

31 October 2017

# Submission to the Commons Science and Technology Committee inquiry into the Science Budget and Industrial Strategy

## Key points

- Broad political consensus on increasing total investment in UK R&D is welcome. To deliver the Government's target of 2.4% of GDP invested in UK R&D within ten years, and a longer term goal of 3% we need ongoing public investment in UK R&D as well as action to create a vibrant environment that fosters research and innovation throughout UK public services, universities, charities and businesses and attracts global investment, incentivising companies to locate their R&D here.
- Care should be taken to ensure that a sector-led approach does not just favour established technologies of major incumbent firms. It will be important to ensure that the Industrial Strategy also supports disruptive innovation that has the potential to found the industries of tomorrow.
- Delivering the government's 2.4% target will require the championing of Britain as a hub of research and innovation attracting a diverse mix of entrepreneurs and researchers from at home and abroad. We must send a bold, positive message that the UK is one of the best places in the world to research and innovate, and capture the benefits stemming from this to improve the lives of people in the UK. In the short term, a commitment to Horizon 2020 throughout the proposed Brexit implementation period would offer reassurance to scientists across Europe and send a strong signal about our intentions to remain a full player in the successor programme to Horizon 2020, thus ensuring that we continue to play a leading role in influencing the future directions of European science
- A successful Industrial Strategy should present a national vision while recognising that the UK and its industries are not uniform. A skilled workforce, access to innovation through proximity to universities or research institutes, high speed connectivity – through the internet and through transport - and the broader business environment will all be important in ensuring that science and technology deliver economic and societal benefit throughout the UK.

## Introduction

1. The Royal Society is the National Academy of science of the UK and the Commonwealth. It is a self-governing Fellowship of many of the world's most distinguished scientists. The Society draws on the expertise of the Fellowship to provide independent and authoritative advice to UK, European and international decision makers. As the UK's academy of science, the Society is concerned with the health of the UK's research, innovation and education system as a whole.
2. The Society has published a number of documents focused on the UK's science budget and industrial strategy including *Open for Business*<sup>1</sup> jointly with the other UK National Academies –

---

<sup>1</sup> UK National Academies (2016) *Open for Business* - <https://royalsociety.org/topics-policy/publications/2016/open-for-business-joint-academy-statement/> [accessed 22 October 2017]

the Academy of Medical Sciences, British Academy and Royal Academy of Engineering – and a submission to the government’s consultation Industrial Strategy Green Paper<sup>2</sup>. Professor Alex Halliday FRS gave oral evidence to the previous Committee’s inquiry into *Industrial Strategy: science, research and innovation*<sup>3</sup>. This submission draws on these.

3. The Society’s president and a number of Fellows are members of the Council for Science and Technology who have recently considered the Industrial Strategy Challenge Fund<sup>4</sup> and advised the Prime Minister on “what more the Government could do to harness the role of science and technology to deliver economic benefits that are shared across the UK”<sup>5</sup>, both issues of relevance to the Committee’s inquiry.
4. Professor Richard Jones FRS - a member of the Society’s Science Policy Advisory Group and a Steering Group member for the National Academies’ project to make a fresh case for investment in research outlined below - is a member of the independent Industrial Strategy Commission that published an interim report *Laying the Foundations* earlier this year and is expected to report in early November.

### **The rationale and coherence for the distribution of funding**

5. The UK is a world-leader in scientific research. Aspects of the UK’s research funding architecture play an important role in ensuring that UK research and innovation is effective and impactful. Two key principles that shape this system are now enshrined in legislation by the Higher Education and Research Act. Firstly the Haldane Principle, which requires that Ministers provide overall strategic direction for funding, while experts identify exactly which research proposals should be supported as those at the cutting edge of their field are best placed to make such technical decisions. And secondly the UK’s dual support system through the introduction of the ‘balanced funding principle’. This consists of two complementary streams, one targeted at specific discipline areas and the other a block grant to institutions (known as quality related funding, allocated according to research quality as assessed by the Research Excellence Framework). Currently, the former is disbursed by the 7 Research Councils and the latter through HEFCE and its devolved counterparts: the Scottish Funding Council (SFC), Higher Education Funding Council for Wales (HEFCW) and the Department for the Economy in Northern Ireland (DfE NI). Both functions will sit within UK Research and Innovation when it is formally created in April 2018. The National Academies will shortly publish a graphic illustrating the new architecture of public funding for R&D and will share this will the Committee.
6. The creation of UK research and innovation offers the opportunity to better support inter-, multi- and cross-disciplinary research that capitalises on the unique strength and breadth of the UK’s

---

<sup>2</sup> Royal Society (2017) *Consultation response: Industrial Strategy Green Paper* - <https://royalsociety.org/topics-policy/publications/2017/consultation-response-industrial-strategy-green-paper/> [accessed 22 October 2017]

<sup>3</sup> <http://www.parliament.uk/business/committees/committees-a-z/commons-select/science-and-technology-committee/inquiries/parliament-2015/inquiry8/> [accessed 22 October 2017]

<sup>4</sup> Council for Science and Technology correspondence (2017) *Advice on the Industrial Strategy Challenge Fund* - <https://www.gov.uk/government/publications/advice-on-the-industrial-strategy-challenge-fund> [accessed 22 October 2017]

<sup>5</sup> Council for Science and Technology correspondence (2017) *Science and technology for economic benefit across the UK* - <https://www.gov.uk/government/publications/science-and-technology-for-economic-benefit-across-the-uk> [accessed 22 October 2017]

research and innovation base. The inclusion of Innovate UK should create a unified voice for research and innovation that is well-placed to undertake more efficient and strategic investment in national research programmes and capabilities and catalyse more effective interactions between industry, business and the research base and between disciplines and sectors. If got right, this could see business take a stronger role in shaping UK research, education and industrial strategy, including developing the talent and skills needed by industry.

7. As emphasised by the Council for Science and Technology, it is important that excellence should remain the basis for funding research in the UK, while recognising that ‘place’ can be a helpful factor in determining how translation or commercialisation is funded. The health of the whole system and the interactions between different constituent parts should be kept in mind. The balanced funding principle requires a reasonable balance in the allocation of funding by the seven research councils and Research England. Innovate UK sits outside this balance and it will be important to consider the impact of any change in the relative allocations to each of UK Research and Innovation’s Councils on the ability of each part of the research ecosystem to cover the full economic costs of the research and development that they are involved in, to support new capacity required and to conduct discovery research and innovation
8. Boosting mobility between industry and academia would yield substantial dividends for the UK. Much innovation takes place in industry, which can benefit from individuals with skills and experience from other sectors. The Dowling review noted that mobility between academia and industry is less common in the UK than other countries. The Royal Society Industry Fellowship scheme has funded the secondment of nearly 200 individuals from academia to industry and vice versa since 1998. Evaluations demonstrate their value in growing long-term university-business collaboration. It is important that more opportunities for secondments are funded and available at all stages of peoples’ careers, and that these schemes offer the types of flexibility that allows companies of different sizes to use them.

#### **The ‘science budget’**

9. Government investment in R&D is allocated largely through the ‘science budget’<sup>6</sup>. This is generally divided into resource and capital. Resource spending is used to cover the day to day costs of research, and also provides research and innovation grant funding. Capital spending focuses mainly on investment in infrastructure, such as laboratory equipment, setting up world class research institutes and or creating innovation centres. Figure 1 - provided as an annex to this submission – sets out a time series of total public investment in R&D, including projections of spending commitments made to 2021.
10. Figure 2 - provided as an annex to this submission - illustrates the interaction between government investment in R&D and the sectors performing R&D. This also illustrates the considerable contribution of non-profit and overseas investment to UK R&D. In addition to direct public investment in R&D the government seeks to encourage further private investment in a number of ways, including R&D tax credits. The Council for Science and Technology has recently recommended that the Treasury, HMRC and BEIS should review R&D tax credits to

---

<sup>6</sup> Department for Business, Innovation and Skills (2016) *THE ALLOCATION OF SCIENCE AND RESEARCH FUNDING* - [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/505308/bis-16-160-allocation-science-research-funding-2016-17-2019-20.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/505308/bis-16-160-allocation-science-research-funding-2016-17-2019-20.pdf)

ensure that they capture shifts towards R&D for software and services, can be employed to improve R&D investment in specific regions and the process of accessing them is simplified<sup>7</sup>.

11. There is now broad consensus across the political spectrum to increase total investment in UK R&D – including public, private, non-profit and overseas investment. The Government has committed to meet a target of 2.4% of GDP invested in UK R&D within ten years, and a longer term goal of 3%. To deliver this, we need to create a vibrant environment that fosters research and innovation throughout UK public services, universities, charities and businesses and attracts global investment, incentivising companies to locate their R&D here.
12. Recent increases in government investment in R&D are welcome, but this alone will not be sufficient to deliver the ambition outlined in the Conservative manifesto to make the UK the most innovative country in the world. To deliver this, research and innovation must be at the heart of the UK's Industrial Strategy and plans for long-term socio-economic growth throughout the UK.
13. The Government's commitments to the 2.4% target and the establishment of UK Research and Innovation mean that there is an important opportunity to provide fresh evidence to inform decisions on investment in research and innovation. The National Academies are working together to generate new evidence to ensure that future decisions on investment in research and innovation are informed by the best available analysis. With this project we aim to develop a better understanding of the ways in which research and innovation in the UK generates social and economic benefits, and the distribution of those benefits. The analysis will be commissioned in winter 2017 by an expert Steering Group, chaired by Lord David Willetts.

#### **The Industrial Strategy Challenge Fund and 'sector deals'**

14. Care should be taken to ensure that a sector-led approach does not just favour established technologies of major incumbent firms. It is important to recognise that some sectors of industrial strength operate through many dispersed smaller companies without the same profile as sectors with one or two bigger companies. Their contributions to the economy are significant and must be supported, although they do not always have the same profile. The Industrial Strategy must also support the growth of emerging technologies that cut across sectoral boundaries such as machine learning and genetic technologies.
15. The Industrial Strategy Challenge Fund aims to bring together the UK's world leading research with business to meet the major industrial and societal challenges of our time and can complement a sectoral approach. The creation of the ISCF, alongside the creation of UK Research and Innovation presents a unique opportunity to incentivise new cross-sector and multi-disciplinary collaborations that deliver economic benefit. However this can only be realised if the Fund adopts new ways of working for the final two waves of the funding, learning from the some of the operational flexibilities in other initiatives, such as DARPA. Firstly, the success of the ISCF will depend on the calibre of the Challenge Directors. They should have the autonomy to pursue the most promising lines of inquiry, and be empowered to rapidly convene, contract

---

<sup>7</sup> Council for Science and Technology (2017) *Harnessing science and technology for economic benefit across the UK* - [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/653231/CST\\_letter\\_on\\_science\\_and\\_place\\_-\\_formatted.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/653231/CST_letter_on_science_and_place_-_formatted.pdf)

and leverage existing capital infrastructure, knowledge and know-how from across academia, business and other organisations. Secondly, the delivery and evaluation model of the ISCF must be one that accepts risk and tolerates failure. The ISCF challenge portfolio should include projects with different risk profiles. Thirdly, it will be important to step away from 'business as usual' in the selection and review of projects to ensure that the process does not reduce the likelihood of funding disruptive innovation. Finally, it will be important to review and learn from the experience of delivering ISCF to ensure that the UK research system supports disruptive and transformational innovation.

### **Place-based funding and growth**

16. We must view the UK's future Industrial Strategy through a global, national and local lens. Delivering the government's 2.4% target will require the championing of Britain as a hub of research and innovation attracting a diverse mix of entrepreneurs and researchers from at home and abroad. We must send a bold, positive message that the UK is one of the best places in the world to research and innovate, and capture the benefits stemming from this to improve the lives of people in the UK. An ambitious Industrial Strategy offers the opportunity to do so.
  
17. Research and innovation undertaken throughout the UK is international. The UK research workforce is truly international; 29% of academic staff in UK universities are non-UK nationals, with 17% coming from other EU countries and 12% from the rest of the world<sup>8</sup> and over half of the UK's academic research output is now the result of an international collaboration<sup>9</sup>. As the UK prepares to leave the EU, uncertainty is a real threat that will harm these international collaborations and cause researchers to leave the UK to seek greater stability. Last week, our President wrote to the Prime Minister to urge her to fully commit the UK to Horizon 2020 throughout the proposed Brexit implementation period. Making an early commitment to this would offer reassurance to scientists across Europe. It would send a strong signal about our intentions to remain a full player in the successor programme to Horizon 2020, thus ensuring that we continue to play a leading role in influencing the future directions of European science.<sup>10</sup> It will also be important to quickly provide guarantees about the status of the highly skilled EU researchers, an immigration system that can attract the brightest and best minds to the UK and a regulatory system that promotes seamless collaboration.
  
18. A successful Industrial Strategy should present a national vision while recognising that the UK and its industries are not uniform. Regional strategies should foster local strengths in research, education, innovation and business, taking opportunities to better integrate and grow these, as well as boosting existing centres of excellence. However if UK funding becomes increasingly regionalised, the risk of duplication and unhelpful competitions grows. Aligning the planning and resourcing of science and regions could help turn regions into hubs of excellence with distinctive opportunities for growth.

---

<sup>8</sup> Higher Education Statistics Agency

<sup>9</sup> Adams J 2013 *The fourth age of research*. Nature, 497, 557-560.

<sup>10</sup> Letter from Sir Venki Ramakrishnan PRS to the Prime Minister - <https://royalsociety.org/-/media/policy/Publications/2017/19-10-2017-PRS-letter-to-PM-on-Horizon-2020-membership.pdf>

19. Both the Nurse Review and Council for Science and Technology<sup>11</sup> have highlighted the value of mapping the UK's local science, technology and innovation assets. The Science and Innovation Audits provide valuable insights but do not cover the whole of the UK. These could inform future work.
20. The Royal Society is working to better understand variances in research and innovation across the UK and reflect this back into the national conversation. Figure 3 – provided as an annex – provides an overview of variances in the sector performing R&D by region in the UK. We are holding a series of regional conferences, intended to foster discussion about the scientific and technical challenges of the next decade and how different regions can consolidate and grow their strengths to benefit local people and drive innovation and prosperity across the UK. The first in Manchester on 20 November, *Creating connections – Research, industry and infrastructure in the North West*, will address the scientific and technical challenges of the next decade and bring together leading experts from academia, industry, government and charities. This will include roundtables discussing what delivering the government's 2.4% target means for the North West and how businesses, local government and universities in the North West can capitalise on the potential of artificial intelligence. We hope that the outputs will support strategic decisions at a local level as well as underpinning the Society's work at a national level. The Committee would be very welcome to join us on the 20<sup>th</sup>.
21. It is clear from our engagement with research-intensive industry that a number of factors influence decisions over where to locate. These include access to a skilled workforce, access to innovation through proximity to universities or research institutes, transport infrastructure and the broader business environment. At a series of discussions among academics, business and politicians held by the National Academies during the 2017 party conference season, the importance of the ecosystem and existing relationships and interactions was consistently referred to. While university spin outs of products derived from research are important, a lot of innovation is incremental and based on work in existing companies, or ongoing relationships between established companies and academia.
22. 51% of UK start-up employees come from outside the UK<sup>12</sup>. Access to a skilled workforce is a common barrier for companies looking to scale up quickly. This not only includes the ability to recruit skilled scientific researchers, but also technical staff and entrepreneurs and business leaders who are experienced in growing companies. Where the availability of talent within the UK is insufficient, immigration and visa schemes must allow companies to recruit internationally. At the same time, we must equip all of our young people with the skills that they will need to keep up with the rapid pace of technological change and succeed in the digital world. The Society's President recently made a speech calling for young people to have the opportunity to study a broad-based education up to age 18, highlighting that "Pockets of good practice that have largely only benefitted the lucky and the rich are not the basis of an education system fit

---

<sup>11</sup> Council for Science and Technology correspondence (2017) *Science and technology for economic benefit across the UK* - <https://www.gov.uk/government/publications/science-and-technology-for-economic-benefit-across-the-uk> [accessed 22 October 2017]

<sup>12</sup> European Start Up Monitor (2015)

for the future”<sup>13</sup> and the Society will shortly be publishing a report making recommendations for how to improve computing education in schools.

23. For the benefits of economic growth to be widely dispersed geographically rather than concentrated in a few dense clusters, infrastructure investment should aim to reduce the isolation and improve the connectivity of the entire country. High speed connectivity – both through the internet and through transport – will ensure that places that are currently left behind will quickly connect up with the highest growth areas nearby.
24. The Council for Science and Technology also highlight that the success of policy interventions depends not just on local assets, but also on more intangible factors: local ambition, leadership and support. In order to sustain the growth of a company, a key need exists for a pool of experienced chief executives and business leaders who can provide advice and mentoring or even be hired by fledgling start-ups to enable them to grow into SMEs. Much of the weakness with the translation of good ideas into significant businesses is not with the academics – who one should not expect to be skilled at building and running a company – but with the supply of really good chief executives.
25. The Council for Science and Technology propose a competitive innovation and growth place fund to encourage local leadership and collaboration. The Industrial Strategy Challenge Fund could also play a role. Funding projects that draw heavily from multiple elements of the UK research, innovation and industrial base could also make it more likely that the resulting products and capabilities will ‘stick’ here in the UK. Challenges should build partnerships spanning a number of centres within and across regions to create fledgling industries with the potential to scale. This would provide an opportunity to generate economic opportunities and returns in places where they are most needed.

We would welcome the opportunity to discuss these issues further with the Committee. For further information, please contact Becky Purvis, Head of Public Affairs on [becky.purvis@royalsociety.org](mailto:becky.purvis@royalsociety.org)

---

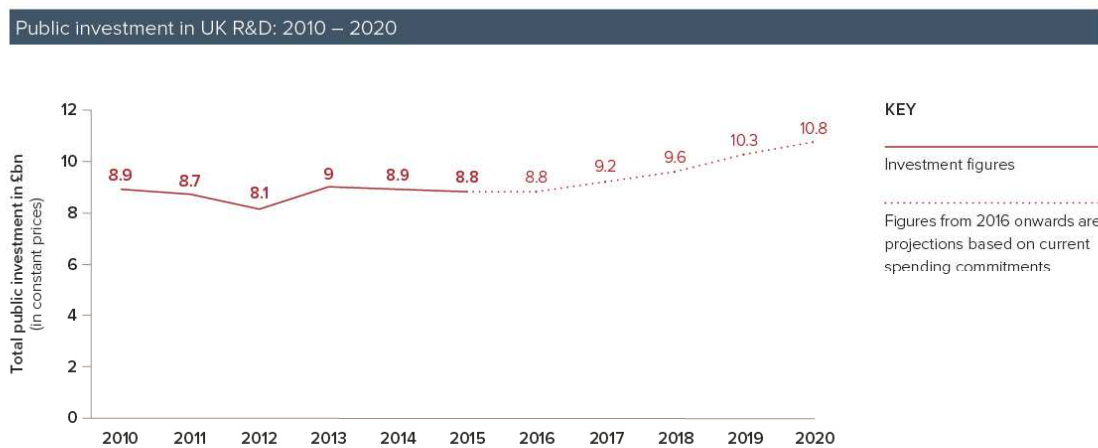
<sup>13</sup> Royal Society (2017) *Broadening the Curriculum Symposium, speech by Sir Venki Ramakrishnan PRS* - <https://royalsociety.org/news/2017/10/a-levels-no-longer-fit-for-purpose-says-royal-society-president/>

## Annex – Figures referenced in the text

The following figures, referenced throughout this document, will be published on 7 November as part of a joint Academy publication *Investing in UK R&D*.

### Figure 1 – Public investment in UK R&D: 2010 - 2020

UK public investment includes Government and Research Council investment as well as Higher Education Funding Councils (England, Scotland, Wales and NI) investment.

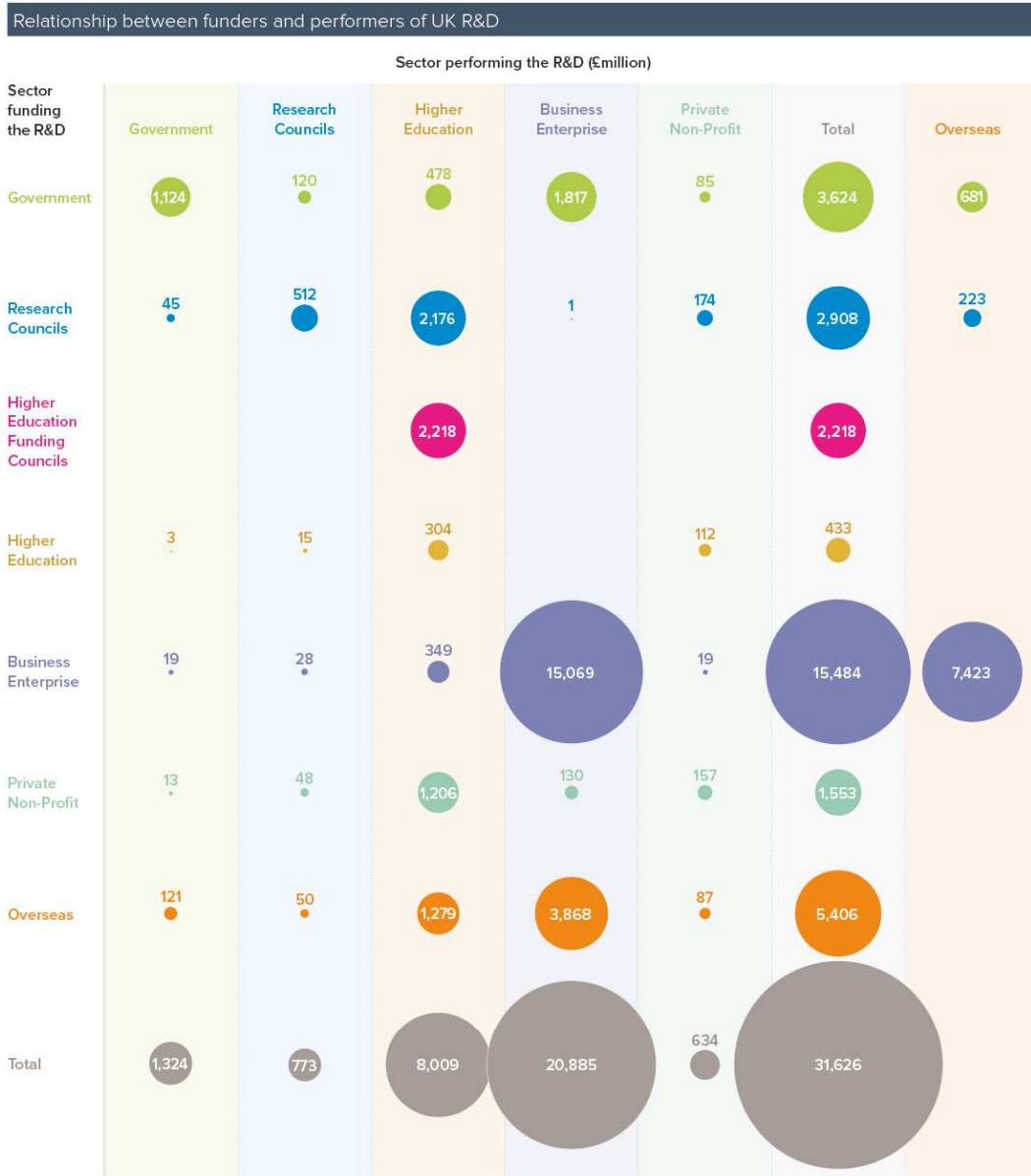


Source: Autumn Statement (2016) HM Treasury. ONS (2015) UK gross domestic expenditure on research and development.

Credit: The Academy of Medical Sciences, The British Academy, The Royal Academy of Engineering and The Royal Society (2017) *Investing in UK R&D*.



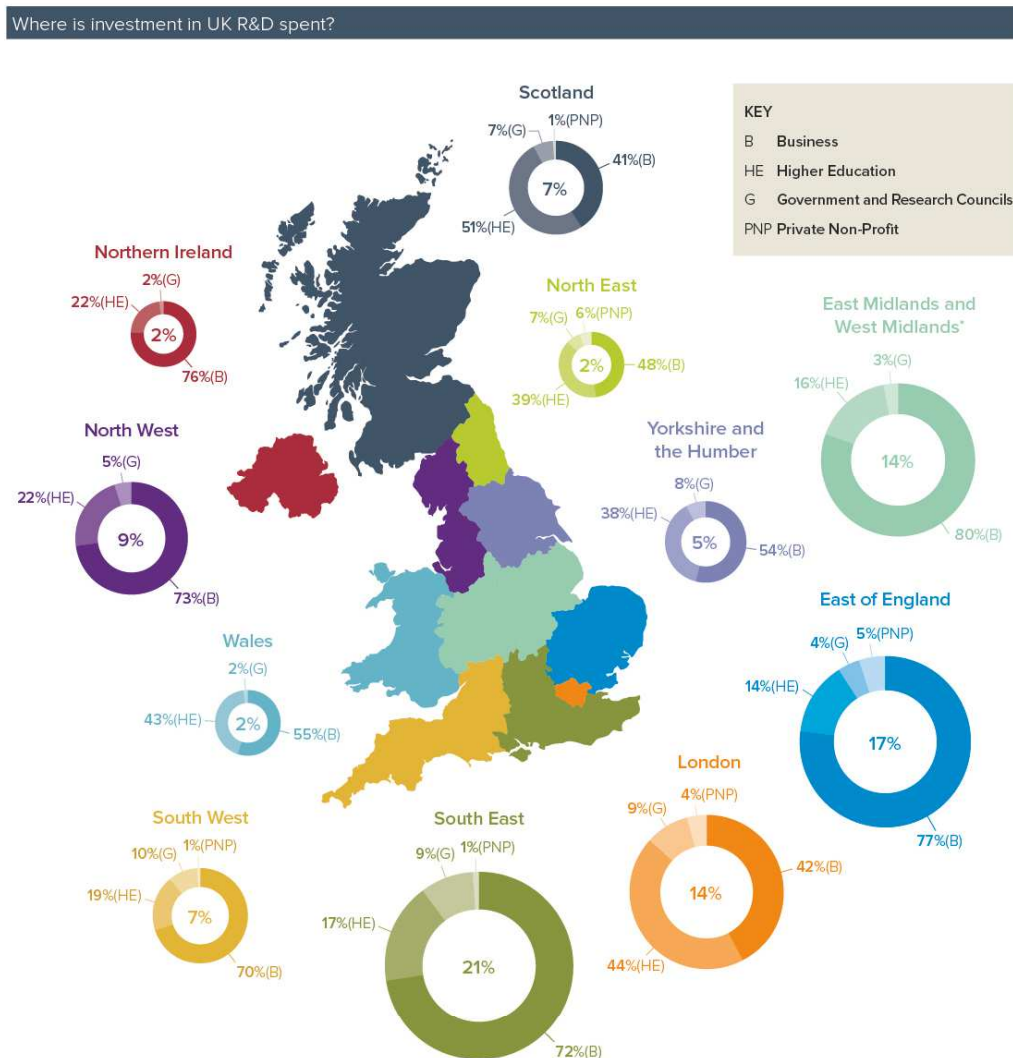
**Figure 2 – relationship between funders and performers of UK R&D**



Source: ONS (2015) UK gross domestic expenditure on research and development.

Credit: The Academy of Medical Sciences, The British Academy, The Royal Academy of Engineering and The Royal Society (2017) *Investing in UK R&D*.

**Figure 3 – Where is investment in UK R&D spent?**



Note – figures are rounded.

Source: ONS (2015) UK gross domestic expenditure on research and development.

\*East Midlands and West Midlands regions' data were combined in 2015 due to confidentiality.

Credit: The Academy of Medical Sciences, The British Academy, The Royal Academy of Engineering and The Royal Society (2017) *Investing in UK R&D*.