Executive Summary

Research and innovation are vital to our country’s prosperity, security and wellbeing and an integral part of delivering the UK’s Industrial Strategy. We want the UK to be the world’s most innovative economy. The Industrial Strategy has set an ambition to increase total investment in R&D to 2.4% of GDP by 2027 and 3% in the longer term. This will deliver on the aspiration of the Industrial Strategy’s Grand Challenges and the goal of boosting productivity across the country. To deliver this the Government is increasing its investment to support our world-class research and innovation system, and drive productivity and growth.

Introduction - Overview

1. Government has a key role in driving R&D investment and innovation across all sectors of the economy. Public investment leverages in private investment in R&D – an average of £1.40 for every £1 of public funding. The UK gets a high rate of return on our investment in R&D with private returns of around 20% and social returns two or three times this. The Government also supports private R&D investment by making the business tax environment conducive to investment in long-term R&D projects, and by investing in the education and skills needed to ensure businesses have the talent they need to innovate and grow.

2. Evidence suggests that public and private investment in R&D drives innovation in the form of new processes, products and services. Moreover, successful innovation drives international competitiveness, opening up opportunities in new markets, as well as attracting Foreign Direct Investment, in turn resulting in more R&D investment and job creation.

3. In an increasingly interconnected world, tackling global challenges is closely aligned with our domestic priorities. These challenges, such as clean growth, ageing and social mobility, affect us all; therefore, funding directed to tackling these challenges through research and innovation benefits us both globally and domestically.

4. Our global reputation for delivering excellence is key to us tackling these global challenges effectively; it has positioned the UK as ‘partner of choice’ for science, technology and innovation, enabling us to develop relationships and build influence with partner governments. These partnerships, built through our research and innovation ODA programmes and science and technology agreements with key partners such as China and the USA, act as a springboard for broader, long-term relationships that go beyond science and innovation and maximise our influence both at home and abroad.

5. Though we are a world-leader in science and innovation and generate a huge impact from our investment in R&D, international comparisons do suggest that the UK underinvests in R&D compared to other leading innovative countries. Neither the government nor the private sector are investing enough in R&D. This means
that, in the long-term, the UK risks losing out in the race to develop the technologies and innovation that will shape the businesses and markets of the future. This is why we have set out our commitment to increase total investment in R&D to 2.4% of GDP by 2027 and 3% in the longer term.

6. As a first step to reaching the 2.4% target, we announced an additional investment of £7 billion for R&D over 5 years (from 2017-18 to 2021-22) as part of the National Productivity Investment Fund. This will raise public investment in R&D from around £9.5 billion per annum in 2016-2017 to around £12.5 billion per annum in 2021-2022 – the biggest increase in public funding of R&D on record.

The effectiveness of public spending on R&D

7. R&D increases the wealth of scientific, cultural and social knowledge available to the UK, this helps build a cycle of discovery, commercialisation and innovation. We rank first amongst comparable research nations in measures of research quality and produce 15.2% of the world’s most highly cited articles with only 0.9% of its population. Based on Global Innovation Index 2018, the United Kingdom moves to 4th place this year, getting closer to the top 3. The UK gains three positions in the Innovation Input Sub-Index and keeps its 6th spot in the Innovation Output Sub-Index.

8. The pillar where the U.K. improves its rank is Business sophistication (12th), especially thanks to the gains in Knowledge absorption (24th). In measures of innovation performance, we are considered an ‘innovation leader’ in the 2018 European Innovation Scoreboard, with performance 21% above the EU average. According to a recent analysis from Universities UK, UK universities generate £95 billion for the country’s economy and support more than 940,000 jobs across the nation.

9. A review of evidence published by BEIS shows that the existing literature tends to estimate private rates of return to R&D investments of around 30% (mean) or 20 to 25% (median). Social returns, based on spillover benefits from R&D conducted by one agent to the productivity or output of other agents, are typically 2 to 3 times larger than private returns. Studies which look at the social returns to publicly-funded R&D investments have found some significant, positive returns (around 30 to 40%) based on the agricultural sector. More recent evidence, looking at how different industrial sectors interact with publicly-funded R&D, has estimated positive and significant social returns of around 20% for UK public R&D investments. However, this is likely to understate the economic return to public R&D spending. Public R&D tends to be more basic than applied, more risky, and may only be commercialised through additional private investments to absorb the knowledge making it hard to attribute the returns adequately. In addition, the benefits of public R&D may be felt in other ways, including their

impact on national health, education, security and the productivity of the public sector.

**UK Research and Innovation**

10. UK Research and Innovation (UKRI) will support and help to connect the best researchers and businesses, as it is already doing through the Industrial Strategy Challenge Fund, Catapult centres and other programmes. UKRI has a total annual budget of around £6.5 billion and by 2020, will invest around £8 billion per year. UKRI will ensure every pound of taxpayers’ money delivers enhanced analytical and strategic capability to better advise Government.

11. R&D is one of the most effective ways to develop new solutions to societal challenges. UKRI will support the Industrial Strategy Grand Challenges to drive partnerships between the best minds in science and business and put the UK at the forefront of global industries. For example, we are investing over £300 million to develop technologies and industries that can help the UK prepare for the challenge of an ageing society⁴.

**The current balance of public R&D funding**

12. The distinction between pure and applied research is an artificial construct with a blurred boundary; most research falls somewhere between the two. If there is an optimum balance, it might exist where the UK is at the forefront of producing new ideas and has the capability to translate these into social and economic benefit to the UK. In accordance with the Frascati Manual, R&D data can be categorised under three headings: basic research (experimental or theoretical work undertaken primarily to acquire new knowledge without any particular application or use in view); applied research (undertaken in order to acquire new knowledge, however, directed primarily towards a specific practical aim or objective); and experimental development (systematic work drawing on existing knowledge). OECD analysis undertaken in 2014 shows that the UK balance is not atypical among comparator countries (see chart below).

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13. The UK was broadly in line with other countries, spending approximately 85 percent of total R&D spend on applied research (as proxied crudely by applied research and experimental development). This was lower than Japan, but broadly similar to South Korea and higher than France and Italy. The same OECD analysis led to similar results in 2011, showing that this profile has been broadly stable over time. There is little evidence from these data to suggest that the UK balance is atypical.

14. Despite pressure on public spending, funding for science and research programmes was protected in cash terms at £4.6bn pa for 2011-2015 within a “ring-fence”. For the first time this included research resource for the Higher Education Funding Council for England (including Quality-related Research - QR), and thus decisions on allocations took account of both aspects – Research Councils and HEFCE research funding - providing stability and certainty to both parts of the dual support system of research funding. Through consultation with key external stakeholders, 9 key criteria were developed for the prioritisation of science and research funding, and the consultation also provided strong advice that the balance of funding between Research Councils, National Academies and HE research funding should be broadly maintained. These key criteria and principles also informed decisions on research allocations for 2015-16. Allocations also included funding for UK Space Agency, and other programmes such as Foresight and the public understanding of science. Decisions on funding for Innovate UK were made separately.

15. These allocations, along with subsequent decisions on funding for 2016-2020, reflect the Government’s continued commitment to the dual support system, provides stability in the funding underpinning our research base through both

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5 Source: OECD
Written evidence submitted by the Department of Business, Energy and Industrial Strategy (BER0064)

prospective competitive grant funding for projects and programmes alongside quality related core research funding for universities. The quality related research funding supports universities’ research capability and infrastructure, enabling them to invest strategically and plan-ahead in order to develop and support excellent researchers, and to explore novel curiosity-driven research, while responding to emerging priorities and leveraging funding from other sources. Consequently, for every £1 allocated to Research Councils, the allocations for research funding through Research England will increase from 63p in 2016, to 65p by 2020.

16. The Higher Education and Research Act 2017 enshrined the “Haldane Principle” in law, provides statutory independence for Research England from Ministers, and sets out the principle of “balanced funding” for dual support.

17. Each Council along with UKRI, has an expert Board (supported by other expert panels) considering, agreeing funding advice and making detailed decisions. Rigorous peer review processes ensure that public funding for both project and core research is only focussed on activities delivering excellent research. Project bids are peer reviewed by academic experts, while the overall quality of research from individual universities, along with the impact from their excellent research, is assessed by academic and user experts in the periodic Research Excellence Framework (most recently in REF2014), this then drives core research funding allocations. Bids to Innovate UK are also rigorously assessed by experts.

18. UKRI will provide advice on both the appropriate balance across “dual support” as well as funding for individual Councils, including Innovate UK, across discipline, and priority societal challenges, informed by evidence and evaluation of the effectiveness of earlier programmes and investments.

19. The research and innovation budget make up the majority of the Government’s spend on science, research and innovation. It is allocated to delivery bodies not only to provide running costs for cutting edge research facilities but also to foster international collaboration and support postgraduate training, public engagement, knowledge transfer, and other core research activities. Innovation budgets are aimed at supporting businesses to improve productivity and growth by realising the potential of new technologies and helping to develop new commercial ideas. Studies\(^6\) have shown that innovation support such as grants significantly increases the economic performance of companies, in terms of companies’ survival rates, and also their employment and turnover.

20. These allocations reflect principles that have been developed with input from stakeholders, since Spending Review 2010, established core criteria for the prioritisation of science and research funding that have continued to guide funding allocations subsequently, including:

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• Further concentrating funding on excellence with impact;
• Protecting mechanisms which leveraged funding from collaboration with business and charities;
• Maintaining a flow of new researchers;
• Research into strategic national challenges;
• Stability of funding – to achieve best Value for Money, provide institutional stability and enable recruitment and retention of research staff.

Delivering the 2.4% target and setting out the future balance of funding

21. Increasing investment in R&D to 2.4% GDP in a decade is ambitious and will require concerted effort by the government and business. In the Industrial Strategy we committed to working with industry to develop a roadmap for reaching the 2.4% target and that work is well underway. A cross-Whitehall Steering Board, including UKRI, has been set up to oversee development of the Roadmap and bring together all the departments with an interest in R&D.

22. There are many different policy levers at government’s disposal which influence R&D expenditure. The process of developing the roadmap is focussing on which combination of these can most effectively be used to increase private sector investment in R&D across the UK in the way which delivers the maximum benefit to citizens. We are working closely with a wide range of organisations across the UK to develop the roadmap – universities, businesses, charities, public sector bodies, innovation and enterprise agencies – and will continue to do so.

23. Through the roadmap we will provide a framework to drive business investment in R&D in key sectors, technologies and clusters. We will aim to improve the business environment, including access to finance, regulatory frameworks and intellectual property to support business investment and maximise the impact of public investment in science and innovation to reach the 2.4% target. There are measures we are already taking to achieve this, for example:

• investing £1.7 billion in the Industrial Strategy Challenge Fund (ISCF) a mission-orientated fund to support collaboration between business and the UK science base.
• investing £1.3 billion in UK talent and skills to grow and attract the best in science and innovation to attract private sector R&D investment.

24. Over the coming months, as we approach the Spending Review, BEIS will be working with UKRI to consider how public expenditure in research and innovation can best help increase R&D in the UK economy. To do this we are carrying out a comprehensive review of the evidence on the impact of public investment and are updating our assessment and evaluations processes for monitoring investments.

Some Challenges
25. The Industrial Strategy recognised the significant disparities in local and regional productivity that exists across the UK. Explicit local collaborations between research organisations (including universities) and local business can encourage research and innovation activity that is more targeted at the needs of local businesses.

26. Whilst a high proportion of research funding and activity takes place within the ‘Golden Triangle’, excellence in research and innovation exists across the country. We want to ensure that we are harnessing the research and innovation assets that exist across the UK. The Strength in Places Fund a new competitive funding scheme seeks to build on the research and innovation strengths that exist in geographical areas in order to help increase local growth and productivity.

27. The Strategic Priorities Fund, administered by UKRI, aims to build on Paul Nurse’s vision of a common fund. It will invest in strategically important, research and innovation and emerging priorities, in multi and inter-disciplinary research, and will support collaboration with Government Departments and the priorities of BEIS Public Sector Research Establishments.

International Science and Innovation to tackle Global Challenges

28. The UK Government has invested significantly in Research Infrastructures (RIs) both at home and abroad – ensuring that our scientists have access to the world-leading capabilities they need to remain at the forefront of research. The diversity of RIs around the world is truly astonishing, ranging from medical research hospitals and ground-based telescopes through to nuclear fusion experimental reactors, neutron sources and particle accelerators. They offer a wide range of business opportunities for UK industry globally.

29. We also need to maintain our position as a global leader in science and innovation. Through the Newton Fund and Global Challenges Research Fund, we collaborate with the best researchers and innovators in developing countries, strengthening their research innovation capacity, whilst working with them to tackle global challenges. Created in 2014, the Newton Fund supports bilateral and regional research and innovation partnerships between the UK and selected developing countries to build science and innovation capability in those countries by addressing the specific development challenges that affect them. It is a requirement that UK investment is matched by investment from the partner country. This approach to partnership has enabled us to build genuine, meaningful science and innovation partnerships, collaborating with the best researchers and innovators to find impactful solutions to global challenges.

30. The Global Challenges Research Fund (GCRF), announced in the 2015 UK Aid Strategy, provides dedicated funding to UK-led research focused on addressing global challenges which most significantly impact upon developing countries. It achieves this through supporting challenge-led disciplinary and interdisciplinary research, strengthening capability for research and innovation within developing countries, and providing an agile response to emergencies, where there is an
urgent research and on-the-ground need. GCRF works at the research base level and decisions on research priorities are made independently of BEIS, albeit with strategic oversight.

31. Taken together, the Newton Fund and the GCRF are part of a coherent, interdisciplinary UK research approach to help promote economic development and social welfare in developing countries, delivering the UN’s Sustainable Development Goals. The programmes leverage the UK’s world-leading research and innovation base to ensure that UK science takes a leading role in addressing global challenges faced by developing countries, such as combating antimicrobial resistance, ensuring food and nutrition security, and building resilience to natural disasters.

32. Last year, we committed to a UK-US Science and Technology Agreement, and the UK is investing £65 million to collaborate on cutting-edge science and innovation. At the same time, our Prime Minister was in Ottawa and witnessed the signing of the UK-Canada MoU on Science, Technology and Innovation, and a £1 million joint fund to support programmes in advanced manufacturing, agri-tech, clean technology and quantum technologies.

33. It is because of our reputation for excellence in science, research and innovation, supported by both our ODA and non-ODA science and innovation programmes, that we have been able to build these international partnerships. Partnerships that will prove vital as we continue to tackle global challenges and deliver the UN Sustainable Development Goals. Our continued investment in research and innovation will ensure that the UK is able to further strengthen its reputation as partner of choice for international collaboration and partnership.

Conclusion

34. Through the creation of UKRI, our commitment to achieving the 2.4% of GDP R&D target, and our record increases in funding for R&D we are ensuring that the UK will retain its world-leading position as an international hub for science and innovation. Furthermore, through the Industrial Strategy we have set ourselves on the path to be a more innovative nation that will create and commercialise the technologies of the future to solve some of the biggest challenges facing society. We are working with industry to develop an R&D roadmap which will set out a long-term delivery plan for realising this vision which we will publish in the coming months.

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