Investing in UK R&D

There is broad consensus across the political spectrum to increase total investment in UK research and development (R&D). The Government has committed to meet a target of 2.4% of GDP invested in UK R&D by 2027, and a longer-term goal of 3%.

Increasing overall investment is the target. To deliver this, the UK's Industrial Strategy will need to create a vibrant environment that fosters research and innovation throughout UK public services, universities and businesses, and attracts global investment, incentivising companies to locate their R&D here. Only by doing this will we improve the health and wealth of the nation.

In 2017, **£34.8bn was invested in R&D** in the UK (up from £33.1bn in 2016)[1].

This document outlines the current investment landscape, why the 3% target is important for the UK and factors that should be considered to deliver it.

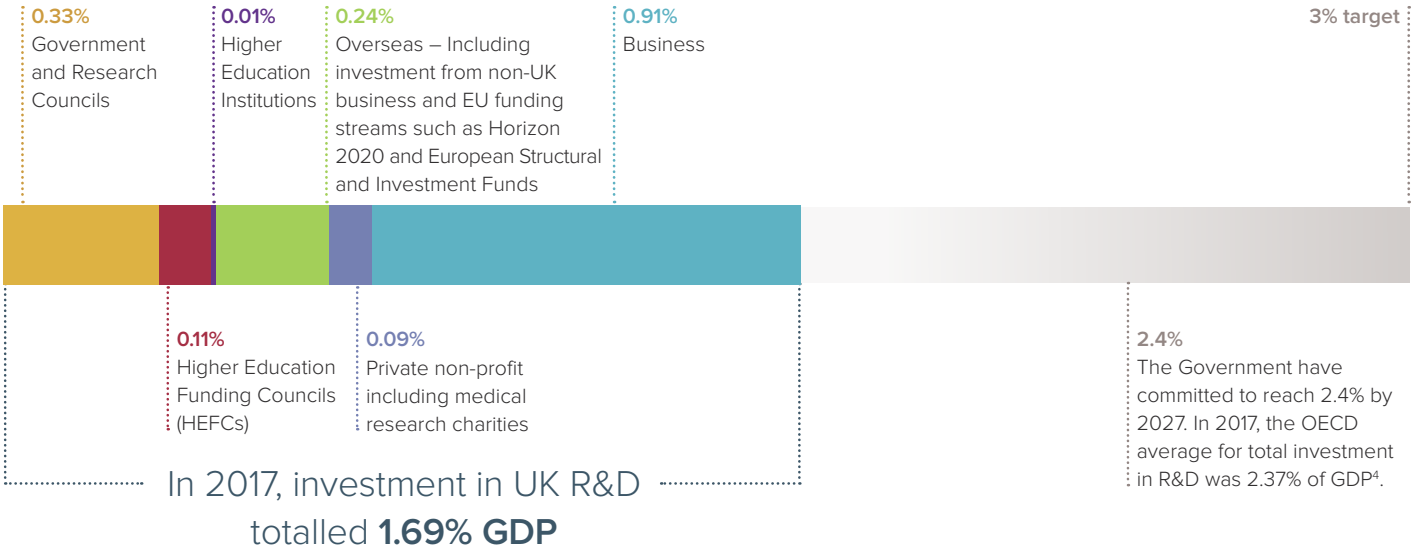
What is R&D?

R&D is defined as creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications and includes basic research, applied research and experimental development[2].

What is innovation?

Innovation often draws on R&D, but R&D is not always part of the activity of innovation. An innovation is defined as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations[3].

FIGURE 1 Where are we now? Total investment in UK R&D as a percentage of GDP



Source: ONS (2019) UK gross domestic expenditure on research and development, 2017. Note – figures are rounded.

1. ONS (2019) UK gross domestic expenditure on research and development, 2017. Note – figures are rounded.
2. OECD (2015) Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities. OECD Publishing, Paris.
3. OECD/Eurostat (2005) Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition, The Measurement of Scientific and Technological Activities. OECD Publishing, Paris.
4. OECD Main Science and Technology Indicators (2017).

Why is investment in R&D important?

R&D and innovation benefits people in the UK and around the world by underpinning our industries, creating jobs and applications that improve the quality of our lives and enriching our cultural wellbeing.

Innovation is instrumental in delivering the economic and productivity gains associated with investment in research. The UK's world-leading research base provides an excellent source of new ideas and discoveries, which, through innovation can result in advances in our economy, social wellbeing and health. This boosts the capacity of the economy to produce more in the long term.

To innovate, we need to invest in research to drive new breakthroughs, and in the innovation system to develop these ideas into new and improved products, services and approaches.

Around **25% of the world's top 100 prescription medicines** were discovered and developed in the UK[5].

Firms that consistently invest in R&D are **13% more productive** than firms that don't invest in R&D[8].

The UK is a world leader in climate science, and the **second largest contributor of expertise to the Intergovernmental Panel on Climate Change** (IPCC) process that informs international decision making about climate policies[6].

The UK has a strong history of leadership in machine learning – a technology which shows promise of supporting **potentially transformative advances in a range of sectors** including healthcare, transport and public services[9].

The UK creative economy comprises an estimated **2.9 million jobs**, or 1 in 11 of all UK jobs[7].

Every £1 invested in medical research **delivers a return equivalent to around 25p** every year, forever[10].

5. BMI Research (2016) United Kingdom Pharmaceuticals & Healthcare Report Q1 2016, p61.
6. Calculated from the annex of author and expert reviewers in the IPCC's Fifth Assessment Report. Total authors and reviewers = 1878, UK based authors and reviewers = 265.
7. Department for Culture Media & Sport (2016) Creative Industries: Focus on Employment.
8. Department for Business Innovation and Skills (2014) Innovation Report 2014: Innovation, Research and Growth.
9. Royal Society (2017) Machine learning: the power and promise of computers that learn by example.
10. Wellcome Trust, National Institute for Health Research, Academy of Medical Sciences, Medical Research Council, Arthritis UK (2017) Medical research: What's it worth?

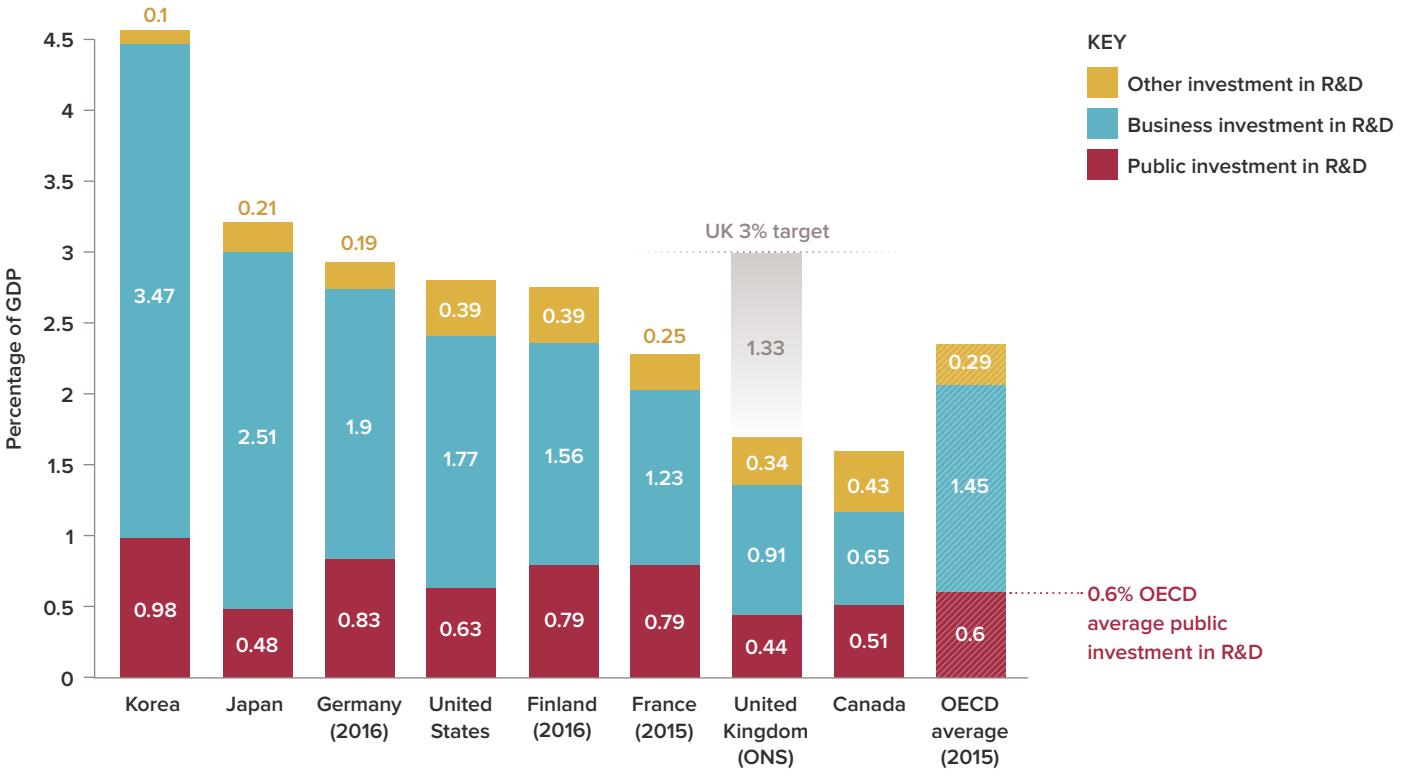
A race to the top: how does the UK compare to its global competitors?

Most companies, including those established in the UK, have to make global decisions about where to situate their high value R&D activities. In this highly competitive and internationalised environment countries must offer a competitive research, innovation and business environment if they want to attract skilled people and companies.

The UK invests a lower percentage of GDP in R&D than most of our competitors, many of whom have also launched specific strategies targeted at boosting their innovation performance, including increasing their R&D investment.

To compare data on investment with other OECD countries, publicly funded R&D has been grouped together. For the UK, public investment includes Government and Research Council investment as well as Higher Education Funding Council (HEFC) investment. Overseas, private non-profit and non-HEFC Higher Education investment are grouped under 'other investment in R&D'.

FIGURE 2 How does UK investment in R&D compare internationally?



Please note, ONS data has been used for the UK for greater accuracy. Some countries have not yet published data for more recent years, in which case the latest available data has been used.

Sources: ONS (2019) UK gross domestic expenditure on research and development, 2017. OECD Main Science and Technology Indicators (2017). Data for comparator countries shown. Note – figures are rounded.

Future spending commitments

In 2017, public investment in UK R&D totalled £9bn – approximately 0.44% of GDP. The Government has committed to invest an additional £7bn in R&D over a five-year period, between 2016-17 and 2020-21 through the National Productivity Investment Fund (NPIF). This £7bn is being phased in with additional investment per year set to reach £2.3bn in 2021-22.

Despite the introduction of this additional funding, in 2017 public investment as a percentage of GDP rose only marginally, up 0.01% from 0.43% in 2016 – still well behind many of the UK's international competitors. Since 2010 the UK has seen a general decline in the amount of public investment as a percentage of GDP.

The target of 3% of GDP also includes investment in R&D from business and non-profit organisations (e.g. medical research charities) and, while we know that government investment in research and innovation leverages other investment, this is harder to project.

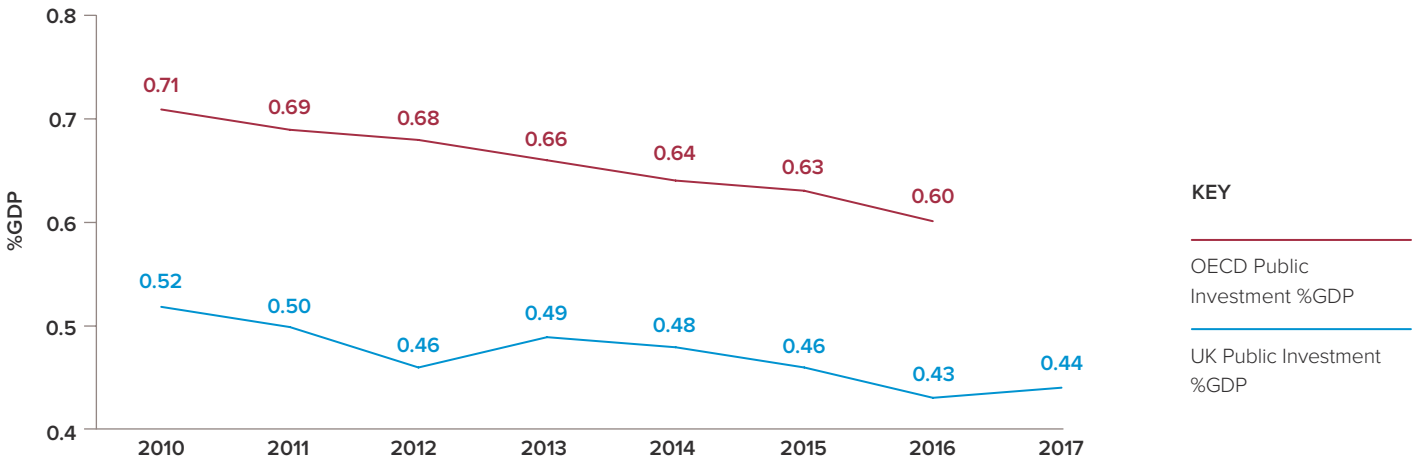
Overseas investment, including investment from the EU (such as Horizon 2020 and European Structural and Investment Funds), also makes a significant contribution towards the target and leverages other investment. Future engagement with EU funding programmes remains unclear as the UK and EU negotiate the details of their future relationship.

The Government has committed to increasing investment in science and innovation annually up to 2021 – 22.

Over the current spending period, Horizon 2020 and European Structural and Investment Funds have provided UK organisations with circa **£0.97bn a year**[12].

In 2017, public investment in UK R&D totalled **£9bn**.

FIGURE 3 Public investment in UK R&D: 2010 – 2017



Sources: ONS (2019) UK gross domestic expenditure on research and development, 2017. Note - figures are rounded.
OECD Main Science and Technology Indicators (2016)

12. Technopolis (2017) The role of EU funding in UK research and innovation. An analysis commissioned by the UK's National Academies: The Royal Society, British Academy, Academy of Medical Sciences and Royal Academy of Engineering.

Delivering 3%: Factors we need to consider

Recent increases in government investment in R&D are welcome, but this alone will not be sufficient to make the UK the most innovative country in the world. To deliver an effective Industrial Strategy we need to better understand the delicate and interconnected nature of the UK's research and innovation ecosystem to identify where changes to funding, infrastructure and regulation may have impacts on other aspects of the system.

For every £1 spent by the government on R&D, private sector R&D output rises by 20p per year in perpetuity, by raising the level of the UK knowledge base[13].

Seed corn funding, small amounts of funding in areas where little funding is available, or funding that offers researchers mobility and encourages collaborations can have a bigger impact than monetary values might suggest[14].

In 2015, over half of the UK's research output was the result of an international collaboration and these collaborations are increasing in absolute terms, and as a proportion of the UK's research output[15].

39% of UK firms have difficulties recruiting staff with skills in science, technology, engineering and mathematics[16].

There is considerable uncertainty over future EU investment in UK research and innovation. Research shows that for every €1 spent to support R&D by the European Commission, a further €0.74 will be invested by universities, companies or other stakeholders[17].

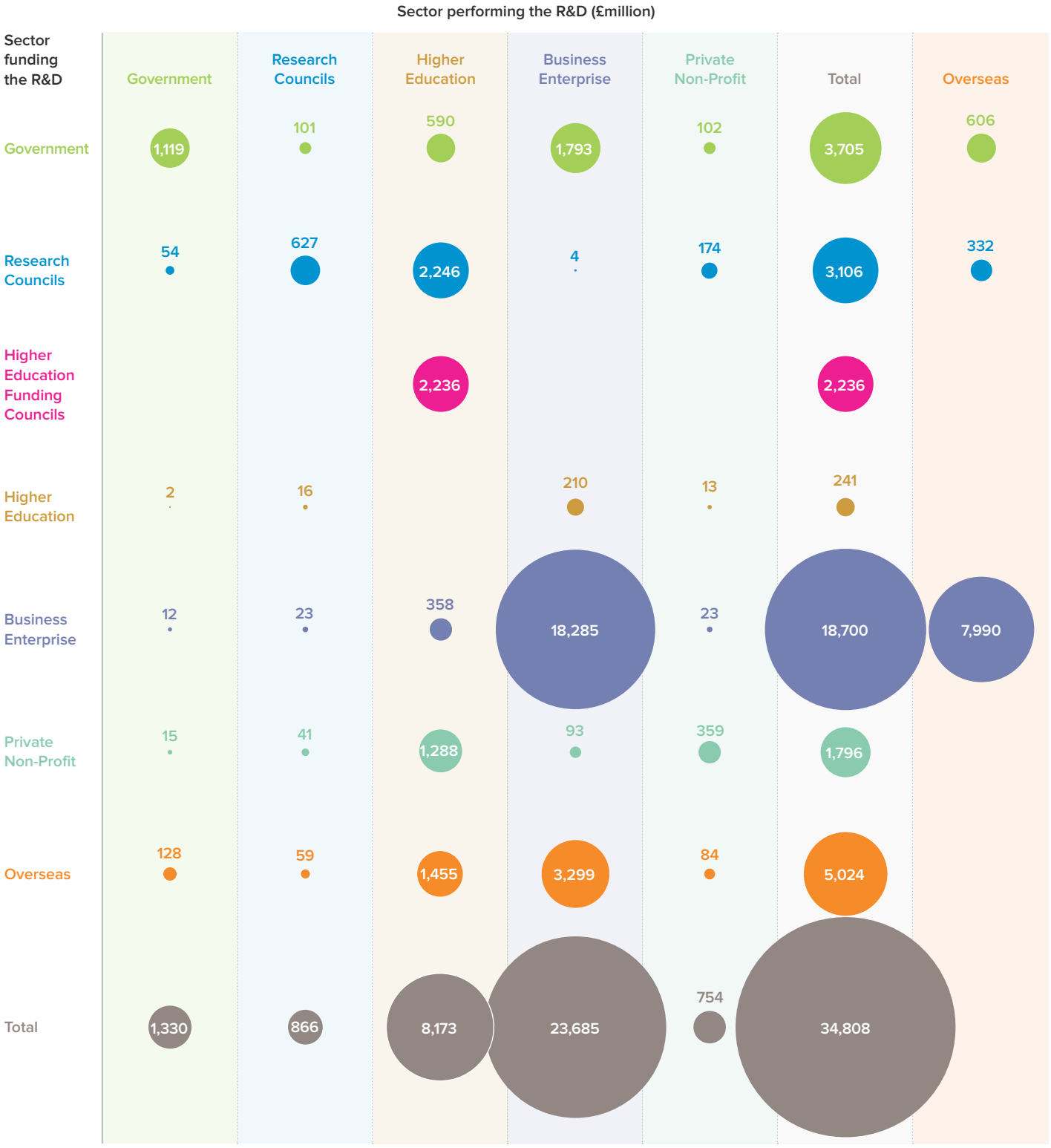
Changes to migration rules and regulation may impact on highly mobile and internationally collaborative researchers, entrepreneurs and the global workforce of large research-intensive businesses.

13. Haskel J, Hughes A, Bascavusoglu-Moreau E (2014) The Economic Significance of the UK Science Base. A report for the Campaign for Science and Engineering.
14. The British Academy (2016) Crossing paths: Interdisciplinary institutions, careers, education and applications.
15. Royal Society (2016) UK research and the European Union: the role of the EU in international research collaboration and researcher mobility.
16. Confederation of British Industry (2015) Inspiring Growth: CBI/Pearson education and skills survey 2015.
17. Adams J (2013) The fourth age of research. Nature 497, 557-560.

UK R&D is funded and performed by multiple organisations

R&D is funded and performed by many different players in its research and innovation ecosystem, with multiple interdependencies between them. A successful Industrial Strategy, underpinned by R&D, should recognise and use these interdependencies to develop a cohesive system.

FIGURE 4 Relationship between funders and performers of UK R&D

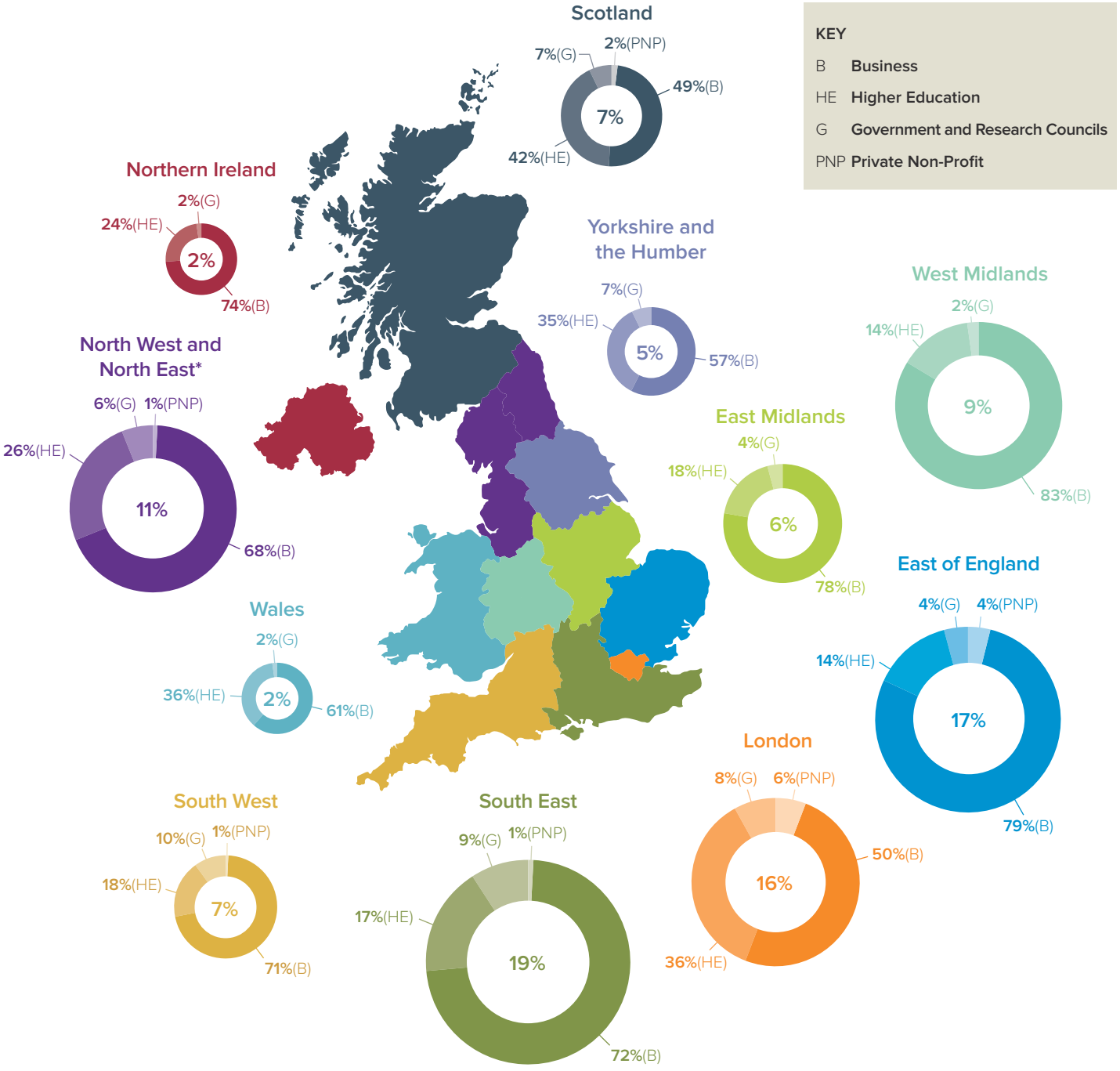


Source: ONS (2019) UK gross domestic expenditure on research and development, 2017. Note – figures are rounded.

Different UK regions have different strengths and dependencies

R&D spend varies from region to region, with each having different strenghts and dependencies. A successful Industrial Strategy should present a national vision while recognising that the UK and its industries are not uniform.

FIGURE 5 Where is investment in UK R&D spent?

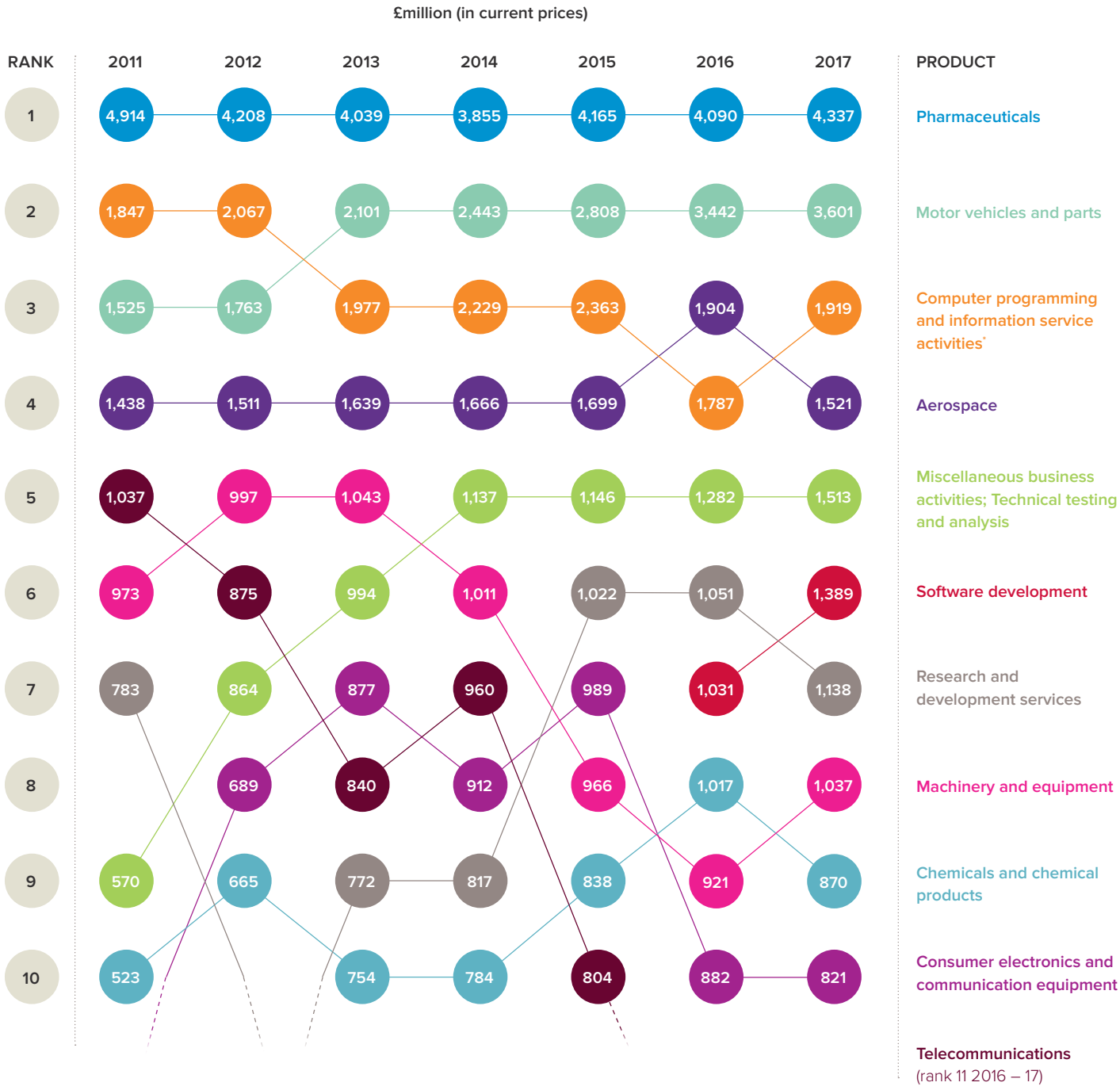


Source: ONS (2019) UK gross domestic expenditure on research and development, 2017. Note – figures are rounded.
*North West and North East regions' data were combined in 2017 due to confidentiality.

The UK's industries are not uniform and investment in R&D changes over time

The UK's industries are not uniform but change over time. A successful Industrial Strategy will need to consider how to capitalise on the existing strengths within sectors as well as taking advantage of upcoming opportunities in emerging sectors and technologies.

FIGURE 6 Top 10 business sectors performing R&D in the UK



Source: ONS (2019) Business enterprise research and development, 2017. Note – figures are rounded.
*Prior to 2016 Software development is included in the product group Computer programming and information service activities.