IOP Institute of Physics

# Influence of EU membership on UK science

Institute of Physics response to a House of Lords Science and Technology Committee inquiry

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**Response to the House of Lords Science and Technology Committee inquiry on the influence of EU membership on UK science**

**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?**

1. The UK receives around 12% of all EU R&D budget appropriations, a proportion only behind that of Germany and France (2013 figures).[1] The UK was seventh in terms of its success rate for research proposals to the Seventh Framework Programme (2007 – 2013), with a success rate of 22.6%. Belgium was the top performer with a success rate of 26.3%.[2] This represented around £500m per year (or around 10% of the UK's national science budget), which is a generous return compared to the UK's budgetary input[3]. The UK leveraged an average of around 15-20% of all budgets across the previous three previous Framework Programmes (5-7).[4]. The UK also receives around 25% of all European Research Council (ERC) grants.[5]

2. The total research grant income UK physics departments received from all sources in 2013/14 was just over £285m.[6] Of this, £226m came from UK sources, representing around 79% of all income. Physics departments' funding from EU sources (including government, charity and industry sources based in the EU) amounted to just under £50m, of which nearly 95% came from EU government bodies. This represents around 18% of the total funding received by physics departments in 2013/2014. This is a slightly greater figure than the average across the sector, where around 16% of funds came from EU sources. The difference is slightly greater when only looking at EU government sources: in physics around 17% of total funding was from this source, against around 13% for the sector as a whole.

3. However, there is variation in funding between departments, somewhat determined by the kind of work they perform. For example, whilst some physics departments report that around 10% of funds come from EU sources, others report that around half of their funds come from EU sources (including the ERC, Horizon 2020, ITNs and Marie Curie Fellowships).[7]

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[1] UNESCO. *Science Report 2015: Towards 2030*, 2015: http://unesdoc.unesco.org/images/0023/002354/235406e.pdf

[2] UNESCO, 2015

[3] Technopolis Group, carried out on behalf of the International Science and Innovation Unit within the Department for Business, Innovation and Skills (BIS). *The impact of the EU RTD Framework Programme on the UK*, May 2010: https://ec.europa.eu/research/evaluations/pdf/archive/fp7-evidence-base/national_impact_studies/impact_of_the_eu_rtd_framework_programme_on_the_uk.pdf

[4] European Commission Joint Research Centre. *European university funding and financial autonomy: A study on the degree of diversification of university budget and the share of competitive funding*, 2011: http://ftp.jrc.es/EURdoc/JRC63682.pdf

[5] Technopolis Group, 2010

[6] HESA data

[7] Information obtained by the IOP directly from departments.

4. A negligible amount of funding is available from countries outside the EU for UK researchers compared to EU and UK funding sources.[8]

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

5. Member states' contribution to the EU budget is determined by their share of GDP in the EU. The UK contribution to the budget between 2007 and 2013 was just under 11% of all funds.[9]

**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?**

6. The UK is acknowledged as operating an efficient funding system, particularly in the way block grant funding is organised and allocated through the research councils.[10] Compared to other EU member states, the UK performed amongst the best for its effectiveness of public spending.[11] The UK performs particularly well in terms of its research impact, with the highest average citation rate amongst the EU's largest states[12] and for citations among the top 10% most cited papers. This is despite having the 12th most intensive rate of investment in R&D in the EU, behind countries including Estonia and the Czech Republic.[13]

7. The EU offers greater support than the UK for the management and administration of funds, but this must be balanced against a more bureaucratic application process than for UK funds. It may be very difficult for some researchers or companies to access funds as consortia are often large and unwieldy, and access to certain funds is only open to collaborative, often cross-border, proposals. This aids collaboration and the sharing of knowledge, but may be restrictive for researchers and SMEs who are less familiar with the system. The EU also requires all funded researchers to provide evidence that they have worked their allotted time on the projects receiving grant funding, providing a level of transparency.

**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?**

8. UK science is extremely collaborative, and UK researchers are amongst the most collaborative of all EU countries. Nearly one in five publications submitted to the Research Excellence Framework in 2014 in physical sciences had an EU collaborator.[14]

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[8] Vitae. *Where to find sources of academic research funding*: https://www.vitae.ac.uk/researcher-careers/pursuing-an-academic-career/research-funding/where-to-find-sources-of-academic-research-funding

[9] Gabriele Cipriani. *Funding the EU Budget: Moving Forward or Backwards?*, 2014: https://www.ceps.eu/system/files/Financing%20the%20EU%20budget_Final_Colour.pdf

[10] Department for Business, Innovation and Skills. *Triennial Review of the Research Councils,* April 2014: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/303327/bis-14-746-triennial-review-of-the-research-councils.pdf

[11] Joint Report by the Economic Policy Committee (Quality of Public Finances) and Directorate-General for Economic and Financial Affairs. *Efficiency and effectiveness of public expenditure on tertiary education in the EU*: http://ec.europa.eu/economy_finance/publications/occasional_paper/2010/pdf/ocp70_en.pdf

[12] UNESCO, 2015

[13] UNESCO, 2015

[14] EPSRC. *Investing in excellence, delivering impact for the UK: Insights from the Research Excellence Framework 2014*, 2015: https://www.epsrc.ac.uk/newsevents/pubs/refreport2015/

Over 55% of UK publications between 2008 and 2014 had foreign co-authors, with four of the top five collaborative countries being EU countries.[15] This greatly enhances the global impact of UK research through our collaboration and presence on the international stage. In physics in particular, many areas are extremely collaborative. Research in areas such as particle physics often involves thousands of collaborators across multiple countries and often sharing a range of facilities. Many scientific challenges require interdisciplinary skills and technological pull-through that can be enhanced with a larger pool in which to find expertise, and a larger market for pull-through.

9. EU funds such as Horizon 2020 have been extremely popular and utilised by a large numbers of researchers and businesses that had previously not engaged with EU Framework Programmes.[16] However, these have been vulnerable to changes in personnel and changes in strategic decisions. Horizon 2020 funding was set to be cut by 2.7bn Euros to support the European Fund for Strategic Investment (EFSI)[17], with no guarantee that the equivalent funding would be spent on research and science through EFSI. However, successful lobbying from across Europe ensured the impact of the cuts was reduced, with 500m Euros being ring-fenced.[18] Horizon 2020 did however provide an overall increase in research funding compared to the previous framework programme.[19]

10. The ERC is also an important complementary funding stream for which "excellence is the only criterion".[20] Whilst application is highly competitive, being investigator centred, the bid writing process is relatively straightforward for academics. The ERC also funds a number of areas to which there is little or no comparable UK funding available.

11. EU countries face many common policy challenges which often require collaborative, interdisciplinary research to come to solutions. EU funds incentivise this collaboration across EU countries, and help to inform and suggest solutions to policy challenges including climate change, energy security and transport infrastructure.

12. Innovative Training Networks (ITNs) have played a significant role in allowing many groups to maintain their number of researchers, whilst EU programs such as Marie Curie scholarships provide an opportunity to host high level international researchers and develop international collaborations within the EU and outside, increasing the volume and quality of UK research (e.g. the IRSES program).

**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?**

13. It is easier for researchers in the UK to apply for grants and other support with EU member states than for non-EU member states due each state having to treat other EU

[15] UNESCO, 2015
[16] European Commission. *Horizon* 2020*: First results*, 2015: https://www.ffg.at/sites/default/files/downloads/page/horizon_2020_first_results_1.pdf
[17] European Commission. *EFSI Factsheet 2: Where does the money come from?*: http://ec.europa.eu/priorities/jobs-growth-investment/plan/docs/factsheet2-where-from_en.pdf
[18] European Commission. *Amending letter no.1 to the draft general budget 2016*, 2015: http://ec.europa.eu/budget/library/biblio/documents/2016/AL/AL1_2016_en.pdf
[19] Universities UK. *Briefing – Horizon 2020* budget: http://www.universitiesuk.ac.uk/highereducation/Documents/2013/BriefingHorizon2020Budget.pdf
[20] European Commission. *Leading experts to carry out the European Research Council Review*, 2009: http://europa.eu/rapid/press-release_IP-09-307_en.htm?locale=fr

countries' researchers largely as they would their own.

14. The EU has a target for states to spend 3% of GDP on R&D, and though the average EU GERD only reached 2% in 2013[21], states including Austria, Denmark, Germany and Sweden are either close to or are exceeding this figure. This push has increased the scope for collaboration in R&D across EU states, particularly in those states that have made greater efforts in increasing their R&R intensity.

15. In addition, the inclusion of associate states[22] and wider access by other non-EU states[23] to EU Framework Programmes helps to promote cooperation with non-EU states within the EU framework without the need to negotiate bilateral deals with individual states or groups of states.

**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?**

16. The UK has very low rates of private R&D investment compared to other countries in the EU – 1.05% of GDP compared to the EU average of around 1.2%[24] - so efforts that encourage further private R&D investment are to be encouraged.

17. Recent research performed for the Department of Business, Innovation and Skills has found that public investment in R&D leverages private investment – for every £1 invested in R&D by the government, private sector R&D output rises by 20 pence per year in perpetuity.[25] There is nothing to suggest that the investment provided by the EU does not bring similar rates of return in leveraging private R&D investment.

18. Many EU schemes are oriented towards SME participation and some SMEs have indicated that income from Framework Programmes has been critical to their research programmes, helping to bolster nascent programmes and secure complimentary investment.[26]

**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?**

19. Membership of the EU has given UK researchers access to a number of facilities based in the EU but outside the UK, has provided funding for a number of UK facilities and allowed UK researchers to participate in certain meetings and networks.

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[21] UNESCO, 2015
[22] European Commission. *Associated Countries*: http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf
[23] European Commission. *Horizon 2020 – Work Programme 2014-2015 General Annexes: List of countries, and applicable rules for funding*: http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-a-countries-rules_en.pdf
[24] UNESCO, 2015
[25] Economic Insight. *What is the relationship between public and private investment in science, research and innovation,* 2015: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/438763/bis-15-340-relationship-between-public-and-private-investment-in-R-D.pdf
[26] Technopolis Group, 2010

20. EU membership has allowed UK researchers to access facilities including the European Spallation Source near Lund and the TRIGA reactor at Ljubljana for neutron irradiation for CMOS R&D. EU programs such as Euromagnet have also provided very important support for accessing large facilities in Europe e.g. High Magnetic Fields which are not available in the UK. Funding from the EU allows UK participation in EU funding-dependent meetings, such as PLANCK (CMB observatory) meetings.

21. The UK-based particle physics experiment, the Muon Ionisation Cooling Experiment (MICE), which is located at Rutherford Appleton Laboratory (RAL), received EU FP7 support for its radio-frequency (RF) amplifier systems, and to allow European colleagues to travel to RAL to participate in MICE.

22. Various projects, facilities and proposed facilities, of which UK universities and businesses are partner organisations or coordinators, have also received important EU funding under previous Framework Programmes. These include the Large Aperture European Solar Telescope[27], the Einstein Gravitational-wave Telescope[28], LAGUNA-LBNO[29], and the Square Kilometre Array[30].

23. EU funding also makes it possible to access specific programmes of access such as EuCARD-2[31], which also acts as a networking and joint research programme. EuCARD-2 includes the ISIS neutron and muon source at RAL as one of its three networked infrastructures. Access to some large global programmes are managed through the EU, for example the UK's participation in the ITER fusion project[32], the JT60-SA tokamak in Japan[33], and the HPC-FF supercomputer at IFERC in Japan[34].

**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?**

24. An important driver of the quality of UK research is the ability to appoint the best candidates, irrespective of nationality, and EU and international students and researchers make a vital contribution to UK research. UK research benefits from attracting top talent from across the EU to conduct work and to study in UK universities, bringing a wider range of scientific and cultural experience to departments. The UK has an above average share in published papers with foreign co-authors, with almost 60% of papers published between 2008 and 2014 having a co-author from an overseas country.[35]

25. Approximately 14% of all research and teaching staff in all UK higher education departments are from other EU countries, and around 11% of all staff are from non-EU

[27] European Commission. *EST: The Large Aperture European Solar Telescope*: https://ec.europa.eu/research/infrastructures/pdf/est_en.pdf
[28] European Commission. *ET: Einstein Gravitational-wave Telescope*: https://ec.europa.eu/research/infrastructures/pdf/et_en.pdf
[29] European Commission. *LAGUNA-LBNO*: https://ec.europa.eu/research/infrastructures/pdf/FP7_Factsht_Laguna2_31may13.pdf
[30] European Commission. *SKADS: SKA Design Study*: https://ec.europa.eu/research/infrastructures/pdf/skads_en.pdf
[31] European Commission. *Physics and Astronomy: Networks of Research infrastructures supported by the European Union*: https://ec.europa.eu/research/infrastructures/pdf/thematic/KI0414728ENE-astronomy.pdf#view=fit&pagemode=none
[32] ITER: https://www.iter.org/
[33] JT-60SA: http://www.jt60sa.org/b/index.htm
[34] HPC-FF projects: http://www.efda-hlst.eu/hpcffprojects
[35] UNESCO, 2015

countries (2013/14 data).[36] Within UK physics departments however, nearly a quarter, 24%, of all research and teaching staff are from other EU countries, with 16% of staff being from other non-EU countries. Some physics departments report that over half of senior independent research fellows originate from non-UK EU countries.

26. In 2013, non-UK EU students made up around 5% of all students at UK universities.[37] In physics departments the situation is similar, with non-UK EU students making up 5.4% of all students in undergraduate departments. This has however fallen slightly since the introduction of the new fees regime in 2012, with the proportion on a rising trend from 4.2% in 2005 to 6.5% in 2010, before falling to 6% in 2011 and 5.1% in 2012.

27. Of the relatively small number of taught master's students in physics (compared to the sector average), 12.3% of all students were from non-UK EU countries, compared to 9.7% across the sector. With increasing numbers of UK students taking up 4-year enhanced undergraduate courses with an additional master's year[38], taught master's courses in physics tend to be more attractive to non-UK students and provide extra income to departments, particularly at a time when many departments are in deficit[39]. EU students were an even more significant group in terms of doctoral study, with 17.2% of all physics doctoral students coming from non-UK EU countries compared to 13.1% in the sector as a whole.

28. The UK is attractive to international researchers and students due to its high reputation for excellence in higher education.[40] EU membership makes it much easier to attract outstanding undergraduate students from within the EU because states must treat EU students as they do their own home students.[41] As such, EU students are not charged the usually far higher fees that non-EU students are charged to study in the UK.

29. EU membership also makes it easier to attract talented graduate students from within the EU. Funding of PhD students by the Science and Technology Facilities Council (STFC)[42] and Engineering and Physics Sciences Research Council (EPSRC)[43] is accessible to EU students with UK residency (i.e. those who have completed their undergraduate degree in the UK) and the EU's Marie Curie scholarships and Innovation Training Networks (ITNs) also support PhD students from the EU to study in the UK, bolstering the sources of funding that they can access.

**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?**

30. Collaboration is required to access much funding under for example Horizon 2020, and often this includes collaboration with researchers from outside of the EU. Funding under

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[36] HESA data
[37] HESA data
[38] UCAS data
[39] Institute of Physics. *The Finances of Chemistry and Physics Departments: Third Review*, 2015: http://www.iop.org/publications/iop/2015/page_66517.html
[40] National Union of Students. *International Student Perceptions on Employability*, 2012
[41] UK Council for International Student Affairs. *Home of Overseas fees?*: http://www.ukcisa.org.uk/International-Students/Fees--finance/Home-or-Overseas-fees/
[42] Science and Technology Facilities Council. *Student eligibility requirements*: http://www.stfc.ac.uk/funding/studentships/student-eligibility-requirements/
[43] Engineering and Physics Sciences Research Council. *Student eligibility*: https://www.epsrc.ac.uk/skills/students/help/eligibility/

Marie Curie Actions for example is available to a wide number of non- EU countries under Annex A of the Horizon 2020 Work Programme.[44] Some EU programmes are also targeted specifically to initiate and strengthen collaborations with countries outside the EU, such as the development of COST International Partner Countries.[45] There are no analogues to this in terms of UK funding schemes that support such large-scale international networks.

31. Many strong physics collaborations are built around truly international facilities, for example the Large Hadron Collider at CERN and the ITER fusion project in France, with members from across the globe. In particle physics for example, UK researchers and physics departments are involved in experiments based outside of the EU, at large accelerator laboratories such as Fermilab in the US[46], KEK[47] and J-PARC[48] in Japan, and PSI in Switzerland[49], and other facilities such as SNOLAB in Canada[50], DUSEL[51] in the US, and Kamioka Observatory in Japan[52]. The experimental collaborations for these experiments are truly global with the UK taking on leadership roles in many cases.

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

32. No comment

**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?**

33. No comment

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

34. No comment

**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?**

35. The UK has a long history of having a Chief Scientific Advisor (CSA) within government and been unusual within Europe in this regard, with only the Czech Republic and Ireland having anything directly similar – though certain countries such as Germany have systems in place to provide scientific advice[53]. The UK CSA and the departmental CSAs have often been an effective and independent voice at the heart of government ensuring

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[44] European Commission. *Horizon 2020 – Work Programme 2014-2015 General Annexes: List of countries, and applicable rules for funding*: http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-a-countries-rules_en.pdf
[45] European Cooperation in Science and Technology. *COST International Partner Countries*: http://www.cost.eu/about_cost/strategy/international_cooperation/ipc
[46] Fermilab: http://www.fnal.gov/
[47] KEK: https://www.kek.jp/en/index.html
[48] J-PARC: http://j-parc.jp/index-e.html
[49] Paul Scherrer Institut: https://www.psi.ch/
[50] SNOLAB: https://www.snolab.ca/
[51] Deep Underground Science and Engineering Laboratory: http://sanfordlab.org/
[52] Kamioka Laboratory: http://www-sk.icrr.u-tokyo.ac.jp/sk/index-e.html
[53] James Wilson. *Science Advice to Governments: Diverse systems, common challenges*, 2014: http://www.globalscienceadvice.org/wp-content/uploads/2014/08/Science_Advice_to_Governments_Briefing_Paper_25-August.pdf

that evidence is readily available to inform decisions[54].

36. The position of Chief Scientific Advisor to the President of the European Commission was introduced in 2012 and to some extent paralleled the position of the UK CSA. The removal of the post in 2014 was a step backwards. The European Commission has recently announced the appointment of a High Level Group (HLG) of Scientific Advisors to provide high-level scientific advice.[55] We welcome their appointment and hope that the new group is allowed to retain the independence and focus in its work as was the position of the CSA.

**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?**

37. Perceived barriers to engagement with European policy development include distance and bureaucracy, but UK researchers, politicians and those working on science policy need to remain engaged and create closer connections with EU instruments in order to better feed in to EU policy.

38. The development of the 2004 EMF Directive provides an example which highlights UK researchers' ability to inform public policy at the European Level.[56] The EMF Directive was adopted in 2004 and restricted occupational exposure to electromagnetic fields (EMF), including those used in Magnetic Resonance Imaging (MRI) scanners. Some of the exposure limits threatened to impact on the current use and future development of MRI technology. Whilst there was some limited engagement beforehand, sustained campaigns and actions were not pursued until after the directive was passed. Lobbying by the MRI community eventually led to a delay in implementation until 2012, and in 2013 a new EMF directive was adopted which contains a derogation for most MRI activities, subject to certain conditions. The directive also contains a general power of derogation that allows member states to exempt other activities where there is justification.[57]

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[54] Institute of Physics. *Response to the House of Lords Science and Technology Committee consultation into the role and function of departmental Chief Scientific Advisors*, 2011: http://www.iop.org/policy/consultations/industry_innovation/file_52682.pdf

[55] European Commission. *SAM High Level Group*: https://ec.europa.eu/research/sam/index.cfm?pg=hlg

[56] Institute of Physics. *MRI and the Physical Agents (EMF) Directive*, 2008: https://www.myesr.org/html/img/pool/MRI-Report-Stephen-Keevil.pdf

[57] Health and Safety Executive. *The Electromagnetic Fields (EMF) Directive*: http://www.hse.gov.uk/radiation/nonionising/directive.htm