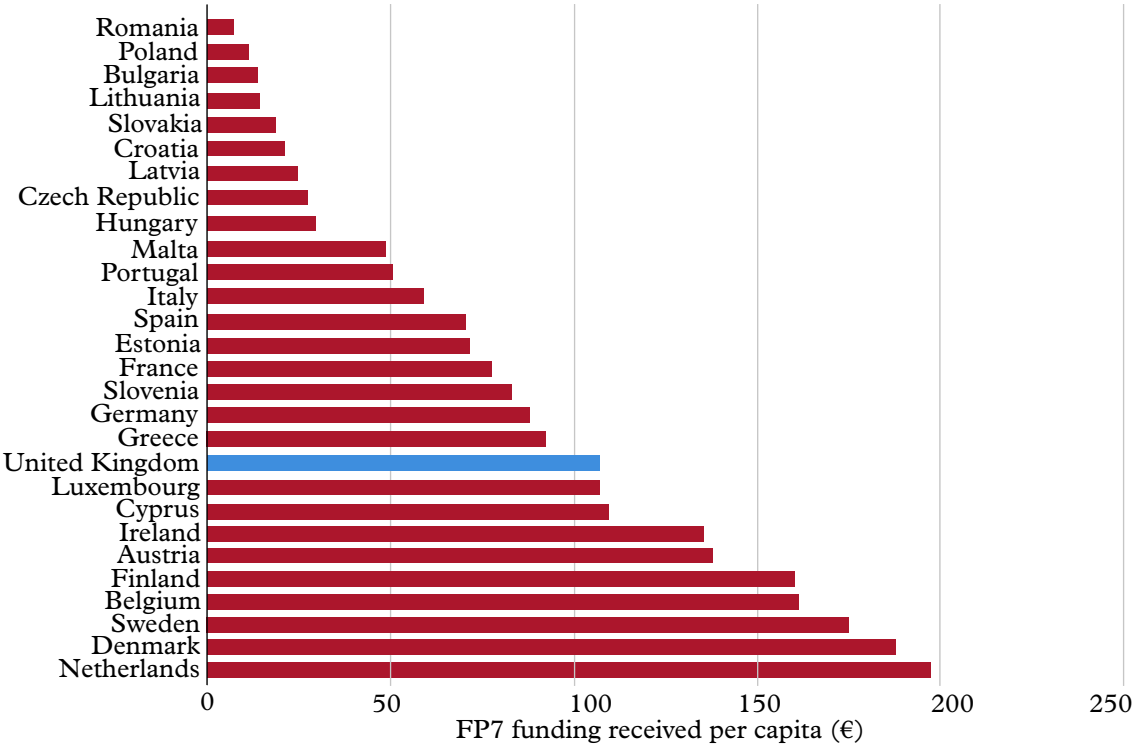
78 FP7 funds are quoted in billions of euros for the time period 2007–13; structural funds refer to those designated for research and innovation and are quoted in billions of euros for the time period 2007–13; population data figures relate to 1 January 2015; GDP figures are quoted in euros per capita for the time period 2007–13; and FWCI figures relate to 2012.

Figure 6: Total FP7 funds awarded against member states per unit GDP



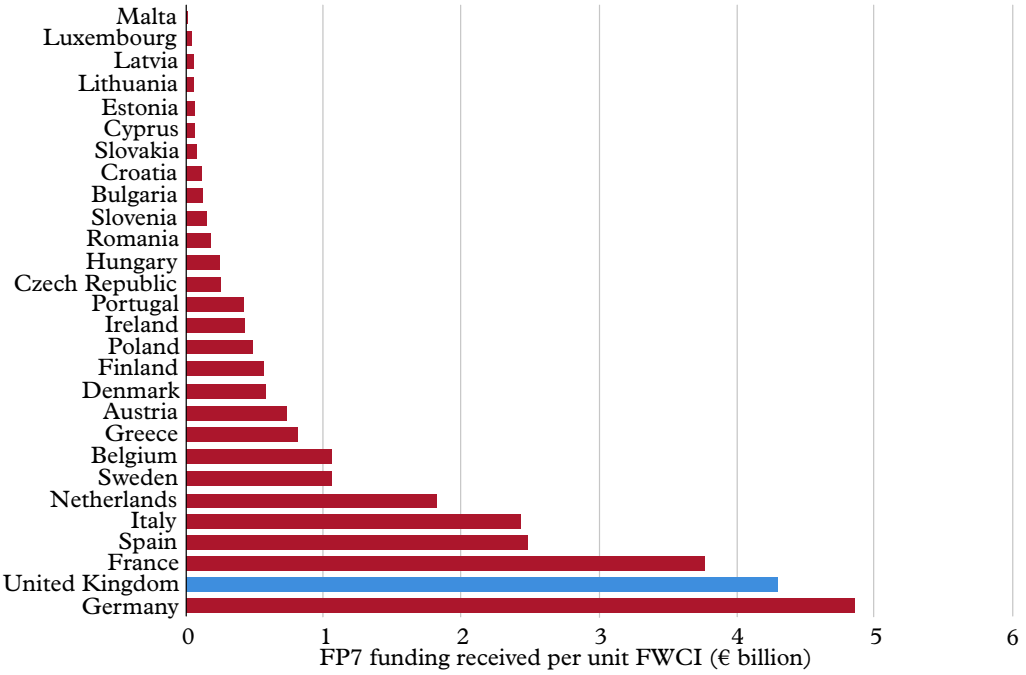
Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016] and Eurostat Gross domestic product at market prices (2015): http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tec00001&language=en [accessed 5 April 2016]

Figure 7: Total FP7 funds awarded against member states per capita



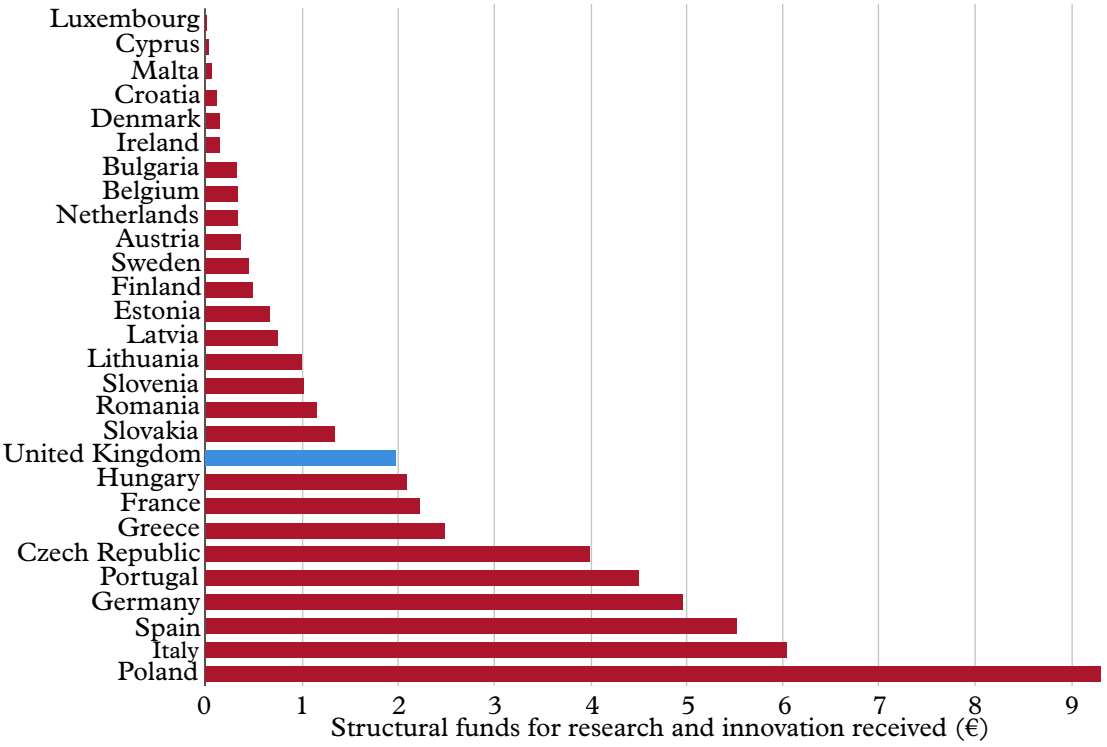
Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016] and Eurostat Newsrelease First population estimates (July 2015): http://ec.europa.eu/eurostat/documents/2995521/6903510/3-10072015-AP-EN.pdf/d2bfb01f-6ac5-4775-8a7e-7b104c1146d0 [accessed 5 April 2016]

Figure 8: Total FP7 funds awarded against member states per national Field Weighted Citation Impact[79]



Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016] and written evidence from Universities UK (EUM0054)

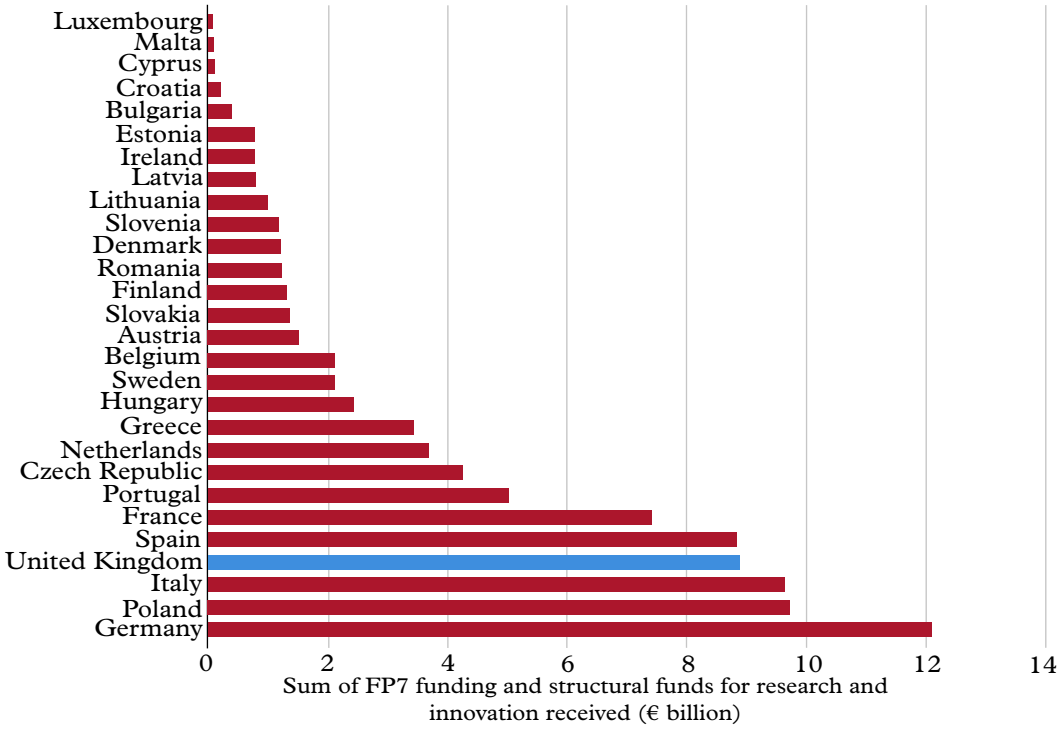
Figure 9: Total structural funds allocated for research and innovation against member states



Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016]

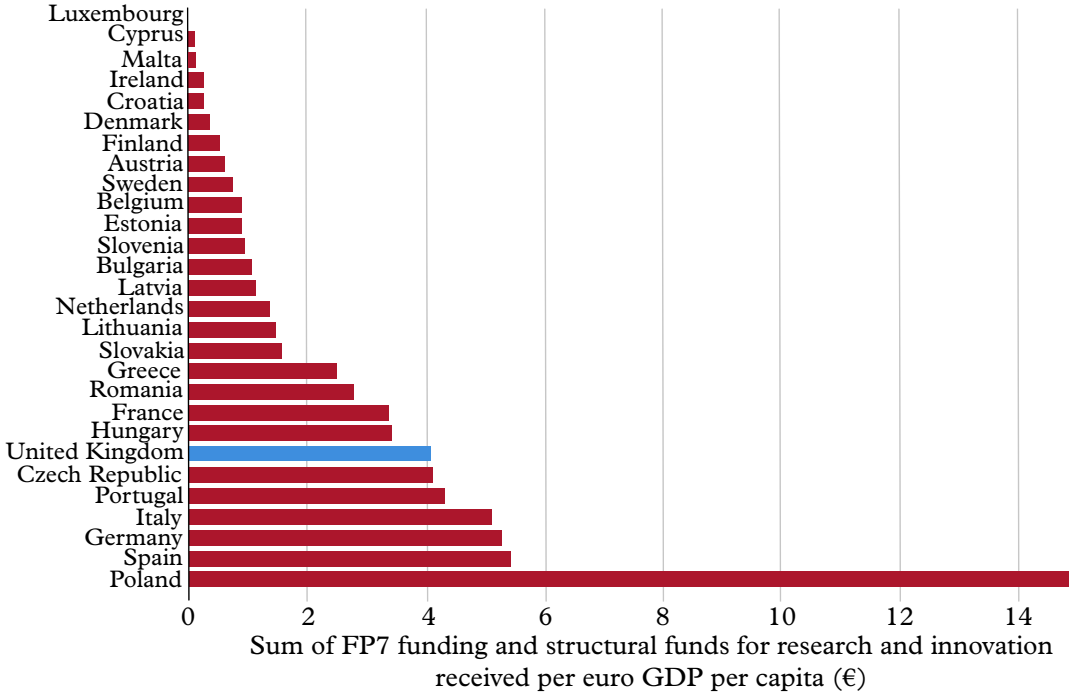
79 Field-weighted citation impact divides the number of citations received by a publication by the average number of citations received by publications in the same field, of the same type, and published in the same year. The world average is indexed to a value of 1.00. Values above 1.00 indicate above-average citation impact, and values below 1.00 likewise indicate below-average citation impact.

Figure 10: Sum of total FP7 funds awarded and total structural funds allocated for research and innovation against member states



Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016]

Figure 11: Sum of total FP7 funds awarded and structural funds allocated for research and innovation against member states per unit GDP



Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016] and Eurostat Gross domestic product at market prices (September 2015): http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tec00001&language=en [accessed 5 April 2016]

110. Appendix 7 also includes a further presentation of the data as submitted to us by the Royal Society.[80]

111. As can be determined from the Figures above and Appendix 7, the UK's comparative performance in terms of securing EU funds for science and research differs depending on whether FP funds or the sum of FP and structural funds is considered. We explored structural funds for research and innovation in some depth and found this area to be somewhat opaque.

112. Structural funds are awarded based on regional GDP per capita. Regions are classified into three categories:[81]

- Less developed regions (GDP/head < 75% of EU average);
- Transition regions (GDP/head between 75% and 90% of EU average); and
- More developed regions (GDP/head >= 90% of EU average).

113. The UK is not positioned to benefit greatly from structural funds. Professor Alex Halliday, Vice-President, Royal Society, indicated this and outlined some areas in the UK that do receive structural funds:

> "Parts of the UK get that funding, such as Cornwall, parts of Scotland and parts of Wales, where there has been a need for investment, and the European Union has been providing some of that funding for infrastructure. However, the scale of what is needed in the UK compared with what is needed in some of the other countries in the European Union is not the same at all."[82]

114. Dr Mike Galsworthy, Programme Director of Scientists for EU, argued that FP funds and structural funds should be considered separately. He suggested to us that the awarding of these funds to less scientifically developed nations increases research capacity and thus provides an increased number of facilities and skilled researchers for the UK to collaborate with and benefit from. He said:

> "By conflating the two, you merely look at the finances of it rather than the value of the whole system, and I believe the value of the whole system is clearly beneficial because it is well structured."[83]

115. Professor Sir Leszek Borysiewicz, Chair of the Russell Group's EU Advisory Group, and Vice-Chancellor, University of Cambridge, succinctly highlighted the fundamental dichotomy that this area presents:

> "This is a major topic within the European Union that goes to the heart of that debate—the competitiveness issue as opposed to the level playing field issue. These are two fundamental principles, and this particular

80 Royal Society, *UK research and the European Union: The role of the EU in funding UK research* (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016]

81 European Commission, *Structural Funds (ERDF and ESF) eligibility 2014–2020*: http://ec.europa.eu/regional_policy/sources/what/future/img/eligibility20142020.pdf [accessed 12 April 2016]

82 Q 26 (Prof Alex Halliday)

83 Q 129 (Dr Mike Galsworthy)

> theme often finds itself involved in a contretemps between those two ideals that Europe proposes."[84]

116. The purpose of the designation of a portion of structural funds for research and innovation projects is to elevate the broader science capacity and capability across Member States. The Minister of State for Universities and Science, Jo Johnson MP, told us:

> "structural funds are about helping disadvantaged, more deprived areas of the European Union to develop the capabilities to be competitive and eventually to be in a position where they are capable of competing for the science streams of money."[85]

117. It is expected that Member States with lower scientific capacity and capabilities will utilise structural funds in such a way that it will enable them to be more successful in applying for FP funds, i.e. funds based on scientific excellence. Jo Johnson MP, however, was unable to confirm to us whether any assessment had been done so far at Commission level in order to determine if the use of structural funds in this way has been effective.[86] There appears to be no evidence that the awarding of structural funds for research and innovation has resulted in an improved success rate, or increased application rate, to FP7 or H2020.

118. **Despite many assertions that the UK performs very well in terms of EU funding for science and research, it has proved challenging to define unambiguously the level of EU spending on R&D in the UK and how this compares with other Member States. We have been able to verify the UK's position as a high receiver of funds in terms of Framework Programme funding only. When the portion of the EU's structural funds designated for research and innovation are taken into account, we have found it more difficult to assess the UK's position.**

119. **The purposes of competitive Framework Programme funds and structural funds for research and innovation are different. By designating a portion of structural funds for research and innovation, the European Commission aims to boost scientific capacity across Member States and increase the success rate of applications for competitive Framework Programme funds from regions with weaker economies. While we commend this approach, we are concerned by the apparent lack of evidence as to whether this spending has actually raised the scientific competitiveness of recipients. We recommend that this evidence should be assembled by the European Commission.**

120. The UK is the top performer across Member States in terms of securing European Research Council (ERC) funding, i.e. funding awarded solely on the basis of excellence. Professor Dame Helen Wallace, representing the British Academy, highlighted that the humanities and social science community in particular benefit disproportionately well from this part of the Excellent Science pillar of H2020.[87]

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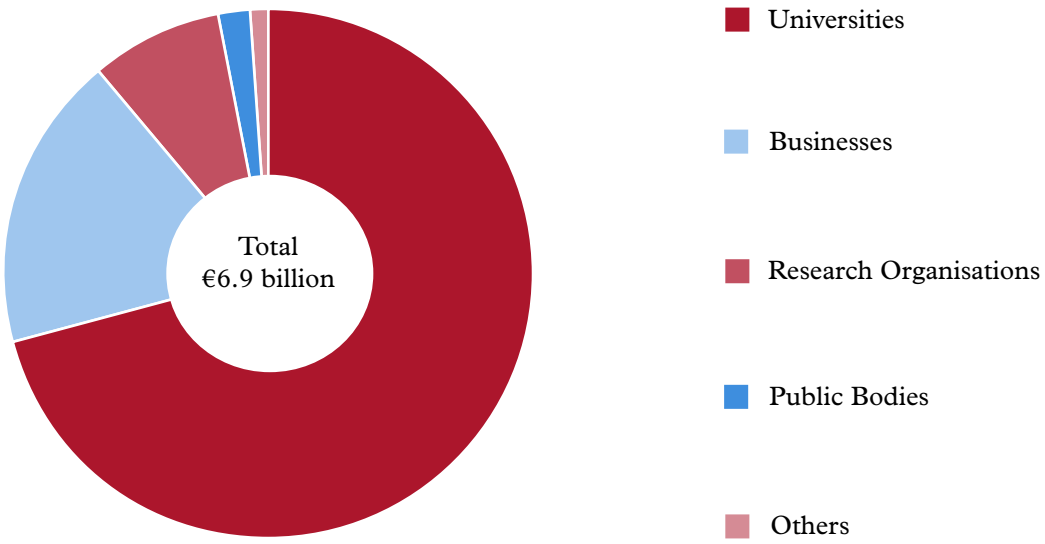
84 Q 65 (Prof Sir Leszek Borysiewicz)
85 Q 144 (Jo Johnson MP)
86 Q 145 (Jo Johnson MP)
87 Q 42 (Prof Dame Helen Wallace)

121. Professor Sir Mark Walport, Government Chief Scientific Adviser, said of ERC funding:

> "The European Research Council in its existing form recognises to a significant extent the emphasis of the UK and some other countries in Europe on supporting the brightest and the best."[88]

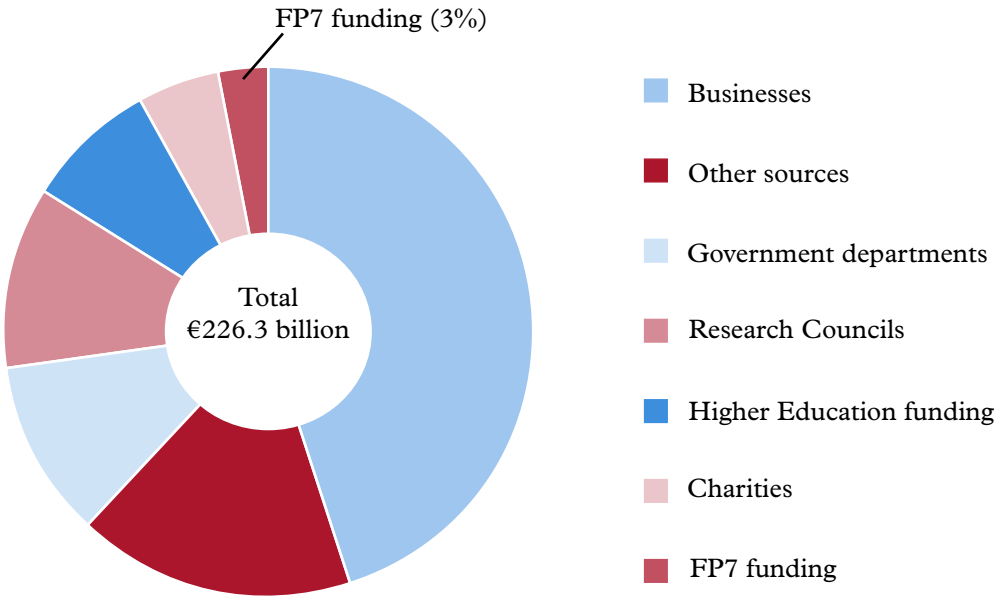
122. Figures 12 and 13 below show the amount of FP7 funding awarded to the UK per sector alongside UK expenditure on R&D by source of funding.

Figure 12: FP7 funding awarded to UK by sector (2007–13)



Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 5 April 2016]

Figure 13: UK expenditure on R&D by source of funding (2007–13)



Source: Royal Society, UK research and the European Union: The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf

88 Q 156 (Prof Sir Mark Walport)

[accessed 5 April 2016]

123. As can be determined from Figure 12, the university sector was the largest recipient of FP7 funding for science and research in the UK between 2007 and 2013. Figure 13 shows that, in the same time period, FP7 funding amounted to 3% of the UK's total expenditure on R&D. We heard from universities that this funding is equivalent to having another Research Council.[89]

124. In the UK, 64% of research and development is conducted by businesses,[90] yet businesses attracted just 18% of the total funds awarded to the UK through FP7. This is below the EU average and much lower than countries such as Germany and France. We return to this this issue in the next section of this chapter.

125. We received submissions from a number of research institutes, organisations and laboratories that emphasised the importance of EU funding to their research portfolios. Submissions from the Wellcome Trust Sanger Institute, the National Physical Laboratory (NPL), the John Innes Centre, the Centre for Ecology and Hydrology (CEH) and the Met Office emphasised the importance of EU funding streams and cited the financial contributions from EU-level funding programmes to their operations.[91]

Business and innovation

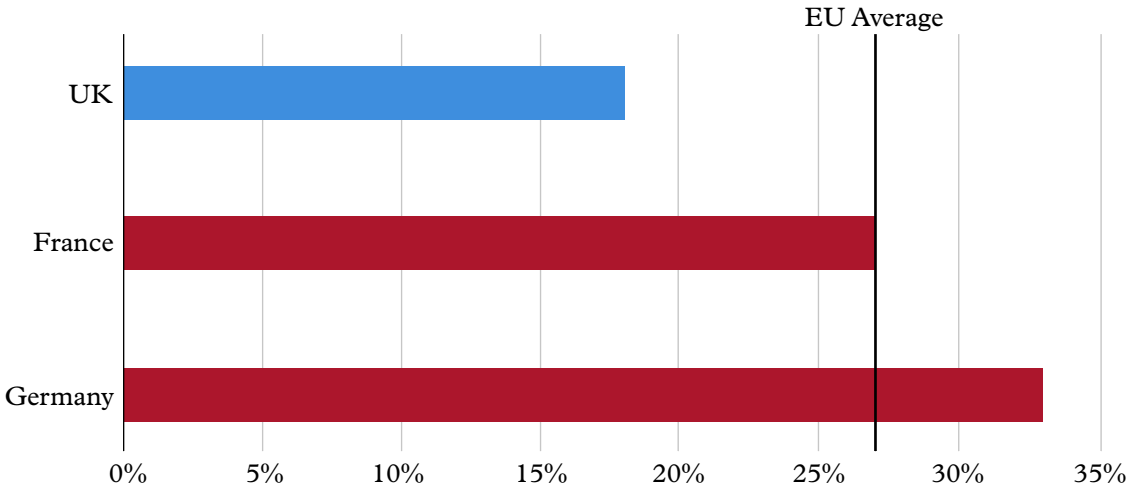
126. As previously mentioned, 64% of R&D in the UK is conducted by businesses yet this sector attracted just 18% of the total funds awarded to the UK through FP7. Figure 14 below shows a comparison between FP7 funding awarded to businesses in the UK and in key competitor nations Germany and France, alongside the EU average.

89 Q 63 (Prof Sir Leszek Borysiewicz)

90 Office for National Statistics, *UK Gross Domestic Expenditure on Research and Development, 2013* (March 2015): http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171778_398876.pdf [accessed 12 April 2016]

91 Written evidence from the Wellcome Trust Sanger Institute (EUM0030), the National Physical Laboratory (EUM0025), the John Innes Centre (EUM0010), the Centre for Ecology and Hydrology (EUM0053) and the Met Office (EUM0060)

Figure 14: Percentage of FP7 funding awarded to businesses in the UK and key competitor nations (2007–13)



Source: Written evidence from the Royal Society (EUM0067)

127. Participation of UK businesses in FP7 was below that of Germany and France and also below that of the EU average. However, this low participation was not uniform across the spectrum of UK business. The Royal Academy of Engineering highlighted UK SME participation to us:

> "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%."[92]

It appears that it is large businesses that are particularly underrepresented in the UK's EU funded research and innovation portfolio.

128. Dr David Hughes, Global Head of Technology Scouting, Syngenta, offered a view from a large business:

> "My impression is that Horizon 2020 was not really designed with big companies in mind. I think it was designed to encourage collaboration, primarily in the private sector, with small and medium-sized enterprises."[93]

129. We explored the difference between the participation of large businesses in Germany and the UK with Professor Siegfried Russwurm, Chief Technology Officer & Member of the Managing Board of Siemens AG. Professor Russwurm suggested that there are a number of cultural differences between the two countries that could account for the difference. He proposed that UK businesses are traditionally more self-sustaining while German businesses interact more closely with Governments and intergovernmental institutions. He suggested that there is considerable expertise in Germany in dealing with business-Government interactions and that there are a number of supportive industrial associations. [94]

130. It was also suggested that one of the reasons that UK business participation is low is due to inadequate support from the UK Government for applying

92 Written evidence from the Royal Academy of Engineering (EUM0066)
93 Q 70 (Dr David Hughes)
94 Q 94 (Prof Siegfried Russwurm)

for funds. Support was previously provided by the, now disbanded, Regional Development Agencies (RDAs). Responsibility lies with the Local Enterprise Partnerships (LEPs) and Innovate UK. Professor Ric Parker raised concerns with regards to this change in the support system for businesses:

> "The RDAs, through their innovation funds and their innovation boards, did a lot to stimulate engagement in Europe from the business community. The LEPs that have replaced them no longer have that prime objective and the funding to achieve that, so we are seeing less stimulation of UK industry to engage in the European programmes, which is regrettable."[95]

131. While we do not view the support previously provided by the RDAs as necessarily optimal, we recognise that it may have deteriorated with the advent of the LEPs. Professor Parker highlighted the role that Innovate UK has to play:

> "It is part of the formal remit of Innovate UK, if you look at their charter, to help in this way. Again, that is very London-centric and tends to be a website people can go to and it really needs to spill out into the regions a bit more."[96]

132. We are aware that changes made to H2020, in light of business interaction with FP7, to facilitate business interaction have been welcomed by some. The submission from EEF—the Manufacturers' Organisation, suggested that UK business participation in H2020 was proving more successful:

> "The programme is deliberately more geared towards industry, and this is paying off. The proportion of funding going to the private sector has increased from 24% to about 28%. A large share of this has gone to SMEs. In particular, the new SME instrument is benefiting smaller UK companies."[97]

133. Syngenta, however, remain reluctant to engage with H2020 projects. They outlined the reasoning behind this as:

> "the number of administrative processes that must be adhered to along with the unacceptable requirements surrounding any intellectual property generated through these projects. Therefore, as a company, we are unlikely to ever lead a Horizon 2020 bid and would only consider engaging in any Horizon 2020 projects where the intellectual property considerations made commercial sense."[98]

They highlighted further misgivings about the H2020 scheme:

> "Additionally, we believe the primary focus of the Horizon 2020 funding is misdirected. Often the questions being asked are very narrow, too focused and consequently fail to look at the bigger picture and address the fundamental issues. Looking at details in isolation without investigating how this then impacts the problem as a whole can lead to all sorts of poorly structured and inaccurate conclusions being drawn."[99]

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95 Q 32 (Prof Ric Parker)
96 Q 33 (Prof Ric Parker)
97 Written evidence from EEF—The Manufacturers' Organisation (EUM0006)
98 Written evidence from Syngenta (EUM0013)
99 Written evidence from Syngenta (EUM0013)

134. As alluded to previously, we did not receive sufficient evidence to make statements across the entire spectrum of sectors within the business community. However, from the range of evidence that we did receive, we discovered that the relevance of H2020 and EU schemes in general varies between industry sectors. We heard from Steve Bates, Chief Executive Officer, BioIndustry Association, that Horizon 2020 may arguably be working better in biomedicine than in the agro-industry area.[100]

135. **We are concerned that the participation of large UK businesses in Framework Programme 7 lagged behind that of key competitor nations such as Germany and France and was below the EU average. We recognise that participation in Horizon 2020 may be greater. However, we remain concerned, particularly in the light of the abolition of the Regional Development Agencies (RDAs) and introduction of the Local Enterprise Partnerships (LEPs), that UK Government support for businesses in engaging with EU funding schemes may be weaker than in some other Member States. The integrated approach adopted in other countries such as Germany could be viewed as a good model and a basis for a programme of benchmarking. For their part, however, we urge businesses to engage fully with the opportunities afforded by EU funding. We recommend that the UK Government benchmarks its level of support for businesses, large and small, wishing to participate in EU programmes with that available in other Member States and put forward proposals for improving UK performance.**

100 Q 70 (Steve Bates)

CHAPTER 5: COLLABORATION

136. Twenty-first century science does not recognise national boundaries; it is a global endeavour. No single country can act alone to address the challenges and threats facing society today. When modern-day scientific endeavours are considered as a whole, we agree with the two key trends identified by Dr David Hughes, Global Head of Technology Scouting, Syngenta:

> "The first one is convergence, which is the blurring of scientific boundaries. The second is internationalisation."[101]

137. Interdisciplinarity was touched on as part of our discussion of the EU's funding system for science and research in Chapter 4, and we will now focus on the internationalisation of science and the necessary collaboration this involves.

138. Concomitant with the evolution of this trend towards internationalisation has been the rise of 'big science'; that is, science performed on an increasingly large scale. We heard that while the USA was the pioneer initially, other countries have caught up. Professor Steve Cowley, Chief Executive of the UK Atomic Energy Authority (UKAEA) and Head of the EURATOM/ Culham Centre for Fusion Energy (CCFE), told us:

> "In the years since the early 1980s, Europe has become the world leader in big science. More and more science is progressing towards big science."[102]

139. The importance of scientific collaboration to the productivity and vitality of UK science and research was repeatedly highlighted. Indeed, it was perhaps the only area we explored where there was almost complete agreement. The submission from the Government identified the UK's top collaborative partners during 2008–12 as the United States, Germany, France, Italy, and Australia.[103]

140. Collaboration is vital across the spectrum of scientific disciples. However, its importance in the medical research sector was said to be particularly important. The Association of Medical Research Charities asserted:

> "In some instances, collaborative research is vital. For example in the case of rare cancers it is often necessary to recruit patients from multiple countries in order to conduct trials with sufficient numbers of participants."[104]

141. We received substantial evidence about the role that EU membership plays in facilitating collaboration. A number of times however, EU and European collaboration were conflated. We view the role of the EU in this respect to be tripartite in nature involving:

- The provision of collaborative funding schemes and programmes;
- The researcher mobility afforded by the requirement for freedom of movement; and

101 Q 74 (Dr David Hughes)
102 Q 2 (Prof Steve Cowley)
103 Written evidence from HM Government (EUM0071)
104 Written evidence from the Association of Medical Research Charities (EUM0052)

- The facilitating and fostering of participation in shared European research infrastructures.

142. Professor Dame Janet Thornton told us of the function of EU funding for science and research in terms of building collaborations: "EU grants serve to form the collaborative umbrella that joins together that nation state funding."[105]

143. The Government also emphasised the value of EU schemes over and above national funding programmes:

> "EU programmes and initiatives provide access to opportunities and co-operation on science and research that are often difficult to provide at national level, either because they are too costly (nuclear fusion, for example) or because the sample size in any one country is so small (rare diseases, for example)."[106]

144. We heard about how a supranational framework, like that provided by the EU, can simplify collaborations when compared to reliance on bilateral or multilateral agreements. Funding schemes that span Member States enable multinational collaborations that may not be possible with only national sources of funding—due to the complexities of aligning funding sources, timeframes and arranging a number of bilateral/multilateral agreements etc. Professor Dame Julia Goodfellow, President, Universities UK (UUK), was among those who stressed the importance of this aspect of EU funding:

> "this is money for cross-country collaboration so, from that point of view, it is very important and perhaps unique in some way."[107]

145. As outlined in Chapter 4, many EU funding schemes and programmes require or encourage collaboration—both between researchers in different Member States and between those in academia and industry. A number of submissions presented case studies of projects, programmes and organisations where EU involvement had been crucial. Individual details of these have not been included in this report but they represent a valuable resource and can be found in the written evidence.[108]

146. The EU aspires to the creation of a European Research Area (ERA) to capitalise on cross-continental collaboration and ensure maximum impact of resources. The Royal Society provided some explanation of the ERA:

> "This is intended to be: 'a unified research area open to the world based on the Internal Market, in which researchers, scientific knowledge and technology circulate freely and through which the Union and its Member States strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges.'"[109]

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105 Q 2 (Prof Dame Janet Thornton)
106 Written evidence from HM Government (EUM0071)
107 Q 63 (Prof Dame Julia Goodfellow)
108 The following submissions highlighted case studies: ISARIC and ERGO at the Centre for Tropical Medicine and Global Health, University of Oxford (EUM0041); Europlanet Consortium (EUM0045); National Physical Laboratory (EUM0025); the UK Atomic Energy Authority (EUM0024); the Wellcome Trust Sanger Institute (EUM0030); and ELIXIR (EUM0036)
109 Written evidence from the Royal Society (EUM0067)

147. There is no formal membership of the ERA; it represents a conceptual network rather than a tangible zone. The European Research Area and Innovation Committee (ERAC) monitors the ERA and comprises the Commission and Member States, with Associated Countries as observers. As part of the ERA the Commission also has partnership agreements with a number of representative bodies, such as Science Europe and the League of European Research Universities (LERU).

148. Collaboration, particularly the role that EU membership plays, is hard to quantify. It is very difficult to ascertain whether the UK's collaborative relationships would have developed in the same way without EU membership. Minister of State for Universities and Science, Jo Johnson MP, told us that:

> "I think it is undeniable that we were a big player in science long before the European Union came into existence. Many of our great universities have been around and were successful as centres of learning long before even the countries that are now part of the European Union came into existence"[110]

149. David Walker, Head of Policy at the Academy of Social Sciences, urged caution in over-emphasising the role of EU membership. He pointed out the complexity encountered in attempting to determine how collaborations were instigated:

> "There is a rich pattern of exchanges, but pinning responsibility for those to the European Union and its programmes is much more difficult."[111]

150. Professor Sir Leszek Borysiewicz highlighted the importance of attempting to quantify collaboration and presented some analysis:

> "If you take UK participation in that programme [Framework Programme 7, 2007–13], 100,000 collaborative links were established as a consequence; 18,500 of those were with Germany; France was second with nearly 13,000, and then Italy with 12,000. Consequential on those Framework Programme 7 links, 10,000 of those links were made within the UK."[112]

151. We also explored the relationship between EU membership and the development of non-EU and non-European collaborations. We considered suggestions that collaborative EU schemes can attract and facilitate interactions with non-European countries. Conversely, we also investigated concerns that the focus of the EU, and stipulation in some cases, on EU Member State and Associated Country collaborations can inhibit interactions with non-European countries.

152. Technopolis suggested that EU membership does not prohibit non-EU collaborations:

> "it [the EU] provides a framework that is often more attractive than inter-governmental agreements. The EU does not have legal competence over science policy in the Member States and there is nothing to prevent

110 Q 147 (Jo Johnson MP)
111 Q 42 (David Walker)
112 Q 63 (Prof Sir Leszek Borysiewicz)

> them [EU countries and non-EU countries] from working together outside of the EU framework in whichever way they choose."[113]

153. On international, non-EU collaboration and whether there is an 'opportunity cost' for Member States associated with having to collaborate with EU Member States, Dr Mike Galsworthy, Programme Director for Scientists for EU, argued the contrary. He described the EU as a "catalyst for our capacity to reach around the globe".[114] He elaborated on Horizon 2020 and non-EU/non-European participation as follows:

> "The size of the programme means that it is comprehensive in subject areas and well-known as a brand—ensuring a certain quality—and therefore, should other countries, such as the US, want to collaborate with the UK, there is a huge channel of potential for doing that through the EU programme, because of all these factors and because you can bring in other partners."[115]

154. As alluded to by Dr Galsworthy, the EU has international agreements for scientific and technological co-operation with 20 countries. These create a framework for participation in joint projects, sharing of facilities, staff exchanges or the organisation of specific events.

155. Professor Robin Grimes, Chief Scientific Adviser, Foreign and Commonwealth Office, cited an example of the role of the UK's EU membership in facilitating interactions with a non-EU, non-European country. On UK-Chinese scientific interactions, he told us:

> "We work with the EU in China to maximise our policy impact and our influence in China to make changes to the enabling framework, which allows better conditions for UK-China collaboration, including on intellectual property protection, for example, where we align our lobbying with the EU and use the EU-China dialogue to push forward on that sort of difficult issue. Again, we come back to the point that it [EU membership] really complements our bilateral activities in this regard."[116]

156. UKspace also suggested a positive role for EU membership in facilitating international connections:

> "One of the benefits of Britain's EU membership is that non-EU organisations (from USA, Japan, etc.) often find UK organisations attractive for collaboration because of our EU membership."[117]

157. **It was repeatedly put to us that one of the most significant aspects of the UK's EU membership is the provision of opportunities to collaborate. We view the EU to have three main influences: the provision of collaborative funding schemes and programmes; ensuring researcher mobility; and facilitating and fostering participation in shared pan-European research infrastructures.**

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113 Written evidence from Technopolis (EUM0037)
114 Q 132 (Dr Mike Galsworthy)
115 Q 132 (Dr Mike Galsworthy)
116 Q 124 (Prof Robin Grimes)
117 Written evidence from UKspace (EUM0028)

158. **Many would maintain that the provision of collaborative opportunities is perhaps the most significant benefit that EU membership affords science and research in the UK. These collaborative opportunities are not just between Member States but can extend to non-EU and non-European countries.**

Researcher mobility

159. Freedom of movement is a fundamental principle of the EU enshrined in Article 45 of the Treaty of the Functioning of the EU (TFEU). This entitles EU citizens to:

- Look for a job in another EU country;
- Work there without requiring a work permit;
- Reside there for that purpose;
- Stay there even after employment has finished; and
- Enjoy equal treatment with nationals in access to employment, working conditions and all other social and tax advantages. [118]

160. Free movement of workers also applies, in general terms, to countries in the European Economic Area (EEA): Iceland, Liechtenstein and Norway. There is also a bilateral agreement in place with Switzerland.

161. In the context of science and research, freedom of movement enables mobility of researchers/students and simplifies the recruitment of scientists from EU Member States and the EEA (plus Switzerland) to the UK. There was a very strong consensus in the evidence we received from across the science community—academia, industry and charities—of the value of researcher mobility afforded by freedom of movement.

162. We heard particularly strong assertions from the UK higher education (HE) sector. Professor Sir Peter Downes, Convenor of Universities Scotland and Principal & Vice-Chancellor, University of Dundee, offered one such opinion:

> "The principle of freedom of movement of people is not only one of the most important principles of the EU but one of the most important benefits of EU membership to higher education in the UK."[119]

163. Professor Sir Mark Walport, Government Chief Scientific Adviser, also highlighted its importance and provided some quantification:

> "At the moment, 30% of European Research Council grantees working in the UK come from other Member States; and 15% of UK academic staff are from continental Europe, which compares with 11% of the whole of non-EU, so not only the funding but the people are very important."[120]

164. The business community emphasised the positive impact that researcher mobility has on their ability to recruit the most talented staff. Professor Ric Parker, Director of Research and Technology, Rolls-Royce plc, representing

118 European Commission, *Employment, Social Affairs and Inclusion: Free Movement—EU nationals*: http://ec.europa.eu/social/main.jsp?catId=457 [accessed 12 April 2016]
119 Q 66 (Prof Sir Peter Downes)
120 Q 147 (Prof Sir Mark Walport)

the Royal Academy of Engineering, highlighted the value of the EU's principle of freedom of movement to Rolls-Royce plc, citing how it enables easy movement of employees across the company's multiple European sites.[121]

165. A number of EU schemes enable researcher and student mobility across the Europe including the Marie Skłodowska-Curie actions (MSCA) and Erasmus Plus schemes (see Chapter 4, Figure 2 for how these schemes fit into the EU environment that supports science and research). These schemes were frequently praised.[122]

166. Movement of researchers and students in two directions is vital. This enables both talented individuals to enter the UK as well as allowing UK citizens to develop specialised skills and knowledge overseas. Professor Andrew Harrison, Chief Executive, Diamond Light Source, suggested this as a reason for the excellence within the UK science community:

> "The reason why many UK scientists are as trained and skilled as they are is that they have also gone abroad."[123]

167. A corollary of the ease of researcher mobility within the EU and EEA (plus Switzerland) could be that international, non-European researchers are put at a disadvantage. However, we did not receive substantial evidence of such a disadvantage. Instead, we consider that it is the UK's own immigration policy, rather than the ease of researcher mobility within the EU and EEA (plus Switzerland), that underlies any disadvantage to non-European researchers. Although outside the scope of our inquiry, we heard a number of concerns about the current visa system for the recruitment of non-EU researchers and students.[124]

168. The prospect of a restriction in researcher mobility has sparked wide concern across the science and research community. The submission from Syngenta highlighted a perspective from large business:

> "[if] restrictions were placed on recruitment from the EU then Syngenta's ability to employ the best talent and scientific minds would be compromised. This would not only impact our ability to remain as one of Syngenta's leading R&D sites but would also hinder the professional development of our UK scientists due to reduced interactions."[125]

169. Professor Siegfried Russwurm, Chief Technology Officer & Member of the Managing Board of Siemens AG, shared these concerns and presented an example to us of how Siemens reacted when researcher mobility was curtailed in South Africa:

> "The South African Government have greatly tightened the inflow of qualified workers, with the result that as this expertise is not available on the labour market in South Africa, we [Siemens] have reduced our activities and refrained from offering some of our Siemens systems because, frankly, we do not have the qualified experts."[126]

121 Q 39 (Prof Ric Parker)
122 See evidence from Q 49 (Prof Dame Helen Wallace), Q 50 (Sir Emyr Jones Parry) and Universities UK (EUM0054)
123 Q 14 (Prof Andrew Harrison)
124 See evidence from Q 14 (Prof Paul Boyle), Q 39 (Prof Ric Parker), Research Councils UK (EUM0016), the Russell Group (EUM0069), Universities UK (EUM0054) and University Alliance (EUM0065)
125 Written evidence from Syngenta (EUM0013)
126 Q 102 (Prof Siegfried Russwurm)

170. Restriction of researcher mobility is, of course, a hypothetical scenario and not inevitably a consequence of the UK leaving the EU (see Chapter 6, Scenarios).

171. **The researcher mobility afforded by the EU's fundamental principle of freedom of movement is of critical importance to the UK science community, including academia, businesses and charities. It is vital that the flow of researchers—both coming to the UK and UK nationals working overseas—is not restricted. We conclude that researcher mobility must be protected if UK science and research is to remain world-leading.**

172. **Our report on international science, technology, engineering and mathematics (STEM) students, published in 2014, highlighted concerns about the negative impact of Government immigration policy on international recruitment from outside the EU.**[127] **We are concerned that this situation appears to have changed little since the publication of our report and we recommend that the Government reviews its policy in this area.**

Shared research infrastructures

173. Sharing large research infrastructures (RIs) allows greater efficiencies of cost, collaborative opportunities and access to a wider range of facilities than would be possible if hosted alone. We explored this area in detail in our report on scientific infrastructure.[128]

174. Europe hosts a number of shared RIs. Indeed, Professor Steve Cowley, Chief Executive Officer, UK Atomic Energy Authority, told us that: "many of the great scientific instruments of our time, of the 21st century, are now in Europe."[129]

175. Professor Cowley continued:

> "There is no question but that the European infrastructures have made us better and, by making us better, they make us collaborate with more people in the world."[130]

176. EU membership is not a requirement to participate in most shared European RIs. However, the EU does play a role in the participation of Member States and Associated Countries. Professor John Womersley, Chief Executive Officer of the Science and Technology Facilities Council (STFC) and current Chair of the European Strategic Forum on Research Infrastructures (ESFRI), outlined the function and limits of the European Commission in facilitating collaborations to address large scale challenges:

> "the way to address these big science questions requires international collaboration and the pooling of resources. The mechanisms to do that are facilitated by the European Commission, but not funded by it"[131]

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127 Science and Technology Committee, *International Science, Technology, Engineering and Mathematics (STEM) students* (4th Report, Session 2013–14, HL Paper 162)

128 Science and Technology Committee, *Scientific Infrastructure* (2nd Report, Session 2013–14, HL Paper 76)

129 Q 2 (Prof Steve Cowley)

130 Q 6 (Prof Steve Cowley)

131 Q 108 (Prof John Womersley)

177. Wide access to many RIs is available to non-EU Member States as well as to countries outside Europe. We have found there to be confusion within the science community with regards to which infrastructures are *EU*-managed and which are *European* in nature. In terms of the latter, the UK is involved directly rather than as a Member State of the EU.

178. Although not a pre-requisite for involvement, EU membership can facilitate influence and provide platforms to collaborate. The European Commission outlined their role in European shared RIs:

> "The scope of the research infrastructures part of the programme is to facilitate the development of world-class research infrastructures in Europe, to integrate and open national research infrastructures, to foster the innovation potential of the infrastructures and their human resources, and to reinforce European policy and international cooperation through synergies by setting up partnerships between relevant policy makers, funding bodies or advisory groups."[132]

179. Pan-European RIs are funded by participating countries. The EU can aid planning and coordination of these through the European Strategic Forum on Research Infrastructures (ESFRI). ESFRI aims to support a coherent, strategy-led approach to policy-making on research infrastructures in Europe, and to facilitate multilateral initiatives leading to the better use and development of research infrastructures. Professor John Womersley is the current Chair of ESFRI. He told us of the nature and function of the group:

> "ESFRI is hosted by the European Commission: That means it provides meeting rooms and a secretariat, but it has no budget from the EC; in fact, it has no budget from anywhere. It is a set of delegates from national governments who come together to construct a mutually agreed roadmap of next-generation scientific facilities that they will then voluntarily decide to join or not, on the basis of individual national contributions."[133]

180. The UK hosts the headquarters of five pan-European RIs. These are:

- ELIXIR (European Life-science Infrastructure for Biological Information) in Hinxton, Cambridgeshire;
- Integrated Structural Biology Infrastructure (INSTRUCT) in Oxford;
- Infrastructure for Systems Biology-Europe (ISBE) in London (Imperial College);
- Square Kilometre Array (SKA) in Manchester (Jodrell Bank); and
- European Social Survey (ESS ERIC) in London (City University).

181. In addition, the UK houses ten facilities that are part of pan-European RIs headquartered in other European countries and is also a member of pan-European RIs entirely based outside the UK, such as the European Hard X-Ray Free Electron Laser (European XFEL) based in Germany.

132 Written evidence from European Commission (EUM0081)
133 Q 108 (Prof John Womersley)

182. As well as being involved with pan-European RIs, the UK is also a part of intergovernmental research organisations, including CERN and the ITER fusion experiment. Each of these organisations has its own institutional arrangements and membership rules. The EU plays a different role in each; some were founded before the formation of the EU. It is difficult to quantify the role of the EU in forming and/or maintaining these bilateral and multi-lateral intergovernmental collaborations and, for those founded after the EU was created, to assess whether they would have developed in its absence.

183. Professor John Womersley told us that the UK had been hesitant in hosting shared RIs in the past. However, he indicated that this attitude had now changed:

> "I think that [attitude] has shifted because we have rediscovered the knowledge that there are long-term benefits to having such things on our soil. Those come from the economic impacts, the spin-outs; from the fact that these facilities serve as an ecosystem for small businesses, or even for large companies to locate around them, and that they have a pool of staff who can go on to stimulate economic activity."[134]

184. The next section will look at three pan-European RIs and two intergovernmental research organisations in more detail: the European Molecular Biology Laboratory-European Bioinformatics Institute (EMBL-EBI) and ELIXIR; the European Social Survey (ESS); the European Organisation of Nuclear Research (CERN); and the ITER nuclear fusion experiment. These will serve to highlight the difference between European science and EU science and are chosen to reflect the variety and nature of different types of European and/or EU collaborative infrastructure projects.

European Molecular Biology Laboratory European Bioinformatics Institute (EMBL-EBI) and ELIXIR[135]

185. The European Molecular Biology Laboratory (EMBL) conducts basic research in molecular biology, engages in technology development and provides infrastructure, facilities, training and services for researchers.

186. An intergovernmental treaty organisation established in 1974, EMBL has 21 countries as full members. All of these countries are European; there are two non-European associate Member States (Australia and Argentina). Countries with full membership include both EU Member States and non-Member States; EU membership plays no part in allowing membership of EMBL.

187. EMBL's headquarters and main laboratory are located in Heidelberg, Germany. All four countries that house EMBL outstations are Member States. The outstations are:

- EMBL-EBI (The European Bioinformatics Institute) Hinxton, UK;
- EMBL Grenoble, France;

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134 Q 111 (Prof John Womersley)

135 Royal Society, *UK research and the European Union: The role of the EU in funding UK research* (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 12 April 2016], Written evidence from the European Bioinformatics Institute (EUM0038) and the European Molecular Biology Laboratory website: http://www.embl.org/ [accessed 12 April 2016] Much of the information that follows is drawn from these sources.

- EMBL Hamburg, Germany; and
- EMBL Monterotondo, Italy.

188. EMBL member countries make a contribution to EMBL's programmes, receive access to all services and programmes and are responsible for all important decisions about the organisation and its activities taken in the EMBL Council. Associate Member States have a reduced membership contribution to the budget of the laboratory and participate in EMBL Council meetings as observers.

189. EMBL exists and acts independently from the EU, but synergises activities with the European Commission. Cooperation is based on a Memorandum of Understanding implemented through biannual work plans. This agreement grants the European Commission 'observer status' in EMBL.

190. The UK was the third highest individual contributor to EMBL in 2014, after Germany and France. EMBL does not receive direct funding from the EU; however, EU funding programmes for research remain the biggest external funding source for EMBL. In 2014, 30% of the external funding awarded to EMBL originated from the EU.

191. The branch of EMBL located in the UK, EMBL-EBI, hosts the European Life-science Infrastructure for Biological Information (ELIXIR). ELIXIR is a pan-European research infrastructure (RI) for biological data. It is an initiative to coordinate, sustain and integrate Europe's life science bioinformatics resources. Sixteen countries (as well as EMBL) are members of ELIXIR; these are all European and include Member States and non-Member States such as Switzerland, Norway and Israel. An additional two countries have observer status. ELIXIR has been recognized by ESFRI as a priority Research Infrastructure for Europe, and has since been awarded a major Horizon 2020 grant in recognition of this.

192. Though EU membership does not influence the UK's ability to be a member of EMBL or ELIXIR, it was suggested to us that EU membership does play a role in the location of EMBL laboratories and the decision to headquarter ELIXIR in the UK. The submission received from EMBL-EBI stated:

> "EMBL-EBI would not have been able to participate so fully, or even at all, in these infrastructure projects were the UK not an EU member, and EMBL-EBI's selection as the hub for ELIXIR would certainly have been in question were the UK not part of the EU."[136]

193. Professor Dame Janet Thornton, former Director of EMBL-EBI and coordinator of the preparatory phase of ELIXIR, said of the establishment of ELIXIR:

> "I do not think that would have happened if we were not part of the EU."[137]

136 Written evidence from the European Bioinformatics Institute (EUM0038)
137 Q 6 (Prof Dame Janet Thornton)

European Social Survey (ESS)[138]

194. The European Social Survey (ESS) is a pan-European research infrastructure whose headquarters are located within City University in London.

195. The ESS was one of the first RIs to be awarded European Research Infrastructure Consortium (ERIC) status. ERIC status was developed by the European Commission to provide a supranational legal framework to facilitate the creation of shared research infrastructures between EU countries in response to concerns that national laws did not fulfil the needs of new European infrastructures.[139] Only Member States, Associated Countries, Third Countries (other than Associated Countries) and intergovernmental organisations can be members of an ERIC. Twelve research infrastructures, including ESS, currently have ERIC status.[140] We heard from Professor Kurt Deketelaere about the value of the development of ERIC status:

> "the ERIC regulation that the European Union has adopted, which makes it possible to negotiate to organise in a legal way consortia for the building up of research infrastructure, this has been a very beneficial initiative."[141]

196. The ESS ERIC is a cross-national survey that has been conducted every two years in Europe since 2001. It measures the attitudes, beliefs and behaviour patterns of diverse populations in more than 30 nations.

197. There are 15 member countries of the ESS ERIC, 14 of which are EU Member States. Norway has recently joined but is not an EU Member State. The single observer country is Switzerland. All participating countries are required to contribute to the central coordination costs of the ESS ERIC; this contribution is made up of a basic membership fee and an additional amount, calculated according to the GDP of each country.

198. Professor Paul Boyle, President and Vice-Chancellor, University of Leicester, told us of the value of the UK's participation in the ESS ERIC:

> "One country could not establish it financially, but there is also the question of getting the buy in from the various organisations that need to be involved. Similarly, if you are not one of the players, you do not shape and influence the survey questions to anywhere near the same degree as the countries that are contributing through the European collaboration. Although we allow other countries to be involved, inevitably the influence on how that survey shapes up is challenging if you are not one of the funders through the European Community."[142]

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138 European Society Survey: http://www.europeansocialsurvey.org/ [accessed 12 April 2016] Much of the information that follows is drawn from this source.

139 On 2 December 2013, the Council adopted the Council Regulation EU n° 1261/2013 amending the Regulation EC 723–2009 concerning the ERIC. The participation of countries associated to the EU Research Framework Programmes in ERICs is now on the same footing as EU Member States. Their contributions to ERICs will be fully reflected in terms of membership and voting rights. The regulation entered into force on 26 December 2013.

140 European Commission, *Research and Innovation*, *Infrastructures*, *European Research Infrastructure Consortium (ERIC)* (February 2016): https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=eric#eric [accessed 12 April 2016]

141 Q 8 (Prof Kurt Deketelaere)

142 Q 13 (Prof Paul Boyle)

European Organisation of Nuclear Research (CERN)[143]

199. The European Organisation of Nuclear Research (CERN) is an intergovernmental research organisation, the facilities of which are situated near Geneva in Switzerland. The largest particle physics laboratory in the world, CERN houses particle accelerators and detectors, such as the Large Hadron Collider. CERN organises and sponsors international research collaborations, promoting contacts between scientists and interchange with other laboratories and institutes. The experiments conducted at CERN are the result of large-scale international collaborations.

200. The UK is involved directly in CERN as one of 21 member nations. Members include 18 EU Member States as well as Switzerland, Norway and Israel. Professor John Womersley emphasised to us that the facilities hosted by CERN are a European rather than an EU research infrastructure:

> "when you talk about things such as CERN as a European success, indeed it is, but it is a voluntary collaboration of European governments and, in fact, it predates the establishment of the European Union."[144]

201. A number of nations from outside Europe have non-member status at CERN, meaning they do not participate in organisational decision making but have co-operation agreements to participate in specific projects.

202. The EU is not directly involved in the organisation of CERN activities nor its policies but has 'Observer Status'. In 2014, the EU provided 1.6% of CERN's funding. While this direct investment from the EU at CERN is relatively low, EU-funded research projects conduct work at CERN and collaborate with researchers who conduct work at CERN. Research Councils UK (RCUK) said of the interactions between CERN and the EU:

> "CERN then engages in a broad portfolio of EU-funded programmes for research and e-infrastructures, for example through providing key inputs into coordinating the EU-funded computing grid initiative alongside its USA and other regional counterparts, to build a global computing infrastructure. EU funding has contributed to the development of the high luminosity upgrades for the Large Hadron Collider (LHC) and the development of advanced detector technologies."[145]

The ITER nuclear fusion experiment[146]

203. ITER is a multinational project and involves the EU, China, India, Japan, South Korea, Russia and the USA. It is an intergovernmental research organisation and the UK's contribution is managed by the EU; the UK is not involved directly. As Professor John Womersley said to us:

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143 Royal Society, *UK research and the European Union: The role of the EU in funding UK research* (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 12 April 2016] and CERN: http://home.cern/ [accessed 12 April 2016] Much of the information that follows is drawn from these sources.

144 Q 108 (Prof John Womersley)

145 Written evidence from Research Councils UK (EUM0016)

146 Royal Society, *UK research and the European Union: The role of the EU in funding UK research* (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 12 April 2016] and ITER: https://www.iter.org/ [accessed 12 April 2016] Much of the information that follows is drawn from these sources.

> "ITER/JET at Culham is one of the few areas where there really is an EU flag on the outside of a big research project."[147]

204. ITER is intended to demonstrate the scientific and technological feasibility of nuclear fusion as an energy source and to pave the way for a functioning fusion power plant. When construction is complete, it will be the world's largest experimental tokamak nuclear fusion reactor. It is located in the south of France.

205. The EU's commitments to the ITER Agreement were agreed through the European Atomic Energy Community (EURATOM) Treaty.[148] The EU is contributing 45% of the construction phase (buildings, machine components and assembly) cost and 34% of the cost of operation, deactivation and decommissioning of the facility. The other six parties are contributing approximately 9% each. The current cost estimates for the EU contribution to the ITER construction phase (2007–20) amount to €6.6 billion. UK industry has so far been awarded over €300 million worth of contracts as part of the ITER project (ranked third behind France and Italy).

206. The UK Atomic Energy Authority (UKAEA) is involved in the UK's interactions with ITER via the EU. On the UK's membership of the EU and the effect this has on collaboration, the submission from the UKAEA stated:

> "Full involvement means that the UK has excellent unhindered access to facilities, leading science teams and the R&D developed, including JET and ITER. Indeed, EU funding and collaboration is essential to sustain the world leading capability of Culham and to position the UK in the technologies of the future fusion (and fission) economy."[149]

207. **The UK gains significant value from being involved in a number of pan-European Research Infrastructures (RIs), both as a host country and as a user of facilities hosted outside of the UK. We conclude that such European based, but non-EU, RIs, although formally independent of the EU, are in fact interlinked to varying degrees.**

147 Q 111 (Prof John Womersley)

148 Initially created to coordinate the Member States' research programmes for the peaceful use of nuclear energy, the Euratom Treaty today helps to pool knowledge, infrastructure and funding of nuclear energy. It ensures the security of atomic energy supply within the framework of a centralised monitoring system. EUR-Lex Access to European Union Law, *Treaty establishing the European Atomic Energy Community (Euratom)* (October 2010): http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV%3Axy0024 [accessed 12 April 2016]

149 Written evidence from the United Kingdom Atomic Energy Authority (EUM0024)

CHAPTER 6: SCENARIOS

208. Our inquiry was principally concerned with exploring the ways in which EU membership affects UK science and research. Inevitably, however, discussions veered towards consideration of the implications of Brexit. As such, a range of hypothetical arrangements and situations were contemplated. We do not wish to dwell unduly on the almost limitless number of post-Brexit scenarios, but there is value in highlighting the main arguments and hypotheses that were rehearsed. Furthermore, we offer some areas which merit attention in the event of the UK choosing to remain in the EU.

Repatriation of EU funds

209. It was suggested that, in the event of Brexit, the UK Government could re-invest an amount equivalent to current EU funds for science into the national science budget. There was, however, no absolute consensus regarding the likelihood of this scenario. Professor Dame Helen Wallace, representing the British Academy, speculated that:

> "The Treasury—George Osborne at least is very keen on science, as we know—might allow for some enhanced science spending, but it would not necessarily have the same criteria of mobility and international collaboration that characterise European funds. My guess is that it would be not as much, it would not be ring-fenced and it would have different characteristics."[150]

210. Professor Angus Dalgleish, spokesperson for Scientists for Britain, thought it likely that the Government would re-invest equivalent funding into the science budget:

> "I think that it would be for a scientist to lobby so that money came back from the Government, because the Government would have more than enough to be able to do it without having to lose elsewhere. I think that would have to make it very likely."[151]

211. Mr Emran Mian, Director, Social Market Foundation argued, however, that it was hard to imagine science and research funding being an immediate priority:

> "In principle, there is no reason why the gap would not be made up. It is a very hopeful position, not least because in the event of Brexit there would be quite significant economic pressure not only on sterling—and the depreciation of sterling has direct impacts on how research moneys are spent or allocated—but, equally, there would be other economic risks to the UK. It might be that over time those risks would be smoothed out, so if you looked at it over 20 or 30 years the UK might be fine, but the immediate impact would be negative. It is very difficult to see in that negative scenario why science and research would be a priority for the UK."[152]

212. The University of Manchester asserted that there were three arguments which countered the view that if the UK were to leave the EU funds would

150 Q 47 (Prof Dame Helen Wallace)
151 Q 131 (Prof Angus Dalgleish)
152 Q 131 (Emran Mian)

be invested nationally. Moreover, they queried the desirability of forfeiting the EU funding stream:

- There is "no guarantee" that repatriated funds would be designated for research;
- Research flourishes when there is plurality of funding sources; and
- In some circumstances more value can be achieved from a research investment made at EU level, as there is "ample evidence of inefficiencies and delays caused by the need of national agencies operating under different rules, priorities and timescales seeking to co-fund a shared project."[153]

213. Furthermore, the Minister of State for Universities and Science, Jo Johnson MP, himself expressed uncertainty regarding the likelihood of repatriating funds:

> "it would be rash to pretend that it would be easy to replace it [the financial contribution from the EU to UK science and research] in the event of Brexit when we would not know what other claims there might be on the public purse, nor what state our economy would be in."[154]

Contingency planning in the event of Brexit

214. Given the consensus regarding the importance of EU funding for UK science and research, we sought to determine whether a process of contingency planning in the event of Brexit had been initiated within the Department for Business, Innovation and Skills.

215. After repeated questioning, the Minister of State for Universities and Science, Jo Johnson MP, was not able to confirm that contingency plans were being prepared for science in the UK. Instead, he said:

> "This is a question for the whole of Government with respect to the EU referendum and possible outcomes of it. The Government are campaigning for a positive vision for Britain within a reformed European Union, and all efforts are focusing on making sure that we have a positive campaign in which the facts are out there and people are able to make an informed choice."[155]

A new regulatory framework for the UK

216. Attention also turned to whether the UK would be able to develop a more suitable regulatory environment in the event of Brexit. Such a scenario is plausible, as the Russell Group stated:

> "There are a number of EU regulatory frameworks that adversely affect the science and research community. It is possible that if the UK were to leave the EU the UK may have more flexibility to set its own regulations which may be beneficial for science and research."[156]

217. Vote Leave suggested that:

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153 Written evidence from the University of Manchester (EUM0044)
154 Q 157 (Jo Johnson MP)
155 Q 148 (Jo Johnson MP)
156 Written evidence from the Russell Group (EUM0069)

> "Outside the EU, the UK would have the power to reconsider these Directives and Regulations. As EU law would no longer be supreme, the UK Parliament would be able to revise them to reduce the burden."[157]

218. Syngenta indicated that there could be value in the UK developing its own regulatory regimes:

> "Leaving the EU could mean that the UK would be free to introduce more scientific, risk and evidence-based approaches to the regulation of agricultural technologies, and therefore could be better placed to provide UK farmers with the latest advances."[158]

219. The Royal Society of Chemistry, however, wrote of the difficulties that might flow from having differing regulatory regimes:

> "In relation to regulation, a point made by industry respondents was the potential for divergent regulatory frameworks if the UK left the EU. The ability for the UK to set its own regulation was not viewed positively due to the perception that businesses would still need to comply with EU regulation, as well as any newly-developed UK regulation."[159]

220. Similarly, the Wellcome Trust argued that:

> "If the UK left the EU, while it could develop its own regulatory framework, which might have a national advantage, it would still be bound by some EU regulation, for example for large scale clinical trials. This would also be without the same opportunities the UK currently has to shape the content of legislation."[160]

Mobility

221. Scientists for Britain suggested to us that freedom of movement would not necessarily be restricted upon Brexit. They told us that: "EU membership has no bearing whatsoever on this topic."[161] They continued:

> "Ending EU membership does not on its own predicate a change in freedom of movement. There are several non-EU European states that maintain free movement with the EU. Freedom of movement would have to be assessed separately by the UK electorate if voters had chosen to leave the EU."[162]

222. Emran Mian, Director, Social Market Foundation, suggested to us, however, that: "It is very difficult for me to see a scenario of Brexit in which researcher mobility is not in some way impaired."[163] He argued that mobility was important because researchers coming to the UK from other EU countries :

> "bring a set of networks already with them and we then take advantage of those networks in making our universities and research projects more competitive in funding."[164]

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157 Written evidence from Vote Leave (EUM0056)
158 Written evidence from Syngenta (EUM0013)
159 Written evidence from the Royal Society of Chemistry (EUM0051)
160 Written evidence form the Wellcome Trust (EUM0034)
161 Written evidence from Scientists for Britain (EUM0075)
162 Written evidence from Scientists for Britain (EUM0075)
163 Q 129 (Emran Mian)
164 Q 129 (Emran Mian)

223. Furthermore, he questioned those arguing that the UK's strong networks across the EU would be maintained as:

> "some of these relationships change very quickly, and, of course, the frontier of knowledge changes very quickly, and the researchers who will be important in 10 years' time are not the researchers who might currently be in the UK or currently have associations with UK universities."[165]

224. He concluded:

> "The real question is how we would maintain mobility and the making of connections. That feels to me very much like a leap in the dark in the event of exit. For me, the biggest area of hesitation is what would happen to researcher mobility and what impacts that would have."[166]

Associated Country Status

225. The implications of the UK leaving the EU and becoming an Associated Country were raised on numerous occasions. As previously outlined in Chapters 4 and 5, non-Member States can participate in EU funding schemes and collaborative platforms. There is therefore an argument that the UK could reap the rewards of EU membership in the event of Brexit by gaining Associated Country status. It was put to us, however, that were the UK to leave the EU, then the UK may face consequences which would mitigate against a smooth and fruitful change in the nature of the relationship. Professor Dame Janet Thornton speculated that "if we left the EU we have no doubt that there will be retribution."[167]

226. There are currently 13 Associated Countries including Norway, Iceland, Israel and Switzerland.[168] These countries are not members of the EU but participate in EU Framework Programme funding schemes. Bilateral agreements are in place with each Associate and terms of association vary from one country to another. Associated Countries generally contribute to EU budgets based on GDP and researchers can apply for funding as those in Member States do. Thus, in the case of funding awarded on the basis of research excellence, Associated Countries are able to be net gainers in terms of funding.

227. Scientists for Britain cited the examples of Norway, Switzerland, Turkey, Iceland and Israel as non-EU countries that participate in and contribute to the science programmes operated via the EU, arguing that if the UK were to leave the EU, it would be perfectly possible to continue to participate in EU science networks in a similar vein.[169]

228. While there was broad agreement that Associated Country status could afford the UK access to EU funding schemes, concerns were raised about the level of influence that the UK would be able to have in decision-making processes and within advisory panels. The UK currently has significant influence on the development of EU policy for science. It is not entirely clear how this would be affected in the event of termination of membership and adoption of Associated Country status.

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165 Q 135 (Emran Mian)
166 Q 135 (Emran Mian)
167 Q 6 (Prof Dame Janet Thornton)
168 See Appendix 6 for a full list of Associated Countries.
169 Written evidence from Scientists for Britain (EUM0075)

229. We were presented with forthright views that the UK, in the event of becoming an Associated Country, would lose its seat at the table when decisions were being made. Professor Dame Helen Wallace, representing the British Academy, claimed that:

> "What the British would lose in that scenario is the opportunity to be full participants in shaping the direction of travel of programmes, because you would be takers, not makers, of the policy process and guidelines."[170]

230. Sir Emyr Jones Parry, GCMG, President, the Learned Society of Wales, argued:

> "The point is that we would be impoverished, diminished, by taking that course of action [leaving the EU]. That is not an argument against universities being international; of course they are international much beyond the European Union, but the EU dimension in what it has brought—the competitiveness, the incentive, the resources—has actually benefited very considerably the sector."[171]

231. Professor Kurt Deketelaere, Secretary-General, League of European Research Universities (LERU), stressed the importance of having a voice in discussions:

> "It is important to be around the table, to be able to say what the problems are and what the solutions should be. Simplification, excellence and investment in research and innovation are going to become much more difficult if you are no longer around the table and no longer have a voice."[172]

232. Professor Sir Leszek Borysiewicz, Chair of the Russell Group's EU Advisory Group, and Vice-Chancellor, University of Cambridge, expressed concerns relating to intellectual property:

> "Associated member status carries with it a huge disadvantage, particularly if we think of the outcomes of that research as they will pertain to the capacity of the UK to exploit them. If you are an associated country you have to negotiate that position on intellectual property in a separate way because you do not form part and parcel of those areas. Were we outside the European Union, it is quite likely that we might still be invited because of the quality of research that is undertaken in Europe, but there is no way that any discoveries would then be exploited necessarily in the UK because we would not hold the intellectual property; it would be held by member states. I believe that being there is a huge advantage."[173]

233. It would seem likely that scientists from Associated Countries participating in EU programmes are able to have some influence, at least at an operational level. The point was repeatedly made to us, however, that they would wield no influence when the high level, strategic decisions were made. Professor Robin Grimes, Chief Scientific Adviser, FCO, argued:

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170 Q 51 (Prof Dame Helen Wallace)
171 Q 51 (Sir Emyr Jones Parry)
172 Q 2 (Prof Kurt Deketelaere)
173 Q 63 (Prof Sir Leszek Borysiewicz)

> "There are some non-EU countries that are part of the European research area and they sit on the European research area committee, but they do not get a seat at the table when the Council of Ministers or the Parliament are setting the rules or deciding on budgets and planning programmes."[174]

234. Similarly, Dr Mike Galsworthy, Scientists for EU, argued:

> "If we were to pull out, then we would no longer have our Government representing us in the Council nor our 73 MEPs. In deciding, two things are important. One is the legislation around science, which is rapidly changing, and the second is actually the nature and the priorities of the science programme itself. In both of those, there are priorities set initially at the Commission level, listening to all the interests of those around them, which will be prioritised for their members over any external parties. That filters down through the Parliament, which would have to agree to it, in which we would have no representation."[175]

235. **The UK might wish to become an Associated Country in the event of Brexit. We heard, however, strong views that the UK would lose its influence and roles in setting strategic priorities and in decision-making. If Associated Country status were to be pursued, further investigation would be required in order to ascertain to what extent, and at what expense, the UK's currently influential position would be diminished.**

Switzerland

236. Much of our consideration of Associated Country status was viewed through the lens of the example of Switzerland, and we think it is instructive to consider the Swiss example in a little more detail. As a world-renowned, high-performing scientific nation and non-member of the EU, Switzerland was repeatedly highlighted as an example that the UK could follow in the event of Brexit.

237. Switzerland is not a Member State, nor a member of the European Economic Area (EEA); it is, however, an Associated Country and a participant in the single market. Switzerland participates in the EU's fundamental principle of freedom of movement via a bilateral agreement.[176] Thus, Swiss nationals are afforded the same mobility as those from Member States (and member countries of the EEA) are.

238. While we heard a number of arguments for why EU membership is vital for various aspects of science, the example of Switzerland—a research community thriving in spite of lack of EU membership—gave us pause for thought.

239. Professor Phillipe Moreillon, Vice Rector, Research and International Relations, University of Lausanne, Switzerland, provided us with a number

174 Q 127 (Prof Robin Grimes)
175 Q 130 (Dr Mike Galsworthy)
176 Agreement between the European Community and its Member States, of the one part, and the Swiss Confederation, of the other, on the free movement of persons, OJ L 114 , 30/04/2002 P. 0006–0072: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:22002A0430(01):EN:HTML [accessed 12 April 2016]

of insights regarding Swiss science. He told us of the high performance of the Swiss science community and how European interactions influence this:

> "Our raw material is science and, talking egoistically from the point of view of small Switzerland, with the networking and the fact we have attracted many scientists from all over the world to work, we have a scientific jewel, if you will. Now, we are out of the big networking from Europe, so you may say we can have networking with the United States, India, China et cetera, but our direct scientific neighbours are the European countries, and they have built this European area of knowledge, education and research, and we would be foolish not to use it."[177]

240. He also stressed the importance of the permeability of Swiss borders:

> "Fifty per cent of Swiss researchers have non-Swiss passports. This is important. I guess it is not very different from the UK. Thirty per cent of Swiss researchers come from Europe, from neighbouring countries, so the networking and mobility that was alluded to in the previous session is quite important, at least for Switzerland."[178]

241. Addressing the question of the influence that Associated Countries have, Professor Moreillon told us: "If you work with European colleagues, or if you are applying for ERC funding, or if you are funded by Europe, you abide by the European rules."[179] He also alluded to Switzerland having a position of lesser influence than full Member States:

> "When we became an associate, it was much, much easier, of course, but we are still not sitting at the decision table or on the consultative committees where the decisions are made. We have a number of ways to interact, such as through university associations. We are still in the corridor, but at least we are part of the whole programme."[180]

242. In a number of areas, Switzerland has its own national regulatory frameworks. The regulatory environment for clinical trials is a prominent example of this.[181] Professor Siegfried Russwurm, Chief Technology Officer & Member of the Managing Board of Siemens AG, referred to these national frameworks as "peculiar rules and regulations."[182] He provided us with the viewpoint from a multinational business in terms of operating within such frameworks:

> "We have to make up our minds whether special Swiss regulations are worth the buck to implement them for such a small market. Siemens does not want to wipe out this Swiss industrial tradition, so we keep this traditional headquarter up and running, with all the emotions that surround that, but frankly we have been reducing our R&D in this location constantly over the last 15 years."[183]

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177 Q 141 (Prof Philippe Moreillon)
178 Q 137 (Prof Philippe Moreillon)
179 Q 140 (Prof Philippe Moreillon)
180 Q 138 (Prof Philippe Moreillon)
181 Switzerland operates its own clinical research rules (Swiss Human Research Act) that are different to the EU's Clinical Trials Regulation.
182 Q 97 (Prof Siegfried Russwurm)
183 Q 97 (Prof Siegfried Russwurm)

243. While this is an interesting perspective from Professor Russwurm, it must be noted that a number of research-intensive multinational businesses are headquartered in Switzerland.

244. During our exploration of Switzerland's affiliation with the EU, the sanctions imposed by the latter in response to the Swiss national referendum in February 2014 that narrowly voted to curtail freedom of movement were repeatedly highlighted to us. These sanctions had an effect on the science community. Switzerland was suspended from access to Horizon 2020. As such, the Swiss government was forced to replicate at national level a temporary programme to replace immediate access to the ERC programme and subsequently negotiated limited access to H2020, with much reduced admittance to programmes, exclusion from the new SME Instrument and loss of ability to coordinate collaborative research within H2020. The Swiss were also not included in Erasmus Plus.

245. We heard from a number of witnesses that these sanctions should be viewed as a warning to the UK on the implications of invoking restrictions on freedom of movement. Dr Mike Galsworthy, Programme Director of Scientists for EU, suggested that the EU's sanctions on Switzerland should be viewed as the establishment of a precedent:

> "Given that, on Brexit, we would most likely adopt a model that goes back on, or cancels, our freedom of movement arrangements with the EU, the real risk is that Switzerland is a strong precedent for the model that would be used for us."[184]

The UK remains in the EU

246. In the event that the UK chooses to remain part of the EU, this should not preclude the UK Government from advancing reforms to enhance the interactions between the EU and UK science and research. While the overwhelming view we received was very positive about the impact of EU membership on science and research in the UK, even those who were arguably most in favour of continued EU membership—the university sector—pointed out that not all interactions were beneficial and were critical of aspects of the EU. Professor Sir Leszek Borysiewicz, Chair of the Russell Group's EU Advisory Group, and Vice-Chancellor, University of Cambridge, told us:

> "I would hate the Committee to take away the idea we have such a rosy-eyed view of the European Union that it can do no wrong; we certainly do not. There are good examples of where considerable difficulties have been posed by directives and issues within the EU. I just pick on one, and that is the directive about intellectual property related to embryonic stem cell development. That is forcing an institution like Cambridge to look for exploitation in California or India in relation to these areas. It is not that everything that comes out of Europe glows and is brilliant—there are the issues with clinical trial directives and the welfare of animals in relation to experimental work—but the important thing is that we do have allies within Europe and we can engage in that discussion and debate."[185]

184 Q 130 (Dr Mike Galsworthy)
185 Q 67 (Prof Sir Leszek Borysiewicz)

247. The Russell Group, in its written submission, elaborated further on the potential for reforms within the EU which could improve science and research in the UK. They highlighted the potential to develop better regulatory frameworks:

> "The EU is not perfect by any means and we would support EU reforms particularly those which enhance our universities' ability to benefit further from forging productive collaborations across Europe. One of the Prime Minister's key areas of reform is to boost the competitiveness and productivity of the EU; research and innovation should be at the heart of this, as key drivers of growth and jobs. There is also a focus on cutting red tape, which would be welcome, particularly if the regulatory burden on UK universities could be reduced."[186]

248. As discussed in Chapter 4, when the figures for the participation of UK large businesses in Framework Programme 7 are considered it is clear that there is scope for this area of the UK's engagement with the EU to be improved. Large businesses in the UK under-perform when compared to key competitor nations and performance is below the EU average. When comparing this participation to that in Germany, Professor Siegfried Russwurm, Chief Technology Officer & Member of the Managing Board of Siemens AG, saw fit to proffer some advice:

> "The only humble advice that I could offer would be to synchronise national science funding with these programmes. Frankly, if it is our tax money that is spent via these programmes, then let us come to the conclusion that our national programmes should help companies and universities to make their way into these European programmes. Over the course of recent years, we have managed national programmes to help companies and universities to get their act together and be more successful in European programmes. We do not put that into the headlines, but it is a matter of fact, and I am not shy about testifying that to this Committee."[187]

249. As well as exploring synergies between national programmes that support businesses with those provided by the EU, we consider that it would be appropriate for the Government to review its support for businesses in engaging with EU funding schemes in light of the abolition of the Regional Development Agencies (RDAs), as discussed in paragraphs 130–135 in Chapter 4 in the section on business and innovation.

250. **Even those who were most in favour of continued membership of the EU—the university sector—criticised aspects of the UK's relationship with the EU. We therefore conclude that, in the event that the UK chooses to remain part of the EU, there would be scope for the UK Government to advance reforms to enhance the interactions between the EU and UK science and research. We suggest that a particular areas of focus should be the influence of the EU on the UK's regulatory environment and the support available for UK businesses in order to facilitate engagement with EU funding schemes.**

186 Written evidence from the Russell Group (EUM0069)
187 Q 104 (Prof Siegfried Russwurm)

APPENDIX 1: LIST OF MEMBERS AND DECLARATION OF INTEREST

Members

Lord Cameron of Dillington
Lord Fox
Lord Hennessy of Nympsfield
Lord Hunt of Chesterton
Lord Kakkar
Baroness Manningham-Buller
Lord Maxton
Duke of Montrose
Baroness Morgan of Huyton
Baroness Neville-Jones
Lord Peston
Viscount Ridley
Earl of Selborne (Chairman)
Lord Vallance of Tummel

Declaration of interest

Lord Cameron of Dillington

Farming interests in receipt of single farm payment

Trustee, Rothamsted

Chair of Advisory Council of Centre for Ecology and Hydrology (CEH)

Chairman, Strategic Advisory Board of the Global Food Security Programme

Lord Fox

Employed by and has financial interest in GKN PLC which participates in publically funded research and development

Lord Hennessy of Nympsfield

Fellow, British Academy

Attlee Professor of Contemporary British History, Queen Mary, University of London

Lord Hunt of Chesterton

Fellow, Royal Society

Director of Cambridge Environmental Research Consultants (CERC) Ltd (institution receives E.C. grants)

Member of Scientists for Europe

Emeritus Professor at University College London (institution receives E.C. grants)

Visiting Professor at University of Technology Delft and Toulouse University

Chairman, Advisory Committee of Tokamak Energy Ltd

Lord Kakkar

Professor of Surgery, University College London (institution receives EU funding)

Active in biomedical research

Chair, UCL Partners

Director, Thrombosis Research Institute

UK Business Ambassador for Healthcare and Life Sciences

Baroness Manningham-Buller

Chair, Wellcome Trust

Lord Maxton

No relevant interests declared

Duke of Montrose

Farmer in receipt of funding under the Common Agricultural Policy

Baroness Morgan of Huyton

Member of Council, King's College, University of London (institution receives EU funding)

Baroness Neville-Jones

Council Membership of the Engineering and Physical Sciences Research Council (EPSRC)

Member, Foundation for Science and Technology

Supporter, ConservativesIN

Lord Peston

No relevant interests declared

Viscount Ridley

Fellow, Academy of Medical Sciences

Vice-President, Conservatives for Britain

Hon. President, International Centre for Life, Newcastle

Ownership of a farm in receipt of EU funding

Earl of Selborne

Fellow, Royal Society

Fellow, Royal Society of Biology

Chairman, Foundation for Science and Technology

Supporter, ConservativesIN

Membership, Environmentalists for Europe (E4E)

Retired Director of an agricultural company

Lord Vallance of Tummel

Chairman, Royal Conservatoire of Scotland

A full list of Members' interests can be found in the Register of Lords Interests: http://www.parliament.uk/mps-lords-and-offices/standards-and-interests/register-of-lords-interests/

Specialist Adviser

Professor Graeme Reid

Professor of Science and Research Policy, University College London

Strategic Advisor to the National Centre for Universities and Business

Chairman of the Board of Directors, Campaign for Science and Engineering

Trustee, Association of Medical Research Charities

Associate Fellow, Centre for Science and Policy, University of Cambridge

Fellow, the Institute of Physics

Fellow, the Institution of Engineering and Technology

APPENDIX 2: LIST OF WITNESSES

Evidence is published online at www.parliament.uk/hlscience and available for inspection at the Parliamentary Archives (020 7219 5314)

Evidence received by the Committee is listed below in chronological order of oral evidence session and in alphabetical order. Those witnesses marked with ** gave both oral evidence and written evidence. Those marked with * gave oral evidence and did not submit any written evidence. All other witnesses submitted written evidence only.

Oral evidence in chronological order

**	Professor Steve Cowley, Chief Executive Officer, UK Atomic Energy Authority and Head of the EURATOM/ Culham Centre for Fusion Energy (CCCFE) Fusion Association	QQ 1–8
*	Professor Kurt Deketelaere, Secretary-General, League of European Research Universities (LERU)	
**	Professor Dame Janet Thornton, Director Emeritus of EMBL-EBI and Senior Scientist, European Bioinformatics Institute (EMBL-EBI)	
**	Professor Paul Boyle, President and Vice-Chancellor, University of Leicester	QQ 9–24
*	Professor Andrew Harrison, Chief Executive, Diamond Light Source	
**	Professor Dominic Tildesley, President, Royal Society of Chemistry (RSC)	
**	Professor Alex Halliday, Vice-President, Royal Society	QQ 25–40
**	Professor Sir Robert Lechler, FKC, President, Academy of Medical Sciences	
**	Professor Ric Parker CBE FREng, Director of Research and Technology, Rolls-Royce plc, representing the Royal Academy of Engineering (RAEng)	
*	Sir Emyr Jones Parry GCMG, President, the Learned Society of Wales	QQ 41–52
**	Professor Dame Helen Wallace DBE, CMG, FBA, Europe Liaison Chair, British Academy	
*	David Walker, Head of Policy, Academy of Social Sciences	
*	Professor Dame Anne Glover, Vice-Principal External Affairs and Dean for Europe, University of Aberdeen	QQ 53–61
**	Professor Dame Julia Goodfellow, President, Universities UK (UUK) and Vice-Chancellor, University of Kent	QQ 62–68

*	Professor Sir Peter Downes, Convenor of Universities Scotland and Principal & Vice-Chancellor, University of Dundee	
**	Professor Sir Leszek Borysiewicz, Chair of the Russell group's EU Advisory Group, and Vice-Chancellor, University of Cambridge	
**	Dr David Hughes, Global Head of Technology Scouting, Syngenta	QQ 69–76
**	Steve Bates, Chief Executive Officer, BioIndustry Association (BIA)	
*	Professor John Latham, Board Member, Innovate UK and Vice Chancellor, Coventry University	QQ 77–89
**	Felicity Burch, Senior Economist, EEF—The Manufacturers' Organisation	
*	Professor Siegfried Russwurm, Chief Technology Officer & Member of the Managing Board of Siemens AG	QQ 90–106
*	Juergen Maier, Chief Executive Officer, Siemens UK	
**	Professor Dame Julia Slingo, Chief Scientist, Met Office and member of the European Commission's Scientific Advice Mechanism (SAM) High Level Group	QQ 107–116
*	Professor John Womersley, Chief Scientific Officer, Science and Technology Facilities Council (STFC) and Chair, European Strategy Forum on Research Infrastructures (ESFR)	
**	Stuart Pritchard, EU Affairs Manager, Wellcome Trust	
*	Professor Robin Grimes, Chief Scientific Adviser, Foreign and Commonwealth Office	QQ 117–127
**	Dr Mike Galsworthy, Scientists for EU	QQ 128–135
**	Professor Angus Dalgleish, Scientists for Britain	
*	Emran Mian, Director, Social Market Foundation	
*	Professor Philippe Moreillon, Vice Rector, Research and International Relations, University of Lausanne, Switzerland	QQ 136–143
**	Jo Johnson MP, Minister of State for Universities and Science, Department for Business, Innovation and Skills (BIS)	QQ 144–161
*	Professor Sir Mark Walport FMedSci FRS, Government Chief Scientific Adviser, Government Office for Science	

**	Gareth Davies, Director General for Business and Science, Department for Business, Innovation and Skills (BIS)	

Alphabetical list of all witnesses

**	The Academy of Medical Sciences (QQ 25–40)	EUM0029
*	Academy of Social Sciences (QQ 41–52)	
	ADS Group	EUM0023
	Association of Innovation, Research and Technology Organisations (AIRTO)	EUM0064
	Association of Medical Research Charities (AMRC)	EUM0052
	Association of the British Pharmaceutical Industry (ABPI)	EUM0017
	Astronomy ESFRI and Research Infrastructure Cluster (ASTERICS)	EUM0059
	Professor Heiko Balzter, University of Leicester	EUM0002
**	BioIndustry Association (BIA) (QQ 69–76)	EUM0046
*	Professor Paul Boyle, University of Leicester (QQ 9–24)	
	Brightwake Ltd	EUM0001
**	British Academy (QQ 41–52)	EUM0020
		EUM0076
	British Society for Immunology	EUM0033
	Tessa Burrington	EUM0018
	Campaign for Science and Engineering (CaSE)	EUM0047
	Campaign for Science and Engineering (CaSE) and the Engineering Professors' Council (EPC)	EUM0048
	Centre for Ecology and Hydrology	EUM0053
	Centre for the Advancement of Sustainable Medical Innovation (CASMI), Oxford-University College London	EUM0008
	Chartered Institute of Ecology and Environmental Management (CIEEM)	EUM0032
*	Culham Centre for Fusion Energy (CCFE) (QQ 1–8)	
	C-Tech Innovation Ltd	EUM0005
**	Department for Business, Innovation and Skills (BIS) (QQ 144–161)	EUM0071
*	Diamond Light Source (QQ 9–24)	
**	EEF—The Manufacturers' Organisation and Innovate UK (QQ 77–89)	EUM0006

	Professor Tim Elliott, School of Earth Sciences University of Bristol	EUM0009
	ELIXIR	EUM0036
**	European Bioinformatics Institute (EMBL-EBI) (QQ 1–8)	EUM0038
	European Commission	EUM0081
	European Society for Evolutionary Biology	EUM0011
	Europlanet Consortium	EUM0045
*	Foreign and Commonwealth Office (FCO) (QQ 117–127)	
	Genetic Alliance UK	EUM0039
	Geological Society (GSL)	EUM0061
*	Professor Dame Anne Glover, University of Aberdeen (QQ 53–61)	
*	Government Office for Science (QQ 144–161)	
	Heptares Therapeutics Ltd	EUM0014
	Imperial College London	EUM0015
*	Innovate UK (QQ 77–89)	
	Institute of Physics (IoP)	EUM0074
	Institution of Chemical Engineers (IChemE)	EUM0004
	The Institution of Environmental Sciences (IES)	EUM0072
	International Severe Acute Respiratory and emerging Infection Consortium (ISARIC) and the Epidemic diseases Research Group Oxford (ERGO) at the Centre for Tropical Medicine and Global Health, University of Oxford	EUM0041
	John Innes Centre	EUM0010
	Professor Jan Kubik, Pro-Vice Provost International-Europe, University College London	EUM0070
*	League of European Research Universities (LERU) (QQ 1–8)	
*	Learned Society of Wales (QQ 41–52)	
	Marine Biological Association	EUM0035
**	Met Office (QQ 107–116)	EUM0060
	Clare Moody, MEP	EUM0062
*	Professor Philippe Moreillon, University of Lausanne, Switzerland (QQ 136–143)	
	National Institutes of Bioscience (NIB)	EUM0050
	National Nuclear Laboratory (NNL)	EUM0019
	National Physical Laboratory (NPL)	EUM0025

	Parkinson's UK	EUM0003
	The Pirbright Institute	EUM0057
	Political Studies Association (PSA)	EUM0012
	Research Councils UK (RCUK)	EUM0016
**	Royal Academy of Engineering (RAEng) (QQ 25–40)	EUM0066 EUM0077
	Royal Astronomical Society	EUM0031
	Royal Society of Biology	EUM0068
**	Royal Society of Chemistry (QQ 9–24)	EUM0051 EUM0080
**	The Royal Society (QQ 25–40)	EUM0067 EUM0078
**	Russell Group (QQ 62–68)	EUM0069
*	Science and Technology Facilities Council (STFC) (QQ 107–116)	
**	Scientists for Britain (QQ 128–135)	EUM0075
**	Scientists for EU Campaign (QQ 128–135)	EUM0058
	Scientists for Labour	EUM0055
	Sense About Science	EUM0073
*	Siemens AG (QQ 90–106)	
*	Siemens UK (QQ 90–106)	
*	Social Market Foundation (QQ 128–135)	
**	Syngenta (QQ 69–76)	EUM0013
	Technopolis	EUM0037
	TransportNewcastle, Newcastle University	EUM0042
	United Kingdom Atomic Energy Authority (UKAEA)	EUM0024
	UKspace	EUM0028
*	Universities Scotland (QQ 62–68)	
**	Universities UK (QQ 62–68)	EUM0054 EUM0079
	University Alliance	EUM0065
	University of Bristol	EUM0027
	University of Cambridge	EUM0049
	University of East Anglia (UEA)	EUM0026
	University of Leicester	EUM0007
	University of Manchester	EUM0044

	University of Oxford	EUM0040
	Vote Leave	EUM0056
**	Wellcome Trust (QQ 107–116)	EUM0034
	Wellcome Trust Sanger Institute	EUM0030
	Professor John Wood, Association of Commonwealth Universities	EUM0021

APPENDIX 3: CALL FOR EVIDENCE

The House of Lords Science and Technology Select Committee, under the Chairmanship of Lord Selborne, is conducting an inquiry into *the relationship between EU membership and the effectiveness of science, research and innovation in the UK*. The Committee invites interested individuals and organisations to submit evidence to this inquiry. The deadline for written evidence submissions is Friday, 20 November 2015.

Background

The UK's membership of the EU has wide ranging influence on the vitality of UK science, research and innovation. Understanding this influence, however, is complex and multifaceted. Its exact nature is uncatalogued in a number of key areas and this inquiry aims to try and understand and characterise the interactions between EU membership and the effectiveness of science, research and innovation in the UK. Funding for research and innovation, collaboration, regulatory frameworks and scientific advice are four areas that we have identified as of paramount importance, though we would welcome information under additional headings if appropriate.

The EU-level funding mechanisms available to UK researchers are myriad and a number are highly intricate. These include European Research Council funding, Horizon 2020 programmes (formerly Framework Programme 7), Joint Programming Initiatives (JPI) and European Innovation Partnerships. As well as public funding, private investment in UK research and development from international (both EU and non-EU) and UK-domiciled businesses is also increasingly recognised as crucial to the performance of the science base as a means to maintain competitiveness and productivity. The UK's EU membership may serve to make the UK a more or less attractive location for investment. As such, membership may influence access to public, private and charitable funding.

Science is, by its very nature, a collaborative endeavour and key breakthroughs are often the result of collaborations between researchers across the globe. In addition to funding, researchers from across the UK have access to shared infrastructure as part of EU partnerships and other international relationships. Shared infrastructure allows for sharing of costs, expertise and facilitates larger scale investments. Within the EU, freedom of movement allows researchers to work in universities, research institutes and industry with relative ease. For example, EU Marie Sklodowska-Curie fellowships fund scientists from any EU country to work in any other, and the ERASMUS programme, likewise, allows unimpeded flow of students and teaching staff across the EU.

Much of the science carried out in the UK is regulated by EU frameworks and directives. The clinical trials landscape and research into genetically modified organisms (GMOs) are two examples of areas dominated by regulations drawn at a European level. Innovation in the UK is also highly influenced by EU-level legislation and regulation and is affected by the balance (or imbalance) struck between regulation and innovation.

There are a number of mechanisms for the provision of science advice and the input of scientific evidence within the EU. The most high profile of these was arguably the position of European Chief Scientific Adviser, a post created by President Barroso during his term in office. Under President Juncker's Presidency, however, a new Scientific Advice Mechanism (SAM) is under development as

a replacement. The strength of the EU science advice environment is untested but it will impinge on the plethora of ways in which UK science, research and innovation interact with the EU.

We are interested in four major themes; funding, collaboration, regulation and scientific advice, and the questions below seek to probe these themes. These questions, however, do not necessarily amount to a definitive listing of the key issues; respondents are therefore encouraged to draw attention to all relevant issues falling under the four themes, as they see fit, and not be limited by the questions posed.

Funding

1. What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

2. What is the scale of the financial contribution from the UK to the EU that supports science and research activities?

3. What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

Collaboration

4. What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

5. What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?

6. How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

7. How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

8. What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

9. Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

Regulation

10. What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

11. If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

12. How is the innovation landscape affected by EU membership?

Scientific advice

13. How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

14. To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

17 September 2015

APPENDIX 4: SEMINAR HELD AT THE HOUSE OF LORDS ON 1 DECEMBER 2015

Members of the Committee present were Earl of Selborne (Chairman), Lord Cameron of Dillington, Lord Fox, Lord Hennessy of Nympsfield, Lord Hunt of Chesterton, Baroness Manningham-Buller, Lord Maxton, Duke of Montrose, Baroness Morgan of Huyton, Baroness Neville-Jones, Lord Peston, Viscount Ridley and Lord Vallance of Tummel.

Presentations were heard from:

- Professor Luke Georghiou, Vice-President for Research and Innovation, Manchester University;
- Professor Colin Riordan, President and Vice-Chancellor, Cardiff University, representing the International Unit within Universities UK;
- Stuart Pritchard, EU Affairs Manager, Wellcome Trust; and
- Professor James Wilsdon, Professor of Science and Democracy, Science Policy Research Unit (SPRU), University of Sussex.

APPENDIX 5: ABBREVIATIONS, ACRONYMS AND TECHNICAL TERMS

AMRC	Association of Medical Research Charities
AMS	Academy of Medical Sciences
BIS	Department for Business, Innovation and Skills
Brexit	Refers to "British exit" from the European Union: phrase is commonly used to include Northern Ireland
CaSE	Campaign for Science and Engineering
CCFE	Culham Centre for Fusion Energy
CEH	Centre for Ecology and Hydrology
CERN	European Organisation of Nuclear Research
CF	Cohesion Fund
COP21	21st annual conference of parties to review the implementation of the Rio Convention on mitigating climate change
Copernicus	Formerly Global Monitoring for Environment and Security (GMES)
COSME	Competitiveness of Enterprises and Small and Medium-sized Enterprises
CSA	Chief Scientific Adviser
DG RTD	Directorate-General for Research and Innovation
EAFRD	European Agricultural Fund for Rural Development
EBI	European Bioinformatics Institute
EC	European Commission
EEA	European Economic Area
EEF	Formerly the Engineering Employers' Federation, now used as part of the name of the Manufacturers' Organisation
EEN	Enterprise Europe Network
EFSI	European Fund for Strategic Investments
EIT	European Institute of Innovation and Technology
ELIXIR	A pan-European research infrastructure for biological data
EMBL	European Molecular Biology Laboratory
EMFF	European Maritime and Fisheries Fund
ERASMUS	European Region Action Scheme for the Mobility of University Students
ERA	European Research Area
ERC	European Research Council
ERDF	European Regional Development Fund
ERIC	European Research Infrastructure Consortium

ESFRI	European Strategy Forum on Research Infrastructures
ESF	European Social Fund
ESIF	European Structural and Investment Funds
ESS	European Social Survey
EU	European Union
EURATOM	European Atomic Energy Community
European XFEL	European Hard X-Ray Free Electron Laser
FCO	Foreign and Commonwealth Office
FET	Future and Emerging Technologies
FP	Framework Programme
FP7	Framework Programme 7
FWCI	Field-weighted citation impact
Galileo	A global navigation satellite system being created by the EU and the European Space Agency
GCSA	Government Chief Scientific Adviser
GDP	Gross domestic product
GM	Genetically modified
GMO	Genetically modified organism
H2020	Horizon 2020
HLG	High level group
IMI	Innovative Medicines Initiative
INSTRUCT	Integrated Structural Biology Infrastructure
ISBE	Infrastructure for Systems Biology-Europe
ITER	"The way" in Latin, an international experimental joint nuclear fusion reactor
JET	Joint European Torus
JPI	Joint Programming Initiative
JRC	Joint Research Centre
JTI	Joint Technology Initiative
KIC	Knowledge and Innovation Communities
KTPs	Knowledge Transfer Partnerships
LEPs	Local Enterprise Partnerships
LERU	League of European Research Universities
MS	Member State(s)
MSCA	Marie Skłodowska-Curie Actions
NIB	National Institutes of Bioscience

NNL	National Nuclear Laboratory
NPL	National Physical Laboratory
RCUK	Research Councils UK
R&D	Research and development
RDA	Regional Development Agencies
REACH	Registration, evaluation, authorisation & restriction of chemicals
RI	Research infrastructure
RISE	Research and Innovation Staff Exchange
RSC	Royal Society of Chemistry
SAM	Scientific Advice Mechanism
SKA	Square Kilometre Array
SME	Small-medium enterprise
STOA	Science and Technology Options Assessment
STFC	Science and Technology Facilities Council
TFEU	Treaty on the Functioning of the EU
UKAEA	UK Atomic Energy Authority
UKRO	UK Research Office
UN	United Nations
UUK	Universities UK
VAT	Value-added tax

APPENDIX 6: MEMBER COUNTRIES OF THE EU AND ASSOCIATED COUNTRIES

Table 1: Member countries of the EU (year of entry)

Austria (1995)	Italy (1958)
Belgium (1958)	Latvia (2004)
Bulgaria (2007)	Lithuania (2004)
Croatia (2013)	Luxembourg (1958)
Cyprus (2004)	Malta (2004)
Czech Republic (2004)	Netherlands (1958)
Denmark (1973)	Poland (2004)
Estonia (2004)	Portugal (1986)
Finland (1995)	Romania (2007)
France (1958)	Slovakia (2004)
Germany (1958)	Slovenia (2004)
Greece (1981)	Spain (1986)
Hungary (2004)	Sweden (1995)
Ireland (1973)	United Kingdom (1973)

Source: europa.eu, European Union (January 2016): http://europa.eu/about-eu/countries/index_en.htm [accessed 9 March 2016]

Table 2: Countries Associated to Horizon 2020 as of 1 December 2015

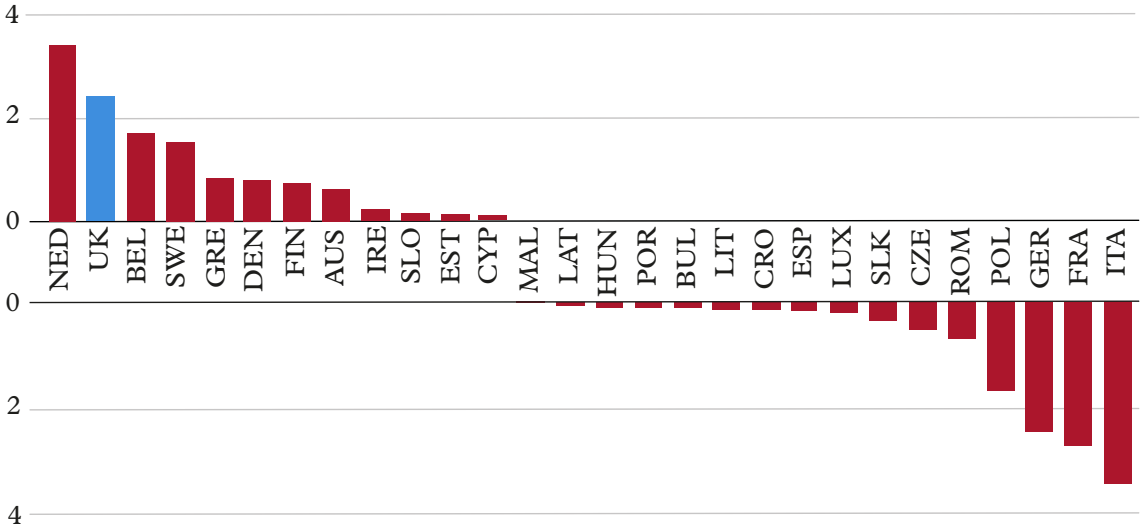
Albania	Montenegro
Bosnia and Herzegovina	Norway
Faroe Islands	Serbia
the former Yugoslav Republic of Macedonia	Switzerland (partial association, see below)
Iceland	Turkey
Israel	Ukraine
Moldova	

Source: European Commission Directorate-General for Research & Innovation, Associated Countries: http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf [accessed 9 March 2016]

Association Agreements with all of the above countries have either entered into force or are provisionally applicable; all Agreements apply retroactively from 1 January 2014 (i.e. from the beginning of Horizon 2020) except for the Agreement with Switzerland, which is retroactively applicable as of 15 September 2014 and the Agreement with Ukraine which entered into force on 17 August 2015.

APPENDIX 7: ADDITIONAL PRESENTATION OF DATA ON FP7 AND STRUCTURAL FUNDING FOR RESEARCH AND INNOVATION AS PRESENTED BY THE ROYAL SOCIETY

Difference between the percentage proportion of Framework Programme 7 funding received and the percentage proportion of EU GDP for each EU Member State. 2007–13



Source: Royal Society, UK research and the European Union The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 17 March 2016]

Difference between the percentage proportion of EU funding on for research, development and innovation (Framework Programme 7 and structural funds) received and the percentage proportion of EU GDP for each EU Member State. 2007–13

Source: Royal Society, UK research and the European Union The role of the EU in funding UK research (December 2015): https://royalsociety.org/~/media/policy/projects/eu-uk-funding/uk-membership-of-eu.pdf [accessed 17 March 2016]