

## **Future frameworks for international collaboration on research and innovation**

Adrian Smith call for evidence

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### **Summary**

- EU research and innovation programmes are unique in the scale and scope of the support they provide for multinational cooperation, including going beyond European countries. Other international research and innovation programmes are orders of magnitude smaller and are often thematically based or focused on a narrower geography. The benefits received by UK researchers, innovators and businesses are both financial and non-financial, and in many cases will be challenging to replicate domestically.
- The UK should seek the closest achievable association with the current and future EU research and innovation programmes to support the UK's ambitions in international collaboration. If full association is not open to the UK and the UK becomes a third country, the government should enable extensive participation in the elements of the programme open to third countries, including by providing the necessary funding. Priority should be given to participation in EU schemes that the UK would be unable to replicate alone, such as large-scale international collaborations.
- If the UK was unable to secure continued access to EU research and innovation programmes, it would be essential for the UK government to create alternative programmes using national funds, which replicate the successful and unique aspects of programmes offered by the EU. This would need to include a domestic alternative that replicates the quality and benefits of the European Research Council, and schemes that are designed to support high-potential SMEs.
- Step changes in both the UK's international engagement beyond European countries and innovation investment are needed to deliver the Industrial Strategy and achieve the government's target of 2.4% of GDP invested in R&D and its concomitant economic and societal benefits.

## Introduction

1. R&D and innovation underpin the ambitious, bold, global vision for the UK as an outward-looking leading trading nation and a top destination for inward investment and international talent, drawing on the UK's existing credentials as a leader in engineering, research, innovation, enterprise and manufacturing. Consequently, the government's commitment to the Industrial Strategy and increasing R&D spending to 2.4% of GDP by 2027 have been welcomed by the engineering community. Engineering business, research and innovation are global endeavours, therefore successfully delivering both the government's ambitions will require international partnerships, and this should include continued association to EU research and innovation programmes. However, step changes in the UK's international engagement beyond European countries and in innovation investment are also priorities needed to achieve the government's ambitious goals, as outlined in the recently published International Research and Innovation Strategy. Defining the optimal frameworks for international collaboration beyond the EU will depend heavily on the UK's future relationship with the EU, including association to research and innovation programmes.
2. It is the Academy's view that the UK should seek the closest achievable association with the current and future EU research and innovation programmes to support the UK's ambitions in international collaboration. This view has wide agreement across the research and innovation community, including with our sister National Academies. EU research and innovation programmes are unique in the scale and scope of the support they provide for multinational cooperation, including with nations beyond the EU. Other international research and innovation programmes are orders of magnitude smaller and are often thematically based or focused on a narrower geography<sup>1</sup>. EU research and innovation programmes act as launchpads into broader international networks, providing an established, trusted and relatively accessible focal point for non-EU countries to engage in collaborative business and innovation activities, therefore providing reciprocal access for EU partners to international networks. Horizon Europe is expected to be much more open to international involvement beyond Europe than previous framework programmes, with significant activity targeted at innovation and partnerships. Furthermore, the benefits, both financial and non-financial, from participation in collaborative EU research and innovation programmes to businesses and researchers have been widely articulated, including by the Academy<sup>2</sup>. If full association is not open to the UK and the UK becomes a third country, the government should enable extensive UK participation in the elements of the programme open to third countries, including by providing the necessary funding.
3. If the UK was unable to secure continued access to EU research and innovation programmes, it would be essential for the UK government to create alternative

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<sup>1</sup> [The role of EU funding in UK research and innovation](#), Technopolis, commissioned by the National Academies, May 2017

<sup>2</sup> This submission draws from previous Academy work, including the following submissions: [Brexit, Science and Innovation: Preparations for No Deal](#), House of Commons Science and Technology Committee inquiry (January 2019); [Brexit: EU student exchanges and funding for university research](#), House of Lords EU Home Affairs sub-committee inquiry (November 2018); [Brexit: science and innovation summit](#), House of Commons Science and Technology Committee inquiry (February 2018); [Future Partnership Project](#), The Royal Society and the Wellcome Trust (Jan 2018); [Leaving the EU: implications and opportunities for science and research](#), House of Commons Science and Technology Committee inquiry (Sep 2016)

programmes using national funds, which replicate the successful and unique aspects of programmes offered by the EU. This should include support targeted at collaboration and partnership at many different levels (researchers, universities, large corporates and SMEs), plus long-term visibility of themes and subject areas. The implications for engineering of not being able to participate in EU research and innovation programmes are set out in the Academy's response to the House of Commons Science and Technology Committee's inquiry on 'Brexit, Science and Innovation: Preparations for No Deal'<sup>3</sup>.

4. One of the key strengths of the UK's research and innovation funding landscape is the diversity of funding sources available, including UK Research and Innovation (UKRI), the National Academies, EU programmes, charitable foundations and trusts, and industry. Domestic alternatives to EU programmes should both build on existing programmes and develop new programmes. Diverse funding mechanisms and delivery partners will ensure outcomes that support the continued strength of the UK research and innovation base.

#### **1. Methods by which new funding arrangements can:**

- **support research discovery of outstanding quality in all disciplines through international partnerships;**
5. If the UK is unable to participate in the European Research Council (ERC) it should create a domestic alternative that replicates the quality and benefits of the ERC. It should provide long-term research awards across all career stages and disciplines to support investigator-driven curiosity-led research, and be open to researchers from all over the world who wish to undertake research in the UK. The ERC is a vital component of the UK's success in excellent research, including engineering. When examining grants awarded in 2018 to engineering and computer science the UK ranks first for Advanced Grants, second for Consolidator Grants and third for Starting Grants<sup>4</sup>. The domestic alternative should operate with similar principles to the ERC, including: excellence as the sole criterion; a structure that guarantees independence from government with a protected long-term budget; be overseen by an independent board of leading researchers, and prioritise a low-burden application process. The Academy has already discussed options with government to support the delivery of such programmes as a contingency measure on a short-term basis in the event of 'no deal'. In the longer-term, to facilitate further international collaborations, researchers should be able to request funding to support international collaborations as part of their grant. Supporting curiosity-led research is also important to the wider 2.4% and Industrial Strategy goals of government. Access to and co-location with excellent research is an acknowledged pull factor influencing why global companies choose to make R&D investments in the UK and therefore crucial to achieving the 2.4% target, both by attracting new foreign investment but also retaining and growing R&D activities already based in the UK<sup>5</sup>.

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<sup>3</sup> [Brexit, Science and Innovation: Preparations for No Deal](#), House of Commons Science and Technology Committee inquiry (January 2019)

<sup>4</sup> Statistics, European Research Council [accessed May 2019] available at:

<sup>5</sup> [Investing in Innovation](#), Royal Academy of Engineering, 2015; [Increasing R&D Investment: Business Perspectives](#), Royal Academy of Engineering, October 2018.

6. The UKRI £110 million Fund for International Collaboration is a welcome increase in support for international collaboration. However, there is potential to increase both the scale of this fund and its scope, specifically to include support for innovation activities. In addition, UKRI should expand the capacity and capability of existing funding arrangements to further support researcher-led international collaborations and activities. Future arrangements should balance both top-down mechanisms for country to country and funding agency to funding agency collaborations, alongside bottom-up collaborations, e.g. those being driven by researchers, research groups and institutions. Flexible funding is required to allow the Councils of UKRI, as well as researchers, research groups and institutions, to respond to initiatives from international partners in a timely manner.
  - **attract to the UK researchers of outstanding capability from around the world; and**
7. The UK will need a larger research and innovation workforce to deliver its ambitions over the coming years. UK engineering departments in Higher Education Institutions (HEIs) have higher than average proportions of international researchers, with 62% of engineering research-staff in 2017-18 from overseas compared to 46% across other subjects<sup>6</sup>. A domestic alternative to the ERC that is open to researchers from anywhere in the world who wish to bring their research to the UK should help to retain and attract researchers to the UK. Furthermore, consideration should be given to the UK providing a relatively light-touch process to allow EU ERC recipients to transfer to the UK. To further maintain the UK's attractiveness as a place to do research, the default for all alternative programmes should be that they are open to researchers wishing to move their research to the UK, in addition to being open to researchers already based in the UK.
8. Like research, innovation and business are also global endeavours. Consequently, funding arrangements should be created to attract innovators and innovative businesses, as well as researchers to the UK. Small early-stage innovative companies are relatively geographically mobile. These companies could be the future scale-ups and large corporates of the UK, as such, the UK should be acting to ensure the UK remains an attractive location for them. For example, the SME Instrument, part of Horizon 2020, provides a key support mechanism for innovative UK businesses with over €152 million allocated to UK SMEs up to 2018<sup>7</sup>. The UK ranks third in the amount of funding awarded, and third for the number of participations (representing 9.5% of the total)<sup>8</sup>. The SME Instrument is an unusually large grant for SMEs at around €2 million and currently there is no comparable UK scheme. The Academy understands and is subsequently concerned that State Aid rules may prevent the design of a comparable UK domestic alternative, with the quantum of funding able to be offered significantly reduced compared to the EU scheme. If this is the case, there is a real risk that the very best innovative start-ups will relocate to the EU in order to be eligible for such schemes and the UK will become less attractive for companies to locate in. Innovative approaches to designing domestic alternatives that might be

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<sup>6</sup> The impact of Brexit on engineering research funding, Engineering Professors' Council, March 2019

<sup>7</sup> EIC SME Instrument Data Hub, European Commission, December 2018

<sup>8</sup> EIC SME Instrument Data Hub, European Commission, December 2018

able to make up the shortfall in funding in other compelling ways should be prioritised. If unable to access elements of EU programmes which support innovative early stage companies, the UK should provide similar schemes that are designed to support high-potential innovation developed by SMEs, to ensure there is no reduction of these activities in the UK.

9. The future immigration system must support efforts to expand the research and innovation workforce at pace including attracting and retaining talented people from overseas for work and study. For research, it must enable the UK to both retain and attract talented researchers to study or take up permanent or limited-tenure positions and facilitate short-term visits for conferences, collaborations or exchanges that are fundamental to the practice of research<sup>9</sup>. For industry, the UK's international R&D workforce is an important factor for locating R&D in the UK for many companies, who strongly value international diversity in their R&D teams<sup>10</sup>. The proposed £30,000 salary requirement could prove problematic for certain crucial support roles for research and universities, such as technicians and language assistants<sup>11</sup>. Similarly, it is likely that a £30,000 salary requirement will also present challenges for the engineering profession. The UK government should increase its efforts at transmitting a positive and assertive message, particularly to European stakeholders, that the UK is still a research and innovation powerhouse and is welcoming and open to researchers and innovators from across the world.

- **attract further R&D investment to the UK, thereby contributing to the Government's 2.4% agenda**

10. EU funding has substantial impact in leveraging further investment from other sources. The €9.6 billion awarded to UK participants from FP7 and Horizon 2020 in the period from 2007-2016 is estimated to have helped generate research and innovation expenditure of €16.6 billion<sup>12</sup>. Given the UK government's 2.4% target, and the key role that 'crowding in' of private investment will need to play in achieving this, potential losses from not being associated to EU framework programmes are not restricted to direct EU funding, but also extend to leveraging effects.
11. Achieving the 2.4% target will require further public investment, but it will also need businesses to do more: that they invest in more R&D, conduct more R&D, and do more with that R&D. UK industry, like our academic base, is consistently highly engaged across all industrially relevant areas of the EU research and innovation framework programmes. UK industry is currently ranked fifth of all EU member states for the amount of Horizon 2020 funding it receives, with UK businesses in receipt of

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<sup>9</sup> [An immigration system that works for science and innovation](#), joint submission from the Academy of Medical Sciences, the British Academy, the Royal Academy of Engineering and the Royal Society to the House of Commons Science and Technology Committee, June 2018

<sup>10</sup> [Increasing R&D Investment: Business Perspectives](#), Royal Academy of Engineering, October 2018.

<sup>11</sup> [£30,000 salary threshold would be detrimental for research and innovation](#), Academy of Medical Sciences, the British Academy, the Royal Academy of Engineering and the Royal Society, May 2019.

<sup>12</sup> [The role of EU funding in UK research and innovation](#), Technopolis, commissioned by the National Academies, May 2017

€982 million<sup>13</sup>. Therefore, it is essential that alternative programmes, if needed, also replicate the schemes that benefitted UK business and innovation stakeholders.

12. Designing domestic alternative programmes will require innovative approaches to replicate the non-financial benefits of EU programmes. The benefits from EU research and innovation programmes accrued by business and innovation stakeholders are far broader than just financial: access to expertise, knowledge and networks; collaboration through provision of trusted, multilateral frameworks; ability to connect to emerging regulation and standards at an early stage; access to customers and end-users, and route to market; attracting investment and integrating supply chains.
13. The UK should prioritise participation in EU schemes that the UK would be unable to replicate alone, such as large-scale international collaborations. EU research and innovation programmes play an important role in facilitating collaboration between multiple businesses, increasing the ease with which businesses can collaborate, scale-up and work towards shared missions, often for societal benefit. One such example is the Clean Sky aeronautical research programme, which was established in 2008 as a Joint Technology Initiatives (JTI), and is now receiving support from Horizon 2020<sup>14</sup>. It addresses the key societal challenge of developing smart, green and integrated transport. Such initiatives involve very large budget commitments from the EU, as well as other partners, which run into the billions collectively, and dwarf the great majority of national collaborations in the UK or elsewhere<sup>15</sup>. In addition, the example of the Clean Sky JTI illustrates the importance of being able to coordinate large-scale national initiatives across borders in an industry where supply chains are very internationalised<sup>16</sup>. Many of the activities facilitated by JTIs, such as creating largescale demonstrators, are often inherently international activities and may be considered too risky for one country to embark on alone<sup>17</sup>. The amount of funding provided by the EU, and the leverage this achieves, combined with its ability as a neutral convener to bring together industrial competitors to collaborate and work towards common goals, is a key element of its success. Such large-scale initiatives would be challenging to replicate domestically, yet are important for the UK to participate in global supply chains.
14. UK domestic alternative programmes and wider initiatives to achieve the 2.4% target should be long-term. Given that uncertainty can have a negative influence on businesses' activities and R&D investment plans are often long-term, providing long-term and stable innovation support can give businesses the confidence to invest. In this regard, innovation support from the EU is considered superior as it is perceived as less susceptible to short-term changes and political whim. The anticipated roadmap to 2.4% should include public spending up to 2027 to demonstrate the government's commitment to the target and provide long-term certainty to businesses.

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<sup>13</sup> UK Participation in Horizon 2020: September 2018, Department for Business, Energy and Industrial Strategy, April 2019

<sup>14</sup> [Appendix: Case studies, The role of EU funding in UK research and innovation](#), Technopolis, commission by the National Academies, May 2017

<sup>15</sup> [The role of EU funding in UK research and innovation](#), Technopolis, commissioned by the National Academies, May 2017

<sup>16</sup> [The role of EU funding in UK research and innovation](#), Technopolis, commissioned by the National Academies, May 2017

<sup>17</sup> [Engineering a future outside the EU](#), Royal Academy of Engineering and EtF, October 2016

15. Most companies, including those established in the UK, have to make global decisions about where to situate their high value R&D activities. In a highly competitive and international environment, countries must offer a competitive research, innovation and business environment if they want to attract skilled people and companies. Critically, the policy environment for business R&D and innovation cuts across the public sector – from government departments to devolved administrations and local government. It is crucial that the UK’s offer to international industry is joined-up across government, including coordination with the 2.4% roadmap, Industrial Strategy and the International Research and Innovation Strategy.
16. In October 2018 the Academy published ‘Increasing R&D Investment: Business Perspectives’, comprising a series of explainers setting out why companies choose to make R&D investments in the UK (building on strengths) and the barriers that stop them from doing so (action needed)<sup>18</sup>. The findings were based upon a series of interviews with the individuals responsible for making decisions on R&D activity (Chief Technology Officers, Directors of R&D, etc) across a wide range of engineering companies. The high-level findings are presented in the table below; all are relevant to attracting further international R&D activities to the UK and retaining existing companies here. Please see the full report for further details<sup>19</sup>.

<b>Building on strengths</b>	<b>Action needed</b>
Engineering workforce	Late-stage development and demonstrators
Innovation funding	Public procurement
Non-financial innovation support	Joined-up approach
Collaboration with universities	Ownership and financial structures
Collaboration between businesses	Support for engineering services
Tax incentives	Innovation across sectors

17. As well as targeting businesses who are already convinced of the value of R&D and innovation to the growth and success of their businesses, there are a significant number of businesses who do not have a history of R&D innovation. For these businesses, innovation and collaboration may be crucial to helping them maintain and grow their market share in the future. Consequently, schemes should also be targeted at these types of companies who will be unfamiliar with the value of innovation and the UK’s innovation ecosystem.
18. It is important to note that EU research and innovation programmes are not the only source of funding for research and innovation. The European Research and Development Fund (ERDF), part of the European Structural and Investment Funds (ESIF), has played a significant role in enabling regional investments in support of research, innovation and associated activities. Of particular relevance is the role ERDF has played in supporting UK SMEs, through one of its key priority areas: ‘competitiveness for SMEs’. Over the period 2014 to 2020, the planned EU spend for the UK of ERDF for ‘competitiveness of SMEs’ is over €3.7 billion<sup>20</sup>. The proposed

<sup>18</sup> [Increasing R&D Investment: Business Perspectives](#), Royal Academy of Engineering, October 2018.

<sup>19</sup> [Increasing R&D Investment: Business Perspectives](#), Royal Academy of Engineering, October 2018.

<sup>20</sup> Data from European Structural and Investment Funds Data, [accessed January 2019] available at: <https://cohesiondata.ec.europa.eu/countries/UK>

Shared Prosperity Fund should fill funding and support gaps which will occur when the UK does not have access to ERDF and these should be framed as part of delivering the 2.4% target.

**2. The optimum balance of emphasis for any new funding arrangements in each of the following dimensions:**

19. If the UK is unable to participate in current and future EU research and innovation programmes, domestic alternative programmes should replicate the balance of benefits the UK would lose. More broadly, to achieve the 2.4% target and deliver the Industrial Strategy further investment in innovation is needed.

- **European collaboration, Overseas Development Assistance and global collaboration;**

20. By taking the lead in addressing global challenges, such as access to clean water and meeting the needs of an expanding global population, the UK is not only solving challenges it is facing, or will face, it is also has the potential to take the lead with new commercial opportunities. Through the Newton Fund and the Global Challenges Research Fund, UK engineering has helped to deliver cutting-edge research as well as partnerships that promote economic development and welfare of developing countries. In evaluating the role of Overseas Development Assistance (ODA) research and innovation programmes it is important to measure the impact the five-years of investment has had on the both the UK research and innovation landscape and its international relationships, and to put forward measures that leverage these changes for broader benefit. The Newton Fund partners include what are expected to be five of the seven biggest global economies in 2050<sup>21</sup>. The current partnership model means that UK researchers and innovators are embedded at the heart of these countries' strategic priorities. There is an opportunity to graduate elements of these partnerships to non-ODA activities. More can be also done to leverage our existing ODA programmes to build alliances around global challenges with European or other developed country partners, crowding in funding from foundations and national aid agencies.

- **support for: outstanding individuals; blue-skies research; business innovation and research impact; and research facilities and infrastructure; and**

21. To achieve the 2.4% target and deliver the Industrial Strategy increased support will be needed for innovation, including business innovation. The argument for public support for innovation have been widely accepted by the UK's global competitors. As a result, the UK faces stiff competition for talent and investment. In this highly competitive and internationalised environment, the role of government in providing an assertive, effective and long-term commitment to innovation and the support of

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<sup>21</sup> <https://www.pwc.com/gx/en/issues/economy/the-world-in-2050.html>

effective translational policies, mechanisms and organisations is more important than ever, including through international collaboration.

22. The UK has historically underinvested in innovation. The ISCF and the developing Industrial Strategy more broadly are important steps in readdressing the balance between investment in research and innovation. However, further investment in innovation is still needed, although this should not be at the detriment of maintaining the UK's excellent research base. Innovate UK is well regarded by the engineering community<sup>22</sup>. While the ISCF has resulted in a welcome increase in investment being delivered by Innovate UK, this should not be at the expense of, or prevent, Innovate UK from expanding its core activities. Only 6% of Innovate UK's 2017/18 budget is allocated to open programmes, limiting their ability to rapidly respond to innovative businesses' needs in any area of the economy<sup>23</sup>. More flexible innovation funding is needed. The engineering profession is calling for Innovate UK's core budget to be increased to boost productivity and address the UK's historic under-investment in innovation and the 'D' of R&D.
23. The UK should ensure that opportunities, especially industry-led, that would benefit from being internationalised are not missed. The ISCF is a welcome addition to the UK's funding landscape and contributes to UK leadership in addressing global challenges. There is an opportunity to internationalise the ISCF, allowing participation from across the world, both from researchers and industry, particularly in a pre-competitive collaboration. This will enable the UK to deliver on these priority areas more efficiently and provide global leadership in doing so. Similarly, the Catapult Centres and Scottish Innovation Centres are essential components of the UK's infrastructure and could benefit from opportunities to work internationally to deliver additional value for their UK partners.
  - **research and innovation domain (research disciplines, business sectors etc).**
- 3. Methods and timescales for introducing any new funding arrangements for international collaboration, including those that**
  - **reflect the ambitions of small and large businesses**
24. Thorough engagement and consultation with businesses is needed when designing new funding arrangements for them. The Academy is pleased to be hosting two roundtables for Sir Adrian Smith FRS to meet with innovative SMEs and Chief Technology Officers of larger firms and is willing to continue working with Sir Adrian to support the review.
25. Transparent processes, especially if thematic areas are being selected, should be prioritised to ensure the community trusts the processes used. Lessons should be learnt from ISCF waves, which have been criticised by some in our community as not being transparent and clear.

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<sup>22</sup> [Increasing R&D Investment: Business Perspectives](#), Royal Academy of Engineering, October 2018.

<sup>23</sup> [Delivery Plan 2017-18: shaping the future](#), Innovate UK, December 2017 (p.32). Notes: budget allocation exclusively to Open programmes, excluding Eurostars, KTPs.

26. If the UK is unable to participate in EU research and innovation frameworks it will be important to have attractive alternative programmes that can be quickly deployed and that businesses are already aware of. Without this, there is a significant risk that small early-stage innovative companies, who are relatively geographically mobile, will move out of the UK to access EU funding. Feedback from the UK's business community suggests that the uncertainty arising from the UK's departure from the EU is already resulting in businesses reviewing R&D investment levels in the UK and even moving it to other countries<sup>24</sup>.

- **foster new systems of international peer review and funding**

**4. The roles of Government, UKRI, National Academies and other organisations in defining the agenda for European and international collaboration and administering any new funding arrangements for such activities**

27. As highlighted in paragraph four, one of the key strengths of the UK's research and innovation funding landscape is the diversity of funding sources available. Retaining diversity to support future international research and innovation collaborations will be important.

28. The Academy will continue to work with the government and other key stakeholders to support the development and delivery of alternative programmes within engineering, technology and innovation. This includes both advising on the design of such replacements and also potentially working as a delivery partner in coordination with UKRI, the National Academies and others, as we currently do on the Newton Fund and the Investment in Research Talent Fund.

**5. Existing evidence on the efficiency and effectiveness of funding for international collaborations**

**6. Any other issues relating to this work that you wish to bring to our attention.**

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<sup>24</sup> [Collaborate to Innovate](#), CBI, March 2018