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Science and Technology Committee

Balance and effectiveness of research and innovation spending

Twenty-First Report of Session 2017–19

Report, together with formal minutes relating to the report

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Science and Technology Committee

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Contacts

All correspondence should be addressed to the Clerk of the Science and Technology Committee, House of Commons, London SW1A 0AA. The telephone number for general inquiries is: 020 7219 2793; the Committee's e-mail address is: scitechcom@parliament.uk.

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Summary

In its 2017 'Industrial Strategy', the Government committed to raising total investment in research and development to 2.4% of GDP by 2027, and to reach 3% of GDP in the longer term. This compared to an investment of 1.69% in 2017, beneath the OECD average. We welcome the Government's target, which—if achieved—would represent a significant increase in the research intensity of the UK economy. Although private sector investment will be critical to achieving this target, it is apparent that public investment will also be required and will gain greater traction if it is undertaken earlier. The Government should consider whether a separate Government R&D spending target, either as a proportion of GDP or in real terms, would benefit the current national target.

Both UKRI and BEIS have committed to producing roadmaps to show the path to 2.4%. We recommend that these are published as soon as possible and no later than the end of 2019. Plans contained in the roadmaps should show an integrated approach between UKRI and BEIS that suitably reflects the strengths and prospects of the UK economy. These plans should be developed beyond 2027 to ensure travel towards the longer-term 3% target. In order to aid public understanding the roadmaps should update the Dowling Review schematic, including details of the main R&D funding streams available through the Industrial Strategy and UKRI.

The creation of UKRI created a significant opportunity for improving the strategy and co-ordination of research funding. We recognise the complexity of addressing the balance of funding of the dual support system, and that UKRI strategy is to approach the task cautiously and without any sudden shifts in funding. UKRI should also assess and report on other dimensions of balance such as the regional concentration of funding, the balance between research and innovation, and the balance between capital and current spending in a similar manner to its analysis of the dual support system. We believe more immediate changes to funding are appropriate to influence balance in these areas. There are many possible 'balances' or policy mixes, and this political choice should be transparently set out. UKRI should continually monitor the appropriateness of balances struck in the operation of the dual support system and publish the advice given to the Government, alongside analysis and commentary, at regular intervals.

We support UKRI's commitment to evaluation, however the current focus appears too strongly to follow traditional metrics, measuring outputs such as publications and patents that should only be one element of evaluation. Research on research is an increasingly important field, and we recommend that UKRI consider a dedicated approach to supporting it, including how this research is incorporated into UKRI strategy and its assessment of the balance of R&D funding. Relatedly, UKRI should attempt to analyse the benefit gained by its creation through its enhanced ability to capture data across research councils and through cross-cutting funds. We recommend that UKRI also develops a 'big data' focus for evaluation. It should publish a plan for creating and investing in new data sources and analysis techniques beyond traditional measures of patents and publications.

The flat profile of quality-related (QR) funding in recent years suggests that it has not been prioritised in funding decisions, although the announcement of a £45 million increase in QR funding by Research England in July 2019 indicates that there may

be a change in this focus. We recommend that focus on QR funding is maintained in future considerations, and that QR should continue to be prioritised to address previous real-terms reductions in funding. We recognise, however, that the seven-year Research Excellence Framework (REF) cycle creates barriers for smaller but potentially fast-growing institutions or areas of excellence who receive lower QR allocations. We recommend that in UKRI's ongoing evaluation work it reviews whether additional support for these institutions should be provided, possibly through specific gearing of investment across the REF period, through additional review periods for smaller bodies, or through separate QR stream for smaller and specialist institutions.

Place is a key focus within both the Industrial Strategy and the UKRI strategic prospectus and development plan. The Government should aim to build further research excellence outside of its existing predominance in the South East of England. We strongly agree that additional regional funding should not be to the detriment of this 'golden triangle'. However, in order to contribute to the 2.4% R&D target, regional strengths will need to be harnessed and cultivated. For UKRI, the main lever with which to stimulate regional excellence is through the Strength in Places Fund (SIPF). The SIPF is still in its infancy, but its rationale and its goals remain somewhat opaque and it is too modest to drive any significant rebalancing of investment. We recommend that UKRI and BEIS substantially increase the size of the SIPF given it appears to be the primary lever through which it is attempting to influence the regional concentration of funding and create new centres of excellence beyond the golden triangle.

The balance across research disciplines should be easier to monitor and adjust under UKRI. Historic patterns clearly should not be maintained for their own sake. We are concerned that the Strategic Priorities Fund (SPF) may not have been established in a way that effectively addresses this. We recommend that UKRI review the SPF and ensure that individual research councils are not exerting excessive influence on what is intended to be a cross-council, multi-disciplinary focus. Future consideration of the balance between disciplines must include robust evaluation of research areas within each discipline. We find the case regarding entrenched concentration of research analysed in The Biomedical Bubble compelling. UKRI analysis should widen this approach and conduct relevant cost-benefit analysis of larger research areas within different disciplines to establish whether R&D spending remains productive.

We welcome the opportunity to redress reductions in capital investment for research. In order for UKRI to take ownership of the 'batteries not included' issue, we recommend that decisions for investment include consideration of the co-ordination of capital and revenue funding and the long-term requirements of new and existing investments. Major capital investment project plans should explicitly state assumptions regarding future QR or research council funding that may be required to staff or run them.

The Government strategy for reaching 2.4% R&D investment should highlight the significant R&D investment that is undertaken by Government departments. The Government needs to make it as easy as possible for businesses to locate and access opportunities to benefit from this investment, and should create a central linking point or web portal to facilitate this. The creation of UKRI represents an opportunity for it to operate as the ultimate steward of this system. The Government's roadmap should

include detail on UKRI's role in coordinating this investment. UKRI should analyse the potential impact of cross-Government funding on dimensions of balance such as regional concentration of spending.

We agree with the Connell Review that the Small Business Research Initiative (SBRI) has a "unique and valuable role to play in the innovation and procurement landscape", supporting UK businesses in developing innovative new products while enabling public sector bodies to source innovative solutions to the challenges they face. However, the Government's response to the Connell Review so far is limited. We recommend that the Government fully adopts the recommendations of the Connell Review, and establishes a central SBRI fund with a National Board to oversee its delivery as part of the 2020 Spending Review.

Alongside increasing the size and reach of SBRI, the Government should produce a procurement strategy and communications plan that specifically identifies innovation opportunities and promotes innovation-friendly practices. It should address barriers currently perceived by the business community, such as treatment of risk and intellectual property. The benefits of a central portal that collates procurement opportunities from across Government should be pursued.

1 Introduction

Background

1. In November 2017 the Government published its Industrial Strategy, *Building a Britain fit for the future*.[1] The strategy identified five foundations of productivity for the UK, namely ideas, people, infrastructure, business environment and places. The first policy commitment made in the strategy, under the heading of "ideas", was to raise total research and development investment to 2.4% of GDP by 2027, and to reach 3% of GDP in the longer term, "placing us in the top quartile of OECD countries".[2]

2. At the same time, in response to Sir Paul Nurse's Review of research councils in 2015,[3] the Higher Education and Research Act 2017 formally established UK Research and Innovation (UKRI) in April 2018. UKRI brought together seven research councils,[4] Innovate UK, and the research elements of the Higher Education Funding Council for England—now called 'Research England'.

3. UKRI published its initial Strategic Prospectus in May 2018, representing the "beginning of the process to develop a detailed Research and Innovation Strategy".[5] Regarding the 2.4% target for R&D spending, UKRI stated that it "will work with Government to develop a plan for meeting this target, maximising the impact of public investment in research and innovation, and supporting businesses and other partners to invest more".[6]

4. The Higher Education and Research Act 2017 stated that the role of UKRI included advising Ministers regarding the balance between the dual support funding streams.[7] UKRI envisaged ongoing work to analyse and understand what constituted a reasonable balance.[8]

1 BEIS, Industrial Strategy, November 2017
2 BEIS, Industrial Strategy, November 2017, p 66
3 BEIS, Ensuring a successful research endeavour: review of the UK research councils by Paul Nurse, November 2015; the review contained many recommendations that would be incorporated in to both the Industrial Strategy and UKRI, including the creation of a single organisation (UKRI) to improve communication and engagement between the research community and policy makers and establish common ways of working, a Ministerial committee for strategic discussions, a common research fund and increased ability for Government to invest in particular sectors, disciplines or regions. The report also recommended that dual support system of funding be preserved and that a principle of "investing in excellence, wherever it is found" be maintained.
4 Arts and Humanities Research Council; Biotechnology and Biological Sciences Research Council; Engineering and Physical Sciences Research Council; Economic and Social Research Council; Medical Research Council; Natural Environment Research Council; and Science and Technology Facilities Council.
5 UKRI, Strategic Prospectus, May 2018, p6
6 UKRI, Strategic Prospectus, May 2018, p11
7 Under the 'dual support' system, Research England will provide annual funding for English institutions in the form of a 'block grant', and UK Research Councils provide funding for specific research projects and programmes. See Chapter 5 for further details.
8 UKRI, Strategic Prospectus, May 2018, p23

Our inquiry

5. In July 2018 we launched an inquiry to look at the balance and effectiveness of research and innovation spending, to identify and understand the levers and choices available to aid the Government and UKRI in reaching the Government's 2.4% target. In the call for evidence we highlighted the need to understand the rationale required for deciding the balance of public R&D funding against many different criteria, including:

- individual research disciplines, research councils and cross-disciplinary schemes;
- the two research funding streams of the 'dual support' system;
- 'pure' and 'applied' research;
- research and innovation;
- block funding, responsive mode funding and directed funding;[9]
- the 'golden triangle' of London, Oxford and Cambridge, and the rest of the UK; and
- global challenges and other strategic/national priorities

6. We also wished to assess the effectiveness of this public spending, in light of new funding streams such as the Industrial Strategy Challenge Fund. With the next Spending Review then expected in 2019 we asked for information regarding the phasing and plans required to meet the Government's targets, and assumptions about the private sector investment that would be necessary alongside Government spending. As such we were also interested in the effectiveness of different levers for encouraging innovation, including R&D tax credits, the Small Business Research Initiative, and other loans and grants available for private enterprise.

7. Given the scope of inquiry and the number of actors involved across Government, universities and business—and the linkages between them—we received a high number of written evidence submissions (around 100). We also took oral evidence from 29 witnesses including the then Minister for Universities, Science, Research and Innovation and the Chief Executive of UKRI, as well as academics, international experts on research and development, and representatives of universities, business, and charities. To assist us in our work, we also appointed Dr Kieron Flanagan, Senior Lecturer in Science and Technology Policy at Manchester Institute of Innovation Research, as a Specialist Adviser for our inquiry.[10] We are grateful to everyone who contributed to our inquiry.

9 The terms of reference considered directed funding for the Industrial Strategy

10 Dr Flanagan declared his interests on 13 November 2018: Senior Lecturer in Science and Technology Policy, Manchester Institute of Innovation Research, University of Manchester: an employee of the University of Manchester and an elected member of that university's Senate

8. In this Report we set out recommendations for the Government and UKRI that we believe will be important in ensuring the 2.4% and 3% targets for R&D as a proportion of GDP are met. Specifically:

- In Chapter 2 we consider the level of ambition of the 2.4% target and how this compares in an international context, which influences how such targets should be viewed and interpreted;
- In Chapter 3 we detail the role and structure of UKRI in the complex wider R&D landscape. This complexity highlights the challenges facing UKRI;
- In Chapter 4 we explore the balance issues across the different dimensions and disciplines that UKRI will need to consider when making its funding allocations; and
- Finally, in Chapter 5, we look beyond UKRI to the other channels of influence that the Government has in incentivising increased R&D, through Government spending, taxation and regulation.

2 Level of ambition of the 2.4% target

9. This Chapter considers the importance of research and innovation spending, and details the current level and composition of spending in the UK. In this context, and compared to spending in other countries, we consider whether the current target of 2.4% of GDP should be viewed as an ambitious one. We also identify other factors that will be of importance in reaching this goal.

Importance of research and innovation spending

10. The Department for Business, Energy and Industrial Strategy (BEIS) highlighted in its submission that "research and innovation are vital to our country's prosperity, security and wellbeing, and an integral part of delivering the UK's Industrial Strategy".[11] UK Research and Innovation (UKRI) summarised the importance of investment in R&D and the positive social returns it had (i.e. additional value created for others in society, beyond those undertaking the investment):

> There is significant national and international evidence that shows public investment in R&D achieves high social rates of return, of around 20% p.a. It attracts substantial private investment in R&D from within the UK and overseas, with every £1 of public spend leveraging about £1.40 of private spend. Private R&D investment also leads to significant benefits, with direct returns to the firm of about 20% p.a. and social returns two or three times this.
>
> The evidence suggests that on average £1 of public R&D investment generates around £7 of net benefit to the UK.[12][13]

11. The R&D target therefore represents a path of increased spending that will benefit the whole of the UK economy through these 'spill over' effects. The Industrial Strategy suggested that doing so will "transform our economy":

> with our businesses creating the next generation of technologies to revolutionise productivity in all sectors from construction and agriculture to manufacturing and the creative industries. This will raise the standard of living and establish UK leadership in global markets.[14]

Current R&D spending

12. The Government has set targets for R&D spending to constitute 2.4% of GDP by 2027, and to reach 3% of GDP in the longer term. The latest ONS data[15] shows that in 2017 total R&D expenditure in the UK was £34.8 billion, or 1.69% of GDP, but the breakdown of this spending is complex[16] and dependent on whether split by funding source or by the sector in which R&D is performed. The Frascati Manual (the internationally recognised

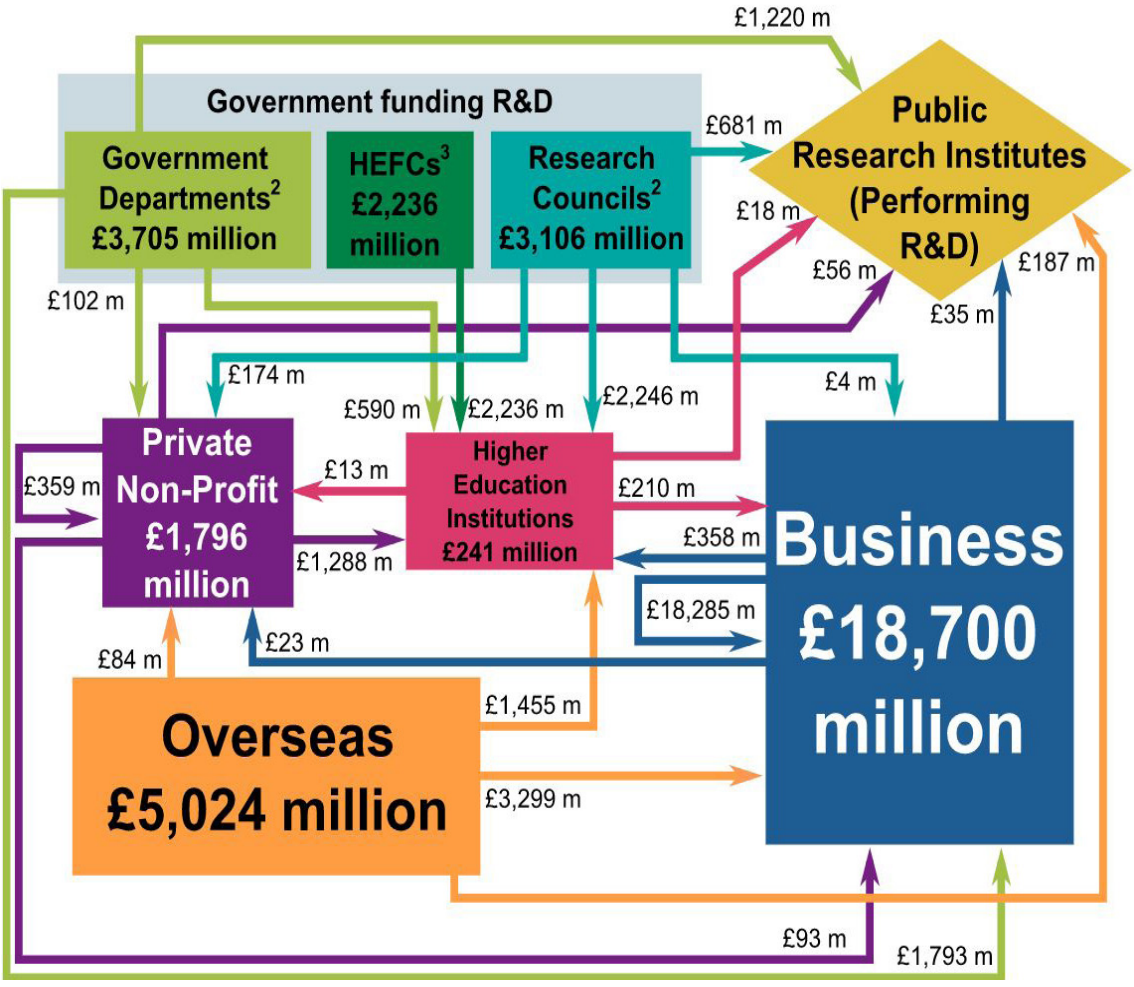
11 Department for Business, Energy and Industrial Strategy (BER 0064)
12 UK Research and Innovation (BER0063) para 7
13 Similar effects were highlighted in many submissions, including The British Academy (BER0042) para 27 and Academy of Medical Sciences (BER0069) p3
14 Industrial Strategy p66
15 ONS, Gross domestic expenditure on research and development, UK: 2017, March 2019
16 The British Academy (BER0042) para 27

methodology for collecting and using R&D statistics), categorises investment from four sectors: business enterprise; Government (including research councils); higher education; and private non-profit organisations (such as charities).[17] Investment by business and non-profit organisations may originate domestically or from overseas.

13. In terms of funding, the UK business sector funded £18.7 billion of total UK-performed R&D activity, representing around 54%. The Government sector was the second-largest source of funding at £6.8 billion or 20%. However, whilst this includes funding by the seven research councils of £3.7 billion, it excludes funding by the higher education funding councils (HEFCs) for England, Scotland, Wales, and the Department for Employment and Learning in Northern Ireland. An alternative split shows funding by Government departments of £3.7 billion (11%) and dual support funding through HEFC and Research Councils of £5.3 billion (15%). Around £5 billion (14%) of UK R&D funding is from overseas investment.

14. The figure below, published by the Office for National Statistics (ONS), represents these flows of funding through the R&D ecosystem. The values in the boxes are the amounts of funding that each sector provided to the recipient performing sector.

Figure 1: Flows of Research and Development Funding, Office for National Statistics (2019)



17 OECD, Frascati Manual 2015, October 2015

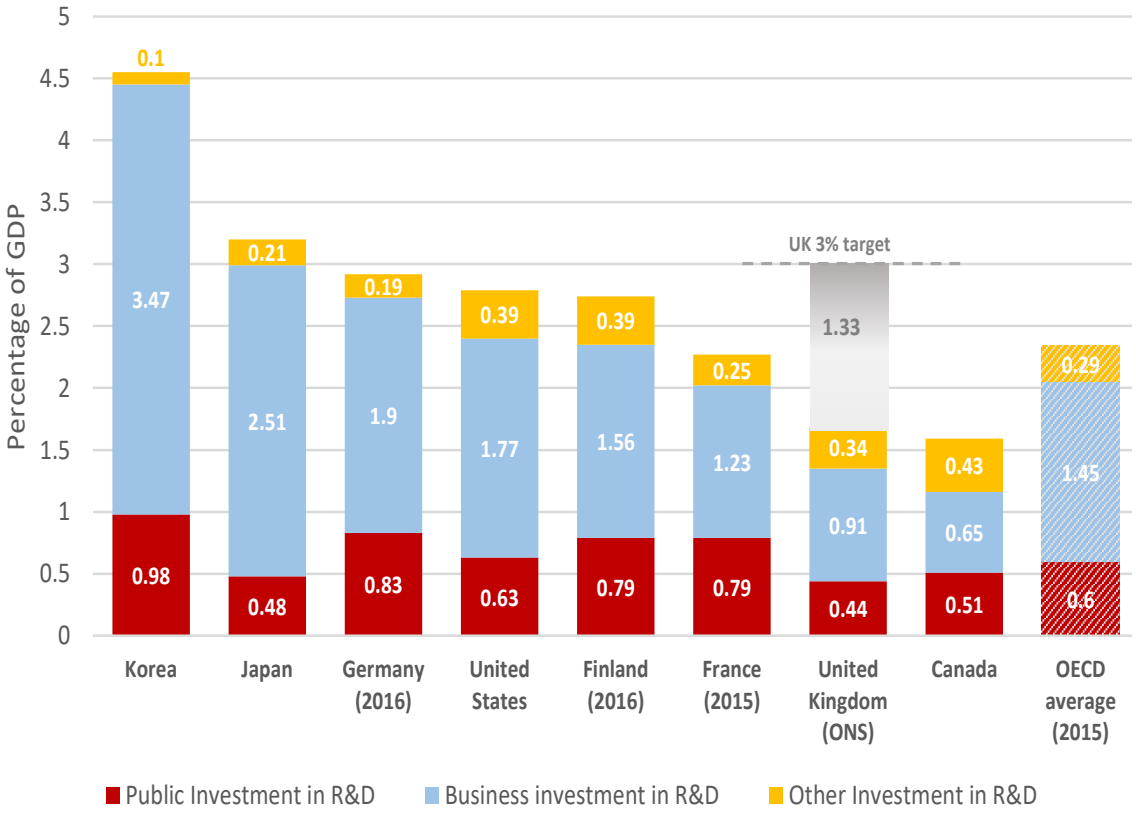
15. In terms of R&D activity, business R&D represents the largest share at £23.7 billion in 2017, or 68% of total UK R&D expenditure. The product groups with the largest R&D activity were pharmaceuticals (£4.3 billion), vehicles and parts (£3.6 billion), and computer programming and information services (£1.9 billion). The higher education sector accounts for R&D activity of £8.2 billion, or around 23% of total UK expenditure, mainly provided through the dual support system by research council and HEFC funding as shown above. The statistics show R&D activity in the UK Government department research institutes and laboratories of £2.2 billion, or 6% of total R&D activity. Private non-profit organisations undertook a further £0.8 billion of activity, or 2% of total spending.

16. The ONS data suggests that R&D spending of 1.69% in 2017 was an increase from 1.67% the previous year. However, OECD data suggested there was a decrease from 1.68% to 1.66%, although this may be revised in light of the more recent ONS figures.[18]

17. In terms of international comparison, using UNESCO data these levels are similar to Canada and Norway, but lower than France (2.3%), Germany (2.9%) and behind table leaders such as South Korea and Israel (both 4.2%).[19]

18. The target of 2.4% of GDP represents the current OECD average spend on R&D; a briefing by the Royal Society illustrated the gap between current level of UK investment, the OECD average, and the eventual target in the figure below.[20]

Figure 2: UK R&D funding, Royal Society (2019)

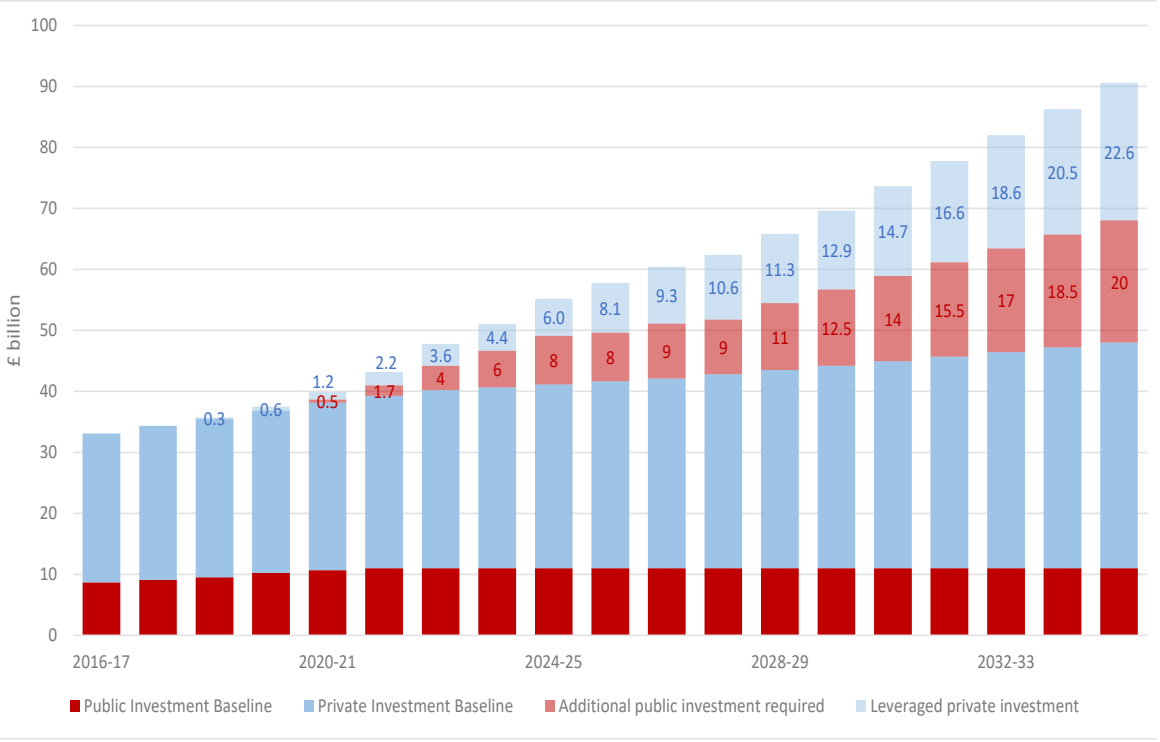


18 OECD, Gross domestic spending on R&D
19 UNESCO, R&D spending by country
20 Royal Society, Investing in UK R&D

2.4% as a 'stretch' target

19. The Campaign for Science and Engineering (CaSE) submitted to us modelling of the additional private and public investment required to meet the 2.4% target. The baseline assumption used by CaSE was that without increased Government investment public expenditure remained flat in cash terms and private expenditure increased in line with GDP; and that additional public investment would leverage further private spending at a ratio of 1.36. Their results showed that "public investment must reach £20 billion in 2027, [an] additional £9 billion per year" if the UK is to reach its 2.4% target.[21] This additional spending is shown in the figure 3 below.

Figure 3: Additional Funding required to meet R&D targets, CaSE (2018)



20. Several conclusions flow from this result, notably that the public investment portion of research and development spending must be frontloaded to achieve sufficient leverage of private investment to achieve the target of 2.4% by 2027. CaSE explained that UKRI and BEIS could not deliver public investment by themselves so cross-Governmental R&D spend "will be crucial to meet the target".[22] However, whilst these are the implications of the modelling, they do not consider the capacity of the research system to absorb these increases and spend money effectively.

21. Rebecca Endean representing UKRI commented that, with the latest ONS data showing that "£34 billion is spent on R&D in the UK. To get to 2.4%, that number will have to double in nominal terms".[23] Professor Sir Mark Walport, Chief Executive, UKRI, also added that a whole-economy approach was needed: "you also need to think about the denominator. What the overall economy does is very critical as well."[24] The then Minister

21 Campaign for Science and Engineering (BER0065)
22 Campaign for Science and Engineering (BER0065)
23 Q398
24 Q399

of State for Universities, Science, Research and Innovation, Chris Skidmore MP, noted that this did make the target a "slightly perverse one" as "we want to have a strong economy and recognise that investment in R&D can deliver that strong economy."[25]

22. There was an element of disagreement in the evidence received regarding the ambition of the target. Kirsten Bound of Nesta summarised this conflict when she explained:

> from one perspective, it is monumentally ambitious. It requires a sustained year-on-year increase that we have not seen in a generation. From another perspective, it will take us to an OECD average intensity spend. No country aspires to be average.[26]

23. Sir Paul Nurse agreed that the target was "a step in the right direction, but you cannot say that it is that ambitious",[27] whilst Mr Polcuch of UNESCO also raised the point that were the UK to move towards 2.4% it would necessarily by 2027 be under the OECD average.[28]

24. The interpretation of the target as ambitious was partly due to the recognised difficulty in pushing through substantial increases in R&D investment. Kirsten Bound suggested that "several countries have achieved this kind of increase in the past", but that "input intensity targets are hard to meet".[29] Professor Edler of the German Fraunhofer Institute for Systems and Innovation Research noted that "there are countries in Europe that have done it […] It can be done [… but] there is a decreasing return on R&D investment at some point".[30] This is partly reflected in previous UK R&D targets which were unmet, notably a 2004 commitment to reach 2.5% of GDP by 2014.[31] A quarter of this increase was sought from public funding and three quarters from private; while there was a modest increase in private R&D investment over this period, publicly-funded R&D remained flat as a share of GDP.[32]

25. However, international comparisons themselves may be of limited use. Dr van Broek of the Raathenau Instituut in Holland suggested "you should think more about understanding what you want to achieve than just about trying to get to 2.4%".[33] Similarly, there was agreement between the international experts giving evidence that it was not desirable to simply copy traits of other systems; they argued that the UK needed to look at its own economic structure and identify where strengths were now and where they might be in the future, and this should dictate the "effectiveness" of any investment.[34] This suggested that the goals of science and innovation policy and the Industrial Strategy must be kept at the forefront of investment decisions, ensuring a focus on quality as well as quantity of research funding.

26. With these points in mind, it was clear that reaching suitable settlements in the next Spending Review and any further spending settlements up to 2027 would be crucial.

25 Q453
26 Q2
27 Q3
28 Q54
29 Q3
30 Q51
31 HM Treasury, Science and innovation investment framework 2004–2014, July 2004
32 UK Research and Innovation (BER0063) para 40
33 Q100
34 Q70

This was echoed by UKRI and BEIS. Professor Sir Mark Walport said that "in order to maintain the trajectory, we will be making a very strong case as part of the spending review, through BEIS, that we are heading in the right direction, but a lot more needs to be done."[35] The then Minister agreed that "the spending review is completely critical"[36] and that "if we do not get it right this year we will struggle to get to 2.4% by 2027",[37] adding:

> I am also chastised by the fact that, when you look at figures published on 14 March [2019] by the ONS, total R&D expenditure in 2017 represented 1.69% of GDP, up from 1.67% in 2016. We put an additional £7 billion into R&D between 2016 and 2021. To hit 2.4% is going to be a challenge and I want to make sure I can commit to meeting it effectively by a 0.1% uplift every year.[38]

27. **Additional frontloaded funding will be key for reaching the 2.4% target, but it clearly is not sufficient. It is also important to ensure that the capacity of the UK economy and research system enables R&D expenditure to be used efficiently and effectively. Creating sufficient leverage of private sector investment will be crucial. *The Government should consider whether a separate Government R&D spending target, either as a proportion of GDP or in real terms, would benefit the current national target.***

28. UKRI and BEIS sought to assure us that work was underway to better understand the research and innovation landscape (see Chapter 3 for an explanation of the complexity of this landscape). UKRI's engagement was demonstrated by its work on the 'research and innovation infrastructure roadmap'—an assessment of existing UK infrastructure, and analysis of future economic and social needs, and the resulting investment priorities.[39] The latest update was published in March 2019.[40] UKRI have suggested that they will publish their roadmap in "summer or autumn".[41] BEIS is also developing a roadmap and have committed to publishing theirs "shortly after the spending review".[42] These are envisaged to sit "side by side".[43] BEIS has also continued to undertake related assessments through the 'science and innovation audits' (SIA), aimed at helping local and regional areas to map their research strengths and identify areas of potential global competitive advantage.[44] Whilst the SIA appear beneficial for understanding the baseline environment in the UK, they do not themselves directly address the challenge of reaching the 2.4% target.

29. Plans such as the roadmaps are inevitably complex undertakings given the range of actors involved. UKRI assured us that they were "working with partners across Government" in developing theirs,[45] and similarly that they were engaging with BEIS in gathering evidence and engaging with stakeholders for the Government's version.[46] Rebecca Endean representing UKRI summarised the need for an expansive view of what would contribute to the target:

35 Q400
36 Q453
37 Q452
38 Q453
39 UKRI Research and Innovation Infrastructure Roadmap
40 UKRI UKRI Infrastructure Roadmap Progress Report
41 Q389
42 Q461
43 Q460
44 BEIS Science and innovation audits
45 Q388
46 Q389

> We need to think about what our offering is around place, infrastructure and industry support. A range of other Government policies will need to support and encourage the R&D, through tax incentives, regulation… What we are trying to do, working with BEIS, is to think about that road map in a very holistic sense. UKRI is very important, of course, but it is not just about UKRI. It is about how UKRI fits into that wider cross-Government initiative, where we look at all the policy instruments around place, infrastructure, people and supporting business.[47]

30. The then Minister also recognised the difficulty inherent in planning towards a target in 2027 when the Spending Review was for a significantly shorter period, with the "interesting challenge" that the review period will be for "three years rather than, traditionally, four years."[48] He said that the publication of the roadmap would follow the Spending Review when "we know exactly how much money we have in the bag from the Treasury".[49]

31. The Chancellor has subsequently confirmed that the next multi-year Spending Review will not be carried out until 2020, and instead on 4 September delivered a one-year Spending Round detailing departmental funding allocations for the 2020–21 financial year.[50] The Spending Round re-iterated the Government's commitment to the 2.4% target:

> The government is committed to increasing levels of research and development (R&D) to at least 2.4 per cent of GDP by 2027. In the autumn, the government will set out plans to significantly boost public R&D funding, provide greater long-term certainty to the scientific community, and accelerate its ambition to reach 2.4 per cent of GDP.[51]

However, it is also noted that whilst the majority of BEIS's capital settlement funds R&D, an accounting change meant that BEIS's capital budget had not been fully set for 2020–21.[52] The documentation currently shows the BEIS capital budget decreasing from £11.5 billion in 2019–20 to £6.4 billion in 2020–21, a reduction of £5.1 billion. Across Government there is an additional £6.5 billion unallocated capital budget for 2020–21 for which the departmental allocations will be "confirmed before 2020–21".[53]

32. Little mention was made in evidence of the "longer-term ambition of 3%."[54] Achieving the initial target is a clear precursor to this aim, but it was left unclear whether success in meeting the initial target would put in place a trajectory that could be followed beyond that.

33. **We welcome the Government's target for R&D spending which, if achieved, would represent a significant increase in the research intensity of the UK economy. However, the difficulty in achieving the target should not be underestimated, and will require successful coordination of public spending and further increases in private investment.**

47 Q398
48 Q462
49 Q458 [Chris Skidmore]
50 HM Treasury, Spending Round 2019, September 2019
51 HM Treasury, Spending Round 2019, September 2019 para 2.35
52 HM Treasury, Spending Round 2019, September 2019 p18
53 HM Treasury, Spending Round 2019, September 2019 p34
54 Q453

34. **We welcome the commitments by UKRI and BEIS to make a strong case at the Spending Review, which we had expected to be this autumn, for the additional funding required to reach the 2.4% target by 2027. Given the stretch of the target, it is apparent that additional public spending is likely to gain greater traction if it is undertaken earlier, thus increasing the potential for leveraging private sector spending.**

35. **Both UKRI and BEIS have committed to publishing roadmaps to show the path to 2.4%. It is our understanding that given the nature of both public and private investment required to reach the target, these roadmaps will address the landscape influencing R&D spending, including the wider Government policies and pillars of the Industrial Strategy (ideas, people, infrastructure, business environment, and places).**

36. **It is not clear whether the Government's recent commitment to "set out plans to significantly boost public R&D funding", which it had promised this autumn, relate specifically to the roadmaps, high-level long-term funding plans, or simply greater clarification of the BEIS capital budget for next year, which was not fully set in the recent Spending Round.** ***Assuming that a multi-year funding commitment is made, a "significant boost" should suitably reflect the frontloaded investment that we have established is required. We are pleased that such decisions will not be delayed until the 2020 Spending Review and urge UKRI and BEIS to make the 'strong case' we expect of them.***

37. **We hope that the promise of providing "greater long-term certainty to the scientific community" indicates both a long-term funding commitment and the detailed plans we expect to be contained in the roadmaps.** ***If not, we strongly recommend that both UKRI and BEIS publish their promised comprehensive roadmaps to illustrate the intended path to the 2.4% target as soon as possible, and no later than the end of 2019 following confirmation of Government funding plans. These should demonstrate an integrated approach between UKRI and BEIS that suitably reflects the strengths and prospects of the UK economy. These plans should also be developed beyond 2027 to ensure that travel towards the longer-term 3% target, indicating how momentum will be maintained and when more detailed plans for this target will be produced.***

3 UKRI and the R&D landscape

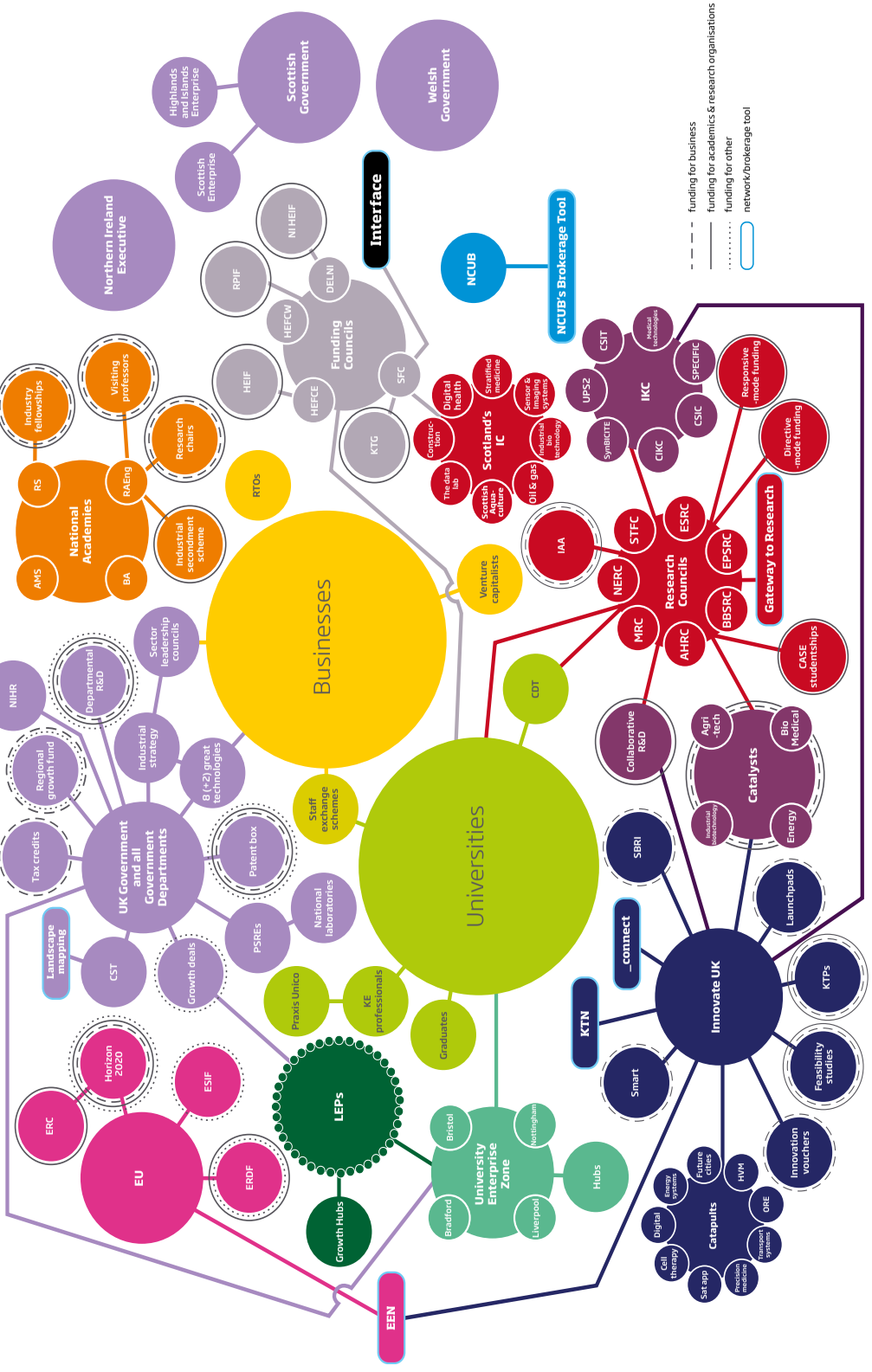
38. The creation of UKRI represents a significant change to the UK research and innovation landscape, one which has already been adapting to policies and strategy contained in the Government's Industrial Strategy. In this Chapter we examine the complexity of the R&D landscape, and detail the additional funding streams created and administered through the Industrial Strategy and UKRI. We then outline the significant challenges for strategy and evaluation of policy that UKRI will face.

Complexity of the R&D landscape

39. In July 2015 the Government published the independent Dowling Review of Business-University Research Collaborations, to develop advice on how the Government can support relationships between UK businesses and UK university researchers.[55] The review identified business research and development as the foundation of productivity and growth and made recommendations to better support relationships between business and university researchers. As part of its research the review attempted to map the UK research and innovation landscape, identifying the channels through which business and university interacted, as shown in figure 4 overleaf.

55 Department for Business, Energy and Industrial Strategy, The Dowling Review of Business-University Research Collaborations, July 2015

Figure 4: Dowling Review (2015)—Research and Innovations landscape



[37] Figure 10 is an attempt to capture the major organisations and funding sources, relevant to business-university collaboration, in the UK's research and innovation landscape. Due to the complexity of the landscape there will inevitably be information missing.

40. The review noted that "due to the complexity of the landscape there will inevitably be some information missing". Consequently the review summarised the challenges of a complex innovation ecosystem:

> Business-university collaboration is an important component of the innovation ecosystem. Innovation is a complex, non-linear process, so the complexity of the UK's innovation ecosystem is not surprising and may be to a degree inevitable. However, the complexity of the policy support mechanisms for research and innovation poses a barrier to business engagement in collaborative activities, especially for small businesses. It also makes it difficult for government to take a systems view of its support mechanisms for research and innovation.[56]

41. As established in the previous Chapter, achieving a 2.4% target for R&D as a proportion of GDP will require a significant increase in public and private investment. This will require the Government to create an effective policy mix across the entire R&D landscape in order to effectively leverage public spending. Changes to the research and innovation ecosystem since the Dowling Review, in particular the Industrial Strategy and creation of UKRI, represent "considerable changes" in the UK R&D landscape.[57] However, these changes created new policies and funding streams which could potentially add complexity. The sections below examine some of these policy developments and identify the challenges they have created.

42. **The complexity of the R&D ecosystem has been well documented and means that understanding the interaction of organisation, funding and policies is difficult. Some complexity may be inevitable given the diversity of policy goals and actors. *UKRI and BEIS should ensure that their roadmaps on how the UK will reach the 2.4% target detail key areas of potential conflict or policy overlap resulting from their choice of policy mix in this complex environment. Unnecessary complexities should be identified and removed as part of the mapping process. In order to aid public understanding they should update the Dowling Review schematic, including details of the main R&D funding streams available through the Industrial Strategy and UKRI.***

The Government's Industrial Strategy

43. The Government's Industrial Strategy stated that its central objective was to improve living standards and economic growth across the country. The 2.4% R&D target was a fundamental pillar of its approach. The strategy incorporated the National Productivity Investment Fund (NPIF), a £37 billion fund for capital investment between 2017–18 and 2023–24. The Fund covers housing, transport and digital infrastructure as well as R&D funding, for which £7 billion was allocated from 2017–18 to 2021–22.[58] Relatedly the Government has created 'Sector Deals' outlining partnerships between Government and industry in areas such as construction and rail, aiming to 'transform' the sector's productivity through innovative new technologies.[59]

56 Department for Business, Energy and Industrial Strategy, The Dowling Review of Business-University Research Collaborations, July 2015, p2
57 AIRTO Ltd (BER0013) p1
58 HM Treasury, Autumn Budget 2018, Nov 2018, p54
59 BEIS, Introduction to Sector Deals

44. The Industrial Strategy set out a series of Grand Challenges to "put the UK at the forefront of the industries of the future, ensuring that the UK takes advantage of major global changes, improving people's lives and the country's productivity".[60] The first four 'grand challenges' were: artificial intelligence and data; ageing society; clean growth; and the future of mobility.

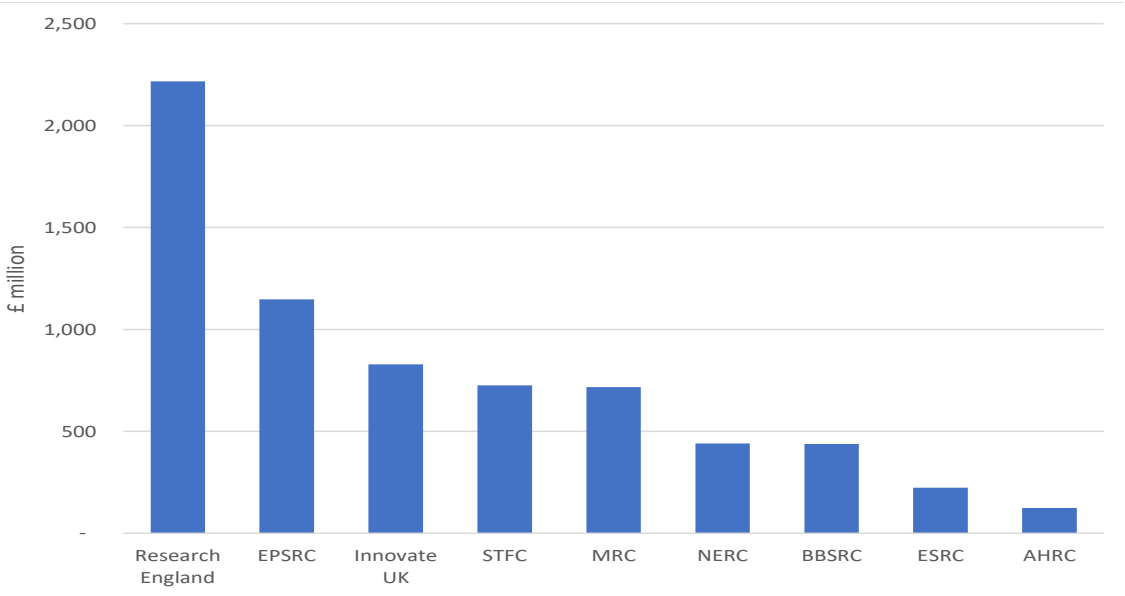
45. Within each of these challenges were more specific missions, focusing on a specific problem in order to bring together Government, businesses and other organisations. For example the AI and data mission was to "use data, artificial intelligence and innovation to transform the prevention, early diagnosis and treatment of chronic diseases by 2030."[61]

46. These challenges have informed one of the major R&D policies introduced by the Government, namely the UKRI-operated Industrial Strategy Challenge Fund (ICSF). We discuss this further in the section below, alongside other funds operated by UKRI.

The creation of UKRI

47. UK Research and Innovation (UKRI) is a non-departmental public body that was formally established in April 2018 through the Higher Education and Research Act 2017,[62] following Sir Paul Nurse's Review of UK Research Councils in 2015.[63] The creation of UKRI united the most significant elements of public sector R&D funding, bringing together the seven sectoral research councils[64] with Innovate UK and Research England (whilst the devolved administration equivalents of Research England remain in place). The current funding allocation for these councils is shown below.[65]

Figure 5: UKRI funding allocation 2018–19, UKRI Strategic Prospectus (2018)



60 BEIS, The Grand Challenges
61 BEIS, The Grand Challenges missions
62 Higher Education and Research Act 2017
63 Department for Business, Innovation and Skills, Ensuring a successful research endeavour: a review of the UK research councils by Sir Paul Nurse, Nov 2015
64 Arts and Humanities Research Council; Biotechnology and Biological Sciences Research Council; Engineering and Physical Sciences Research Council; Economic and Social Research Council; Medical Research Council; Natural Environment Research Council; and Science and Technology Facilities Council.
65 UKRI Strategic Prospectus, May 2018

48. In its case for the creation of UKRI the Government highlighted a range of benefits stemming from integrating these research and innovation functions within a single body.[66] These included:

- a greater focus and capacity to deliver on cross-cutting issues that are outside the core remits of the current funding bodies, such as multi- and inter-disciplinary research;
- a strengthened, unified voice for the UK's research and innovation funding system, facilitating the dialogue with Government and partners on the global stage;
- improved collaboration between the research base and the commercialisation of discoveries in the business community;
- better mechanisms for the sharing of expertise and best practice—for example, around management of major projects and large capital investment;
- more time for research and innovation leaders to focus on strategic leadership through the centralisation of back and middle office functions and the reduction of administrative responsibilities; and
- improved quality of evidence on the UK's research and innovation landscape through the pooling of multiple datasets and information sources, underpinning effective funding decisions.

49. Within UKRI the research councils are responsible for funding and co-ordinating academic research within their field, as well as funding postgraduate study. Council funding is project-orientated, representing one pillar of the 'dual support' system.[67] Similar to the Grand Challenges of the Industrial Strategy, individual research councils have their own themes, with, for example, the Engineering and Physical Sciences Research Council (EPSRC) listing 12 themes including digital economy, energy and engineering.[68]

50. In addition to these seven research councils UKRI incorporates the new council 'Research England'. This takes forward the England-only research responsibilities of the Higher Education Funding Council for England (HEFCE), responsible for the block grant funding element of the dual support system.[69] Although UKRI incorporates Research England, there are separate HEFCs for devolved administrations—the Scottish Funding Council, the Higher Education Funding Council for Wales, and the Department for the Economy in Northern Ireland, which maintain powers to work jointly with Research England and UKRI.

51. The final organisation incorporated into UKRI was Innovate UK. It works with people, companies and partner organisations to drive science and technology innovations,

66 BEIS Case for the creation of UK Research and Innovation, June 2016

67 The dual support represents the two main funding lines of UKRI, and can be thought of project-orientated elements and block grants. For more discussion see Chapter 5.

68 Engineering and Physical Science Research Council, Themes

69 The dual support system refers to the split in funding for institutions between the research councils project funding and the annual 'block grant' funding provided by Research England. This is discussed in detail in Chapter 4.

for example through the Knowledge Transfer Network (KTN).[70] Innovate UK is also responsible for the Catapult network of R&D centres which connect businesses with research and academic communities.[71] It also delivers the Small Business Research Initiative, a programme aimed at delivering improved public services through harnessing innovative solutions from business to challenges faced by Government.[72] The Innovate UK model is significantly younger than the research council model and the scale and scope of activity has grown rapidly from a small base.

52. The aim of increasing capacity to deliver on cross-cutting issues is demonstrated through UKRI's administration of a number of cross-cutting funds, created in line with the priorities of the Industrial Strategy and funded through the National Productivity Investment Fund. The list below details those outlined in BEIS's allocation documentation:

- Industrial Strategy Challenge Fund (£491 million in 2019–20): fifteen challenges "informed by industry", these focused on "specific areas where either the UK already has world-leading research and businesses ready to innovate, or where the global market is large or fast-growing and sustainable". Whilst these challenges are informed by the Industrial Strategy Grand Challenges (ISGCs), Nesta has called for a "stronger link" with the ISGCs and a review of the fund to make sure it is challenge led.[73]

- Strength In Places Fund (£32 million in 2019–20): funding to support significant local economic growth, by supporting areas of R&D strengths that are driving clusters of businesses that have potential to innovate, so that those clusters become nationally and internationally competitive.[74] It also aims to enhance local collaborations between universities.

- Future Leaders Fellowships (£900 million over the next 11 years[75]): aimed at helping the "next generation of researchers, tech entrepreneurs, business leaders and innovators" to get the support required to develop their careers by providing up to seven years of funding for around 550 early-career researchers from the UK and abroad in UK-based universities and businesses[76] (subject to certain eligibility criteria[77]).

- Strategic Priorities Fund: building on Sir Paul Nurse's recommendation of a common fund support for multidisciplinary and interdisciplinary programmes identified by researchers and businesses. The multidisciplinary programmes are coordinated through the combinations of relevant research councils in six 'priority areas', including tackling antimicrobial resistance and global food security.[78]

70 KTN is a network partner of Innovate UK that provides advice on funding, industry expertise and connections to other sectors through a network of businesses, universities, funders and investors.

71 There are ten Catapult centres, with a total budget of around £100 million; Cell and Gene Therapy, Digital, Future Cities, High Value Manufacturing (a network of another seven centres), Offshore Renewable Energy, Satellite Applications, Transport Systems, Medicines Discovery, Compound Semiconductor Applications, and Energy Systems

72 Innovate UK Small Business Research Initiative

73 Nesta (BER0072) para 2.3

74 UKRI Strength in Places Fund

75 UKRI Background to the Scheme

76 UKRI Background to the Scheme

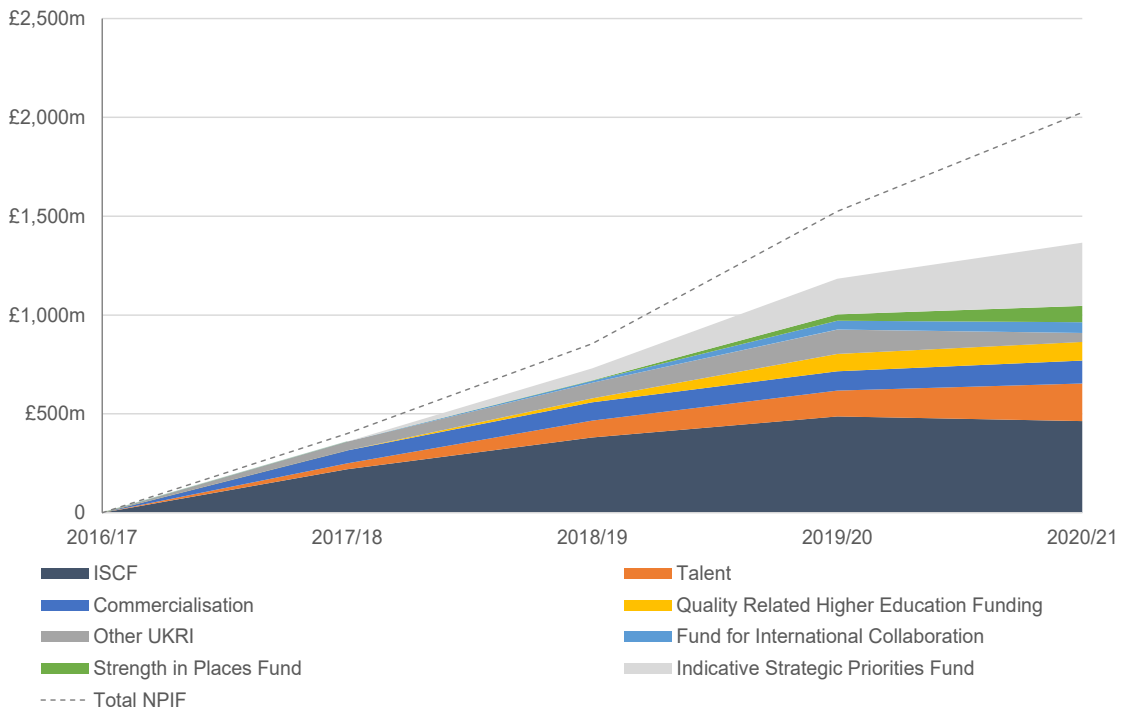
77 UKRI Future Leaders Fellowship: Person Specification

78 UKRI Themes and Programmes

- Commercialisations: includes the £210 million Higher Education Innovation Fund administered by Research England to support interactions between English universities and "the wider world",[79] and the £100 million Connecting Capability Fund for collaboration between English universities in research commercialisation.[80]
- The UK-wide Fund for International Collaboration (£110 million): focusing on bilateral and multilateral partnerships with global R&D leaders.

53. The UKRI Strategic Prospectus (figure 6 below) illustrated how this funding was distributed:[81]

Figure 6: UKRI Funding through National Productivity Investment Fund, UKRI Strategic Prospectus (2018)



54. In addition, UKRI also administers the UK-wide Global Challenges Research Fund (GCRF), aimed at supporting research that addresses challenges faced by developing countries across three challenge areas (equitable access to sustainable development; sustainable economies and societies; and human rights, good governance and social justice).[82] This forms part of the UK's Overseas Development Assistance (ODA) and aims to tackle the UN's Sustainable Development Goals. UKRI also administers the Newton Fund,[83] another part of UK ODA that supports economic development with partner countries. GCRF and Newton Funding thus count both towards the Government's 2.4% R&D target and towards the Government's 0.7% overseas aid target.

79 UKRI The Higher Education Innovation Fund (HEIF)
80 UKRI The Connecting Capability Fund (CCF)
81 BEIS, The allocation of funding for research an innovation, July 2018 p12
82 UKRI Global Challenges Research Fund
83 UKRI Newton Fund

Challenges for UKRI

55. The significant majority of evidence we received expressed support for the creation of UKRI, its aims, and for the opportunities it represented. This included universities, professional organisations, business and charities.[84] But as with any newly established organisation there are also inherent risks.[85] The main challenges identified in our inquiry predominantly related to strategy and evaluation.

Strategy

56. Sir Paul Nurse argued that the previous research council structure created a "lack of decision making", and that the formation of UKRI meant there was an opportunity to take on strategy discussions that "are both exceptionally important and quite difficult to do well."[86] The innovation Foundation Nesta suggested that the creation of UKRI was a "huge opportunity to do things better, and not just to remake the existing system on a grander scale".[87] The Campaign for Science and Engineering suggested that such a strategy required a "clear vision of the purpose of increasing the R&D intensity of the UK".[88] We discuss later in this Report the balance between the different dimensions of research and innovation in the development of this strategy.

57. The UKRI strategy has continued to progress during the course of our inquiry. The Strategic Prospectus published in May 2018 set out the initial vision, mission and values that would inform this development of UKRI, and focused on "pushing the frontiers of human knowledge and understanding", with the aim of "delivering economic impact" and "creating social and cultural impact by supporting our society to become enriched, healthier, more resilient and sustainable".[89] However, this only represented the "beginning of a process to develop a detailed Research and Innovation Strategy" in order to answer a "series of big questions".[90] The prospectus contained various commitments, such as to the Haldane principle,[91] support for a balanced dual support funding system, building a culture of evaluation, and support for growth across the UK. It also set out several pieces of ongoing work that would help to refine the UKRI strategy:[92]

i) "We will develop a longer-term Research and Innovation Talent Strategy in 2018" (p.15);

ii) "In its first year, UKRI will engage with its stakeholders to develop a strategy and action plan for equality, diversity and inclusion" (p.16);

84 Russell Group (BER0060); Academy of Medical Sciences (BER0069);The Confederation of British Industry (CBI) (BER0026)

85 Deloitte Managing the Execution Risks of Change Initiatives: Risks of organisational restructuring could be that a focus on establishing the organisation and processes may mean wider opportunities are missed, the creation of groupthink could harm the diversity of research funding, or potential 'regulatory capture' (such that Innovate UK is seen increasingly as the tech transfer arm of research councils, rather than equally reflecting private sector interests)

86 Q6

87 Nesta (BER0072) page 1

88 Campaign for Science and Engineering (BER0065) page 1

89 UKRI Strategic Prospectus p6

90 UKRI Strategic Prospectus p5

91 The Haldane principle states that whilst the government sets the overall strategic direction that research should take, decisions about which research projects to fund are taken by experts in the field through peer review.

92 UKRI Strategic Prospectus, as identified by WonkHE Seven things we have learned from the launch of UKRI's strategy, May 2018

iii) "We will scope a new UKRI Ethics Policy and Framework" (p.17);

iv) "We will review our open access [data] policies to assess their effectiveness and make recommendations in 2019" (p.19);

v) "We will develop effective data and metrics to understand the research and innovation landscape in different sectors, technology domains and places" (p.28); and

vi) "We will review our public engagement programmes and develop a new public engagement vision and strategy by March 2019" (p.39).

58. UKRI has subsequently published its 2019–20 Delivery Plans, highlighting the "areas of focus and key activities of UKRI's nine constituent councils and its cross-cutting themes."[93] However, progress on many of the other commitments is less clear. We address the issue of evaluation in the next section.

59. Regarding public engagement, Sir Paul Nurse emphasised the importance of scientists earning their "licence to operate", "by engaging the public and getting them on board",[94] a sentiment supported by Professor Sir Mark Walport, Chief Executive of UKRI.[95] However, the evidence for UKRI's work in fostering this licence to operate, as published on the UKRI website, appears largely based on investments made by research councils over the last decade,[96] rather than through a new public engagement strategy as committed to in the prospectus. The review of open access to data appears to be ongoing, and due to launch in March 2020, although there will be no change to the Research Excellence Framework (REF) 2021 open access policy.[97]

60. The main area which appears to be lacking in the UKRI strategy is the review of balance that this Report addresses. The prospectus commits to continuing "to champion both responsive and strategic modes of funding to enable discovery-led research to flourish in the UK and drive impact from new knowledge and breakthroughs", whilst the delivery plan states that UKRI is:

> undertaking a programme of evidence gathering and analysis on the dual support system […] to better understand the pressures facing the higher education sector, the impact of different funding scenarios, and to provide advice to ministers on the most appropriate balance of funding.[98]

61. Whilst there is additional detail regarding funding allocations for the ICSF, Strength in Places Fund and Strategic Priorities Fund, there is no detail regarding how these decisions were made, or their impact on balance of funding across the dimensions that we address in this Report.

62. **The creation of UKRI created a significant opportunity for improving the strategy and coordination of research funding. However, there remain significant risks in**

93 https://www.ukri.org/about-us/delivery-plans/
94 Q10
95 Q401
96 UKRI Embedding public engagement
97 UKRI Open Access Review
98 UKRI Delivery Plan 2019 p22

introducing a new strategic oversight, and in gaining the support of the wide range of stakeholders, including the public, with whom UKRI will interact. The overall success of UKRI is dependent on overcoming these challenges at an early stage.

63. **We recognise the complexity of addressing the balance of funding of the dual support system and that this is a fundamental remit of UKRI. Creating a robust evidence base for this assessment will be crucial, and we recognise that UKRI strategy is to approach the task cautiously and without any sudden shifts in funding.**

64. ***In line with the approach taken in this Report, UKRI should also assess and report on other dimensions of balance such as the regional concentration of funding, the balance between research and innovation, and the balance between capital and current spending, in a similar manner to its analysis of the dual support system. We believe more immediate changes to funding are appropriate to influence the current balance in these areas. There are many possible 'balances' or policy mixes, and this political choice should be transparently set out.***

Evaluation

65. The UKRI Strategic Prospectus outlined the ambition to build a culture of evaluation at UKRI.[99] The creation of UKRI is intended to build on "existing strengths" in order to use data "in new ways to look across the research and innovation landscape to understand the impact of our investments and maximise the return we get".[100] This also recognised that evaluation of the return on investment was "notoriously difficult", due to "long lags, difficulties in obtaining a true baseline, and difficulties in correctly attributing benefits". Evaluation is both internal, through a "framework for tracking and reporting UKRI performance" that will also have a focus on "specific areas of strategic importance such as Place, Talent, and Infrastructure"; and also outward-facing where to measure performance against long-term ambitions UKRI will "monitor a broad set of outcomes with a wide range of quantitative and qualitative indicators".[101] These include:

- Pushing the frontiers of human knowledge and understanding: New research tools, and methods; high quality people; and improved knowledge sharing;
- Delivering economic impact: New products, businesses and services; increased business growth and jobs; links between the research and the innovation, business and investment communities; and
- Creating social and cultural impact: Improved wellbeing; health outcomes; improved policymaking and public services; improved security, resilience, and cost avoidance.

66. UKRI reiterated its commitment to undertaking this robust monitoring and evaluation,[102] drawing attention to previous evaluations of Knowledge Transfer Partnerships[103] and the Small Business Research Initiative.[104]

99 UKRI Strategic Prospectus p28
100 UKRI Strategic Prospectus p28
101 UKRI Strategic Prospectus p44
102 UK Research and Innovation (BER0063) para 25
103 Innovate UK, The Knowledge Transfer Partnership programme: an impact review, Oct 2015
104 BEIS, Leveraging public procurement to grow the innovation economy; an independent review of the Small Business Research Initiative by David Connell, Nov 2017

67. In evidence the innovation foundation Nesta suggested that there was limited evidence on the effectiveness of innovation and growth policy, and without good evidence it was impossible to allocate limited resources to the programmes that have the greatest impact, whilst also suggesting there was insufficient innovation in these policies to allow better analysis.[105] This was supported by the Academy of Social Sciences submission, highlighting the need for a specific strand of research ("diagnostic, experimental and evaluative") to find out what worked in improving productivity.[106]

68. Nesta also suggested that traditional data sources, such as business surveys and academic publications and patents, were ill-suited for analysis in new industries, failed to capture networks of collaboration, and might involve substantial time lags.[107] Kirsten Bound of Nesta suggested that more should be done to capture the "power and possibility" of 'big data', for example:

> we should look at scraping millions of job ads, to see which technologies people are hiring for. We should look at the information in thousands of websites and millions of open datasets, draw it together and visualise it in new ways, so that policy makers can have much more granular and real-time access to data for decision making.[108]

69. In our session with UKRI, Professor Sir Mark Walport agreed that evaluation and measurement of success was an "absolutely critical" part of their work, but conceded that this was also "very hard", suggesting that the "initial focus" must look at "what outputs from our funding are, both at the level of discoveries and at the level of innovation."[109] The then UKRI Director of Strategy, Rebecca Endean, elaborated on the evaluation that UKRI had undertaken to date:

> As a starting point, UKRI has gathered together all our grant-funding data […] on a coherent and consistent basis, so we know which grants are funded. We can then collect outputs from those grants, from the monitoring that IUK [Innovate UK] does and from how people report on them, through their grants and with Researchfish.[110] [In order to understand outcomes] we need to link that grant data to a range of outcomes in firms. We can look at spin-outs, patents and business growth in firms. That allows you to do the evaluation consistently at a microeconomic level. You look at what you are spending the money on and what that actually leads to.[111]

70. This approach was replicated in the recently published UKRI delivery plan, where it stated that as a near term action UKRI would "continue to develop our data reform programme, bringing together key datasets and enhancing our analysis tools and capabilities to better capture UKRI's wider impact."[112] In supplementary evidence UKRI highlighted its commitment to "research on research", such as through the Economic and

105 Nesta (BER0072) para 1.2
106 Academy of Social Sciences (BER0034) para 15
107 Nesta (BER0072) para 3.1
108 Q13
109 Q390
110 Researchfish is an impact assessment platform aimed at standardising, simplifying and enhancing impact assessment. For more detail see researchfish.net
111 Q393
112 UKRI Delivery Plan 2019 p46

Social Research Council investment in What Works Centres, which aim to improve the way Government and other organisations create, share and use high-quality evidence for decision-making.[113]

71. **We support UKRI's commitment to evaluation, and understand the inherent difficulties in analysing the impact of research and innovation and attributing it to wider outcomes, which may occur after a significant time-lag. We recognise that in some cases evaluation will be impossible and UKRI should be explicit that this is the case and explain why. Unfortunately the current focus appears too strongly to follow traditional metrics, measuring outputs such as publications and patents that should only be one element of evaluation.**

72. ***Research on research is an increasingly important field, and we recommend that UKRI consider a dedicated approach to supporting it, including how this research is incorporated into UKRI strategy and its assessment of the balance of R&D funding. Relatedly, UKRI should attempt to analyse the benefit gained by its creation through its enhanced ability to capture data across research councils and through cross-cutting funds.***

73. ***We recommend that UKRI also develops a 'big data' focus for evaluation. It should publish a plan for creating and investing in new data sources and analysis techniques beyond traditional measures of patents and publications.***

Government influence on research and innovation beyond UKRI

74. Whilst the establishment of UKRI is clearly viewed as an opportunity for increased coordination and coherence in R&D spending, albeit with inherent risks, we must also be aware of the limitations of its influence. The combined budget of UKRI is around £7 billion, but as the Campaign for Science and Engineering, a non-profit advocacy body, noted "30% of public R&D spend and a disproportionate amount of benefit from research and innovation fall outside UKRI and outside BEIS", meaning that other organisations are important too:

> Many of the levers that will be needed to improve the environment and achieve the R&D target sit in other departments, including Treasury, HMRC, International Trade, Home Office, Health, DCMS amongst others. Members (of the Campaign for Science and Engineering) have raised with us their experience of government actions competing against other parts of government creating hinderances and frustrations for businesses and diminishing effectiveness of positive government policies, funding and initiatives.[114]

75. The frustrations mentioned demonstrate the complexity of the R&D landscape (see paragraph 42), and the difficulty in leveraging private sector R&D which will be crucial in reaching the 2.4% R&D target. Whilst there are a multitude of other Government actors responsible for both Government spending and control of the policy levers that influence private spending, BEIS has a responsibility for coordinating these levers and developing

113 UK Research and Innovation (BER0098) p1
114 Campaign for Science and Engineering (BER0065)

the policy mix. Professor Sir Mark Walport suggested that the overall landscape "is perhaps more joined up than it appears to be at first sight" but it is "necessarily a complex landscape, and I think we could do more".[115]

76. These areas form the basis of our analysis in Chapter 5, and include:

- the 30% of R&D funding that is undertaken by Government outside of UKRI;
- harnessing the power of wider Government procurement to stimulate research and innovation;
- R&D tax credits as an incentive for private sector investment; and
- the issue of finance (related to the "valley of death" of business development) which we address through patient finance.

77. We recognise that there are many other important policy contributions that will influence R&D. For example, as Professor Sir Mark Walport stated, "education policy is absolutely key",[116] as are place, infrastructure and industry support, which we expect to be included in the UKRI and BEIS roadmaps to give a better "holistic sense"[117] of these other important drivers. Due to the breadth of possible areas we have not addressed all of these in this Report and instead have focused on areas where more direct intervention was highlighted.

115 Q402
116 Q402
117 Q398

4 UKRI influence on the balance of R&D spending

78. In this Chapter we address the issue of balance in R&D spending across the different dimensions we identified through this inquiry. Our focus is on the influence that UKRI can exert, and the opportunities created to re-assess existing balances that may be the product of previous political decisions or the result of the previous R&D ecosystem. In turn we address the balance between: the two elements of the dual support system; regional spending; 'pure' and 'applied' research; research and innovation; different research disciplines; capital and current spending; and domestic and overseas policy goals.

UKRI

79. The terms of reference for our inquiry requested evidence regarding the rationale for deciding on the balance of public R&D over a range of dimensions, However, whilst much of the evidence we received was useful for illuminating the inherent trade-offs, there was often very little to suggest the optimum level. As the innovation foundation Nesta stated "there are no easy answers to the question of finding the 'right' balance of funding."[118] This was reflected in the response of Professor Sir Mark Walport, Chief Executive of UKRI, regarding the issue of investigator-driven research; "It is slightly like asking, 'How long is a piece of string?' There is no simple right answer to what the balance should be."[119] The appropriate balance will depend on the goals and objectives of research policy. As outlined in Chapter 3, the complexity and uncertainty of the research system may mean that the optimal balance is unknowable.

80. **Decisions about what balances to strike are essentially political. The current balance and concentration of funding is the result of previous policy choices, and this should be explicitly recognised. But the various balances discussed in this Report should take account of current goals and needs rather than reflecting those of past decades.**

81. **Finding the correct balance in each area may be impossible, but it is the policy mix needed to best support R&D that is important rather than just the performance of individual policies. Although optimal balance might not be identifiable, in many cases where evidence recommended a need for increased funding, such increases might be more feasible and palatable in an environment with an increasing spending envelope as they will not necessitate reallocation of funding from elsewhere.**

The dual support system

82. The "dual support" system is widely regarded to be a key feature of UK research funding. Through this combined approach, research councils (RCs) offer competitive project-based funding, whilst Quality-Related (QR) block funding based on quality assessment through the Research Excellence Framework (REF), gives greater flexibility for use and longer (seven year) periods of assured funding. As the QR funding is un-

118 Nesta (BER0072)
119 Q406

hypothecated, universities are free to direct it as they wish rather than specifically to the research area for which its 'excellence' is awarded, thus allowing cross-subsidisation in to other research areas.

83. The balance of these elements has changed over time, with increasing research council funding from 2012 not met with increased QR funding. QR funding saw a 13% fall in its value in real terms from 2010–11 to 2017–18.[120] Until 2015–16, total QR funding was higher than research council grant funding to higher education institutions, but is now slightly lower.[121]

84. Most university submissions, including the UCL and Coventry University submissions, supported a continuation of QR funding, and many had concerns about the level of QR given its relative reduction in recent years.[122] Universities UK stated that "in recent years, QR funding in England has remained at a flat level. Given the importance of such funding to the UK research base, the UK Government should raise levels of investment in QR while considering the impact on devolved nations."[123] Professor Reid of UCL agreed with this sentiment whilst extolling the benefits of QR, including increased agility, stable careers for researchers, and ability to meet the full economic costs of project funding.[124]

85. Gordon McKenzie (CEO of GuildHE, a representative body for UK higher education) stated that QR was more equitable from the perspective of smaller institutions and research environments, as many small institutions received no research council funding at all.[125] But the seven-year REF cycle also created limitations and "may need to be tweaked, because smaller research environments grow quickly from a relatively low base". Mr McKenzie told us that it would be beneficial to find a way to feed money in to continue building capacity in these areas in between the REF cycles.[126] The GuildHE submission suggested the following process:

> a year on year uplift of QR, via a 'gearing' formula providing at maximum 10% increase in funding, for institutions with relatively low QR allocations - say, below £200,000. This would be expressly to support emerging research environments to establish infrastructure and capacity to keep pace with mandates and enable them to more effectively enter competitive schemes.
>
> […] such investment would need to be monitored to ensure the additional funds are used for expressed purposes. We suggest institutions provide strategies for the additional investments, and also provide monitoring data at reasonable intervals. This has a precedent - allocations for GCRF [Grand Challenge Research Fund] within QR is handled in a similar way.[127]

86. The suggestion of further assessment for QR was countered by Professor Reid of UCL though, who suggested that "we should recognise the stability of the long-run REF cycle combined with more dynamic grant awards".[128]

120 Russell Group (BER0091)
121 Campaign for Science and Engineering (BER0065)
122 Coventry University (BER0023), University of Oxford (BER0021), Russell Group (BER0060)
123 Universities UK (BER0044) p1
124 Q267
125 Q271
126 Q273
127 GuildHE (BER0055) para 38
128 Q274

87. None of the evidence specified what the balance between QR and project funding should be. Professor Reid said he could not point to "evidence that will determine the balance of project funding and QR funding".[129] Professor Sir Mark Walport agreed that understanding the balance between the two elements was work in progress.[130]

88. Following our evidence sessions, in an announcement on 2 July 2019, Research England published budgets for university research for the year 2019–20. This included an additional investment of £91 million, of which £45 million was to be allocated to mainstream QR funding, an increase from £1,050 million in 2018–19 to £1,095 million in 2019–20.[131] The former Minister commented on the announcement that:

> for the first time since 2010, we have a significant uplift in QR funding for universities [… which] marks an important recognition of university research and the need to invest more in flexible, curiosity-driven research that has tremendous benefits to developing our international standing as a research powerhouse.[132]

89. **We recognise that the dual funding system of block grants and project-based research council funding has been crucial to the success of UK universities, and that maintaining this system with 'appropriate balance' will be a key function of UKRI. There may be no optimal balance, but trying to reach an appropriate balance in the light of current policy goals is a key political choice and should be made in a transparent and accountable fashion. *UKRI should continually monitor the appropriateness of balances struck in the operation of the dual support system and publish the advice given to the Government, alongside its analysis and commentary, at regular intervals.***

90. **The flat profile of QR funding in recent years suggests it has not been prioritised in funding decisions. The announcement of a £45 million increase in mainstream QR funding by Research England in July 2019 indicates that there may be a change in this focus, and a recognition of the benefits of un-hypothecated budgets which allow universities to maintain agility and develop their own areas of expertise. *We recommend that focus on QR funding is maintained in future considerations, and that QR should continue to be prioritised to address previous real-terms reductions in funding.***

91. ***UKRI should review the quality-related (QR) formula which has been responsible for increasing concentration of regional spending, paying attention to the formula used in Scotland which has been less geared towards driving concentration.***

92. **Whilst QR funding provides a stability of funding over the course of the seven-year REF cycle, we also recognise that these timeframes create barriers for smaller but potentially fast-growing institutions or areas of excellence who receive lower QR allocations. *We recommend that in UKRI's ongoing evaluation work it reviews whether additional support for these institutions should be provided, possibly through specific gearing of investment across the REF period, through additional review periods for smaller bodies, or through separate QR stream for smaller and specialist institutions.***

129 Q279
130 Q415
131 Research England, Uplift for Research England Quality-Related research funding to support the Government's 2.4% commitment to R&D. Note that the charity and business research elements of QR are maintained at previous levels.
132 BEIS University research to receive major funding boost

Regional concentration of research

93. We received a great deal of analysis regarding the concentration of research funding. This clearly supported an understanding of the 'golden triangle' of concentration of funding in universities in London, Cambridge and Oxford. Eurostat data shows that 41% of Government-supported research was concentrated in these three regions (Inner West London, Oxford, and Cambridge).[133] Royal Society analysis, based on ONS data, shows that London, the South East and the East of England accounted for 42% of UK R&D funding.[134]

94. We understand that it is possible to paint a different picture, as normalising for regional population, gross value added, university concentration, and the split between public and private spending can all give a different interpretation of concentration and research funding prioritisation.[135] However, this argument was more forcefully made by institutions that had to date benefited from previous regional concentration; the Russell Group concluded that "whilst there are clear differences between the regions, the expenditure figures alone do not give us a full overview of what is a much more complex picture".[136] UCL agreed that any assessment of geographic distribution required the scale and characteristics of the region to be taken in to account and that there was no "uniquely authoritative" way of describing this distribution.[137]

95. Whilst the pattern can be analysed in different ways it seems clear that there is a concentration of research in the 'golden triangle', largely driven by the 'Excellence Principle' of a funding allocation based on assessed research excellence, further accentuating any natural 'Matthew Effect'—essentially that as any cluster grows it becomes more likely to be successful in securing funding, leading to further growth.[138] Professors Wilsdon and Jones of the University of Sheffield argued that any 'place-blind' funding would eventually lead to this effect, but that this meant 'place-blind' was not the same as 'place-neutral',[139] thus again reflecting a deliberate political policy choice in terms of regional concentration.

96. This regional agglomeration has been long-recognised, with a predecessor Committee of ours noting the difficulty created by the Excellence Principle and the funding concentration in the golden triangle:

> On the face of it, the Excellence Principle is a good thing because it keeps science competitive and sends the money where it is most likely to produce the best results. However, there is a clash with another very important concept. The Government views science and innovation as key factors in economic development. This is a long-standing position that has been reaffirmed many times since the current economic crisis started. When one combines the view that science and engineering are important for the economic health of a region, on the one hand, with Government's responsibility for

133 Professors Richard Jones and Professor James Wilsdon, University of Sheffield (BER0051)
134 The Royal Society Investing in UK Research and Development, May 2018, p7
135 Russell Group (BER0060) paras 7.1–7.7, UCL (BER0014)para 23–28
136 Russell Group (BER0060) para 7.4
137 UCL (BER0014)para 23–28 para 27
138 From Matthew 25:29 "For unto everyone that hath shall be given, and he shall have abundance".
139 Nesta, The Biomedical Bubble, July 2018 p45

> the economic health of the region, on the other, one logically arrives at a policy whereby the Government makes strategic decisions regarding the economic health of regions by influencing where research money is spent.[140]

97. Both Professor Sir Mark Walport of UKRI and the then Minister recognised these tensions between the rewards for excellence increasing regional redistribution, but stressed that the excellence of institutions should not be diminished.[141] They raised several points regarding the possible policy response. The then Minister highlighted the current policies aimed at addressing regional imbalance, including the Strength in Places Fund, the Northern Powerhouse strategies for future investment, and a longer-term strategy of investing in people, ensuring that there was a supply chain behind larger infrastructure projects.[142] Professor Sir Mark Walport echoed this last point in his analysis of what was required to create new clusters of excellence:[143]

> If you look at the four features of a cluster, first and foremost it is about leadership. It is very difficult to develop clusters if there are not strong leaders. The second is an area of business strength; thirdly, it is a combination typically of universities that can provide the range of skills needed; and, fourthly, it is local support. That is what we are looking for in the strength in places fund. If we are going to grow the economy in other parts, that is what we have to be looking for.[144]

98. The then Minister was clear that he did not want the Strength in Places Fund (SIPF) to be viewed as the only "magic-bullet" solution to the regional issue, and that it needed to sit within other policies such as the Higher Education Innovation Fund and the progression of the Industrial Strategy.[145] Encouragingly the responses we received were supportive of the SIPF.[146] For example, the Academy of Medical Sciences called it "a positive step towards the goal" of increased investment in research and innovation across the regions. However, there were also suggestions that a larger fund would be more effective.[147] Professor Wilsdon of the University of Sheffield, for example, suggested that to tackle the balance issue at a regional level it would need to be "larger by an order of magnitude to make a significant difference":[148]

> The Strength in Places Fund is very welcome. It is not sufficient to tackle the scale of the regional imbalances in R&D spending […] this is a debate that needs to be approached with nuance and subtlety. It is not simply a matter of "out of the golden triangle good, inside bad." However, there are observable trends towards greater concentration over the last 20 years. They are very clearly visible in the data. There are also all of the dynamics we have already touched on within the system that will further concentrate R&D spending

140 Innovation, Universities, Science and Skills Committee, Eight Report of Session 2008–2009 Putting Science and Engineering at the Heart of Government Policy, HC 168-I paras 168–169
141 Q442 [Professor Sir Mark Walport], Q494 [Chris Skidmore]
142 Q494
143 Q442
144 Q442
145 Q499
146 GuildHE (BER0055) para 50, Russell Group (BER0060)para 7.6, Royal Academy of Engineering (BER0061) para 11, Academy of Medical Sciences (BER0069)para 52.
147 Q355 [Prof Seckl], Q351 [Sarah Haywood]
148 Q43

> in areas that are already successful … . [E]xcellence breeding excellence. It is also other Matthew effects… in the funding systems. It is very hard to disentangle the positives from the negatives of all of that.[149]

99. Evaluation of the SIPF is likely to prove difficult. We have already identified some of the issues regarding the measurement of regional concentration of funding (paragraph 94) that mean at an input level there may conflicting considerations. The diversity of goals that might be addressed by regional R&D and innovation activity further complicates matters, and in terms of outcomes, measuring the influence of any policy on local economic growth is innately complex.[150]

100. **Place is a key focus within both the Industrial Strategy and the UKRI strategic prospectus and development plan. In the context of the regional concentration of research funding, the aim should be to build further research excellence outside of its existing predominance in the South East of England. We strongly agree that additional regional funding should not be to the detriment of this 'golden triangle', and excellence in this area should continue to be rewarded, recognising that this is a tide that lifts all boats in terms of international recognition of the UK as a place of quality research. However, in order to contribute to the 2.4% R&D target, regional strengths will need to be harnessed and cultivated.**

101. **For wider regional growth to succeed, expertise and infrastructure beyond universities will be required, as envisaged in the wider Industrial Strategy. For UKRI, the main lever with which to stimulate regional excellence is through the Strength in Places Fund (SIPF). The SIPF is still in its infancy, but its rationale and its goals remain somewhat opaque and it is too modest to drive any significant rebalancing of investment given the strength of existing drivers of increasing regional concentration in funding. Whilst the fund is still in its infancy, it appears to be a more innovation-orientated approach that appears too small to drive a significant re-balancing of investment given the current level of regional concentration in funding.**

102. ***We recommend that UKRI and BEIS substantially increase the size of the Strength in Places Fund given it appears to be the primary lever through which it is attempting to influence the regional concentration of funding and create new centres of excellence beyond the golden triangle. It should further clarify the rationale and expectations of this expanded programme. This should include the intended evaluation approach and key metrics for assessing the level of regional concentration of funding and the outcomes of this funding.***

Balance between 'pure' and 'applied' research

103. Our call for evidence asked respondents to explain the rationale for allocating funding between the 'pure'[151] and 'applied'[152] elements of research. Evidence received suggested that such definitions were contentious, with BEIS suggesting that this is "an artificial construct with a blurred boundary".[153] Partly reflecting this view, evidence

149 Q43
150 Q393, Q496
151 Exploratory research without an end-use in mind.
152 Research aimed at finding a solution to a specific problem.
153 Department for Business, Energy and Industrial Strategy (BER0064) para 12

submitted to the inquiry also used a range of different terminology for both 'pure'[154] and 'applied'[155] research. The OECD Frascati manual definitions do refer to 'basic research' 'applied research' and 'experimental development', and these categories are widely used for statistical purposes.[156] For the purposes of our inquiry we have continued to use 'pure' research, but consider this synonymous with 'basic' research.

104. Much of the evidence received suggested that support for basic research enabled future applications which cannot be envisaged. The Royal Society of Chemistry stated:

> Support for fundamental, curiosity-driven research must be sustained, alongside challenge-based and applied research. Evidence shows that supporting fundamental, curiosity-driven research results in long-term impacts that bring benefits beyond pushing the frontiers of science–delivering economic growth and solutions to challenges that the world faces with regards to health, energy and environmental sustainability.[157]

105. Much of the evidence submitted to our inquiry supported the idea of 'pipeline' of discovery, for which well-funded basic research is required.[158] However, we also appreciate that most researchers would understandably prefer to be given complete freedom and open-ended funding for their work. This pipeline description is also contested by academic literature such as the research of Salter and Martin,[159] which suggested that the benefits of basic research funding was to increase the stock of human knowledge and support a creative environment that attracted the top researchers. The new knowledge, equipment and methods developed are available to applied and industrial researchers and provide the main environment in which researchers were trained. Research results might also sometimes inspire applied research or spin outs, but this was probably the least frequent or important impact. There are also many historic examples of fundamental insights achieved from applied (problem-oriented) research, such as Pasteur's germ theory.[160]

106. This would not necessarily imply that there is a need to prioritise basic (investigator-driven) research. BEIS suggested that, if there were 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."[161] The Royal Society of Biology suggested that "the interdependence of pure and applied research is such that they complement each other and this is just one of the reasons to safeguard a healthy balance of funding for both",[162] whilst UKRI stated its position that "fundamental and applied research, and innovation are often mutually reinforcing element's of UKRI's portfolio. We aim to recognise their complementarity and break down barriers between them."[163]

107. **We understand that the distinction between pure and applied research is a contested definition and as such it does not appear to be a dimension of balance**

154 'Pure' research was also described as 'basic', 'investigator-led', 'curiosity-driven' or 'blue-sky'
155 'Applied' research was also described as 'application-led', 'use-inspired', 'industrial pull' or 'problem-orientated'.
156 OECD Frascati manual
157 Royal Society of Chemistry (BER0037) para 1
158 Q241, Imperial College London (BER0067) para 2, UCL (BER0014) para 20
159 Salter, A & Martin, B; The economic benefits of publicly funded basic research: a critical view
160 Stokes, D.E., 1997. Pasteur's quadrant: Basic science and technological innovation. Brookings Institution Press.
161 Department for Business, Energy and Industrial Strategy (BER0064) para12
162 Royal Society of Biology (BER0076) para 2.4
163 UK Research and Innovation (BER0063) para 15

on which funding decisions can usefully be made, whilst also understanding the importance of maintaining funding for pure research as a foundation of other benefits and dimensions of balance.

Balance between research and innovation

108. The contested distinction between 'pure' and 'applied' research noted above somewhat extends to that between research and innovation, with much of the latter being indistinguishable from highly applied research and what the OECD Frascati Manual defines as 'experimental development'. Though historically the UK has been active in taxpayer support for technological development, since the 1980s the decision of Prime Minister Margaret Thatcher to end most Government support for so-called 'near market' research, the UK has had an internationally unusual public research system focused on the 'basic' research funding through the dual support system.[164]

109. The UK has generally had a ratio of around 10:1 between science funding and innovation funding,[165] compared to ratios of "up to 1:1" in other competitor nations.[166] This ratio is largely reflected in the relative budget of Innovate UK compared to the other research councils. Evidence from the Catapult Network and AIRTO Ltd suggested that the ratio would have narrowed somewhat since the establishment of the Industrial Strategy Challenge Fund. The Catapult Network explained:

> We would not suggest that there should be an even balance, nor would we advocate moving the funding away from research but, at a time when private sector confidence to invest is under pressure, we see a compelling case for directing increases in public funding to incentivise activity at higher [Technology-Readiness Levels].[167]

However, the submission stated that it was "not making a case for further increases to Catapult core grant funding at this time", instead it was advocating increases in measures to support access to finance such as innovation loans, Innovate UK's Investment Accelerator and initiatives to improve the availability of patient capital.[168]

110. Addressing this issue of balance, Professor Sir Mark Walport stated that "historically, the balance was very strongly towards discovery, with very little money spent on the innovation side of the fence. Indeed, Innovate UK is only 12 years old this year. It is a relatively new agency."[169] The then Minister said that when it:

> comes to innovation spending, I think we still have significantly more to do […] The question is whether we continue the traditional pattern of what we have done, which is to invent and realise significant milestones in science and innovation in technologies and let some other country take the commercial opportunities.[170]

164 See e.g. Agar, J., 2019. Science Policy under Thatcher. UCL Press.
165 The Catapult Network (BER0032) para 8
166 AIRTO Ltd (BER0013) para 13
167 The Catapult Network (BER0032) para 8
168 The Catapult Network (BER0032) para 9
169 Q406
170 Q464

111. **Since the 1980s the UK has had a very different profile of scientific research spending versus technological development and innovation spending to other developed countries. As a result the public sector science base, and the dual support system, have been expected to do almost all the heavy lifting of driving and supporting innovation, together with an emphasis on commercialisation of academic science. This generic science-based innovation policy may explain the paradox that the research focused UK system has felt progressively more 'applied' and directed to many of the researchers working within it.**

112. **Since the global financial crisis successive Governments have made tentative steps back towards more active support for technological development, with milestones including the establishment of Innovate UK and the Catapult Network. The Industrial Strategy and the Industrial Strategy Challenge Fund are the latest milestones in this direction of travel. Funding for the development of new technologies is not the only way Governments support innovation, but is an important part of any Industrial Strategy. Continued growth in technological development and innovation funding should also allow a rethinking of the 'innovation focus' of the 'basic' public sector science base.**

Balance between research disciplines

113. The balance between research disciplines was widely viewed through the balance of funding allocation between research councils. QR funding allocated by universities themselves can alter this balance, but UKRI does not have discretion over these decisions. However, cross-cutting funds administered by UKRI such as the Industrial Strategy Challenge Fund and the Strength in Places Fund, and multi-disciplinary collaborations, can also influence the balance.

114. As with regional concentration of research spending it seemed that disciplines or specific areas of research could become self-reinforcing areas of spending. Research by Professors James Wilsdon and Richard Jones highlighted this effect in *The Biomedical Bubble,* suggesting that previous success in the area had created ongoing spending commitments that could not be rationalised through cost-benefit analysis.[171] At a more macro level, Sir Paul Nurse pointed to the Medical Research Council and Natural Environment Research Council, suggesting that their proportion of funding had been largely unchanged in nearly fifty years: "that tells us that history is determining what is happening. That cannot be right",[172] a view supported by Professor Wilsdon.[173] Sir Paul Nurse's suggestion was that as funding was increased there should be some cross-research council bidding.[174] This partly echoed the suggestions contained in his review of research councils, one of the key recommendations of which was:

> establishing mechanisms to deal with cross-cutting issues such as the support of multi-disciplinary and inter-disciplinary research, grand challenges and the redistribution of resource between Research Councils in response to new developments, advances and priorities in the research endeavour.[175]

171 Nesta, The Biomedical Bubble, July 2018
172 Q24
173 Q21
174 Q24
175 BEIS, Ensuring a successful research endeavour: review of the UK research councils by Paul Nurse, November 2015, p26

115. The Strategic Priorities Fund (SPF) built on the Sir Paul Nurse vision of a "common fund" to address these issues, an approach that was broadly welcomed in evidence, including by the Academy of Medical Sciences and the Academy of Social Sciences,[176] although this was largely in theory as further details were awaited.[177] However, Professor Dame Athene Donald, Chair of the Interdisciplinary Advisory Panel for REF2021, raised significant concerns over the fund, suggesting that the process for allocating funding had been:

> (a) driven by individual research councils, which raises all the pre-UKRI concerns about work that straddles boundaries and accompanying concerns about how assessment will be done;
>
> b) is unlikely to provide a means by which genuinely exciting cross-cutting research gets promoted and fairly assessed;
>
> c) carried out with a total lack of transparency raising the spectre that one of the key roles that UKRI might play is being lost without a genuine discussion of the funding balance ever being initiated.[178]

116. Wave 1 of the SPF has subsequently been announced by UKRI and detailed in the delivery plan, with UKRI committing to deliver the SPF programmes announced to date, including running research calls and innovation competitions open to researchers and business across the UK.[179] The updated documentation does not clearly address the concerns raised by Dame Athene. Whilst UKRI was very supportive of the fund during our evidence session, the commitments to being "agile and responsive to exciting new opportunities" and examples of funding such as modern anti-slavery research at the Arts and Humanities Research Council failed to address these criticisms.[180]

117. **The balance across research disciplines should be easier to monitor and adjust under UKRI. Historic patterns clearly should not be maintained for their own sake. However, we are concerned that the Strategic Priorities Fund (SPF) may have not been established in a way that effectively addresses this issue.** ***We recommend that UKRI review the SPF and ensure that individual research councils are not exerting excessive influence on what is intended to be a cross-council, multi-disciplinary focus.***

118. ***Future consideration of the balance between disciplines must include robust evaluation of research areas within each discipline. We find the case regarding entrenched concentration of research analysed in The Biomedical Bubble compelling. UKRI analysis should widen this approach and conduct relevant cost-benefit analysis of larger research areas within different disciplines to establish whether R&D spending remains productive.***

176 Academy of Social Sciences (BER0034) para 1, Academy of Medical Sciences (BER0069) para 19, Royal Society of Biology (BER0076) para 1.2
177 University of Oxford (BER0021) para 31
178 Professor Dame Athene Donald (BER0019) para 13
179 UKRI Deliver Plan 2019 p 17
180 Q348

Balance between capital and current funding

119. Evidence submitted to the inquiry specifically citing the level of capital expenditure was relatively limited. A previous review of capital funding by the Higher Education Funding Council for England (HEFCE, the precursor to Research England), showed that funding for capital expenditure had reduced by nearly 70% between 2005–06 and 2013–14, from £1.2 billion to £340 million.[181] Evidence from the Institute for Cancer Research (ICR) noted that capital funding had remained at a similar level since 2013–14, representing a real-terms decrease.[182] The ICR also noted that other sources of research funding had grown at a faster rate than core funding for infrastructure, and that given that project grants did not cover the overheads of research, there was not enough investment in the physical infrastructure of higher education institutions, including research equipment, to keep pace with project funding.[183] This is likely to be reflected in the concerns regarding the Full Economic Costs (FEC) of research that were also highlighted in our evidence sessions.[184]

120. The Earlham Institute suggested there was a need for better coordination between capital and resource funding awards:

> At times, capital funding is awarded for the purchase of new equipment, such as DNA synthesisers and high-performance computing equipment, but the budget for the required software, training, staff and electricity to run the equipment have to be paid from revenue awards that are fixed across budget cycles. The situation is not practical or efficient, impairs research impact and even causes delays to research.[185]

121. This represented what the Association of Innovation, Research and Technology Organisations (AIRTO Ltd) referred to as the 'batteries not included' scenario investment:[186] facilities or major items of research equipment were made without ongoing resource spending commitments in place. Ongoing costs are not guaranteed but expected to be covered be the normal functioning of the dual support system, i.e. through QR and competitively won grant funding. This represented a "very ineffective use of public funding".[187]

122. UKRI was commissioned by BEIS in January 2018 to develop the first national research and innovation infrastructure roadmap,[188] which sought to detail existing UK infrastructure, future needs, and resulting investment priorities. The most recent Progress Report was published in March 2019, identifying emerging themes and areas of potential capability that could be addressed by new infrastructures (identified through consultation with research and innovation communities).[189] This is an important exercise which should be beneficial in setting out new infrastructure plans over the next 10 years. The roadmap was supported by Professor Dowling of the Royal Academy of Engineers, Professor Hall of the Earlham Institute and Dr Griffiths of the Institute for Cancer Research, although

181 Frontier Economics, A review of HEFCE capital expenditure, 2015 p8
182 The Institute of Cancer Research (BER0086) p2
183 The Institute of Cancer Research (BER0025) p2
184 Q289–292Qq289–292
185 Earlham Institute (BER0071) para7
186 AIRTO Ltd (BER0013) para 11
187 AIRTO Ltd (BER0013) para 11
188 UKRI Research and Innovation Infrastructure Roadmap
189 UKRI Infrastructure Roadmap Progress Report

Professor Hall noted "it is being put together very quickly, which is worrying, in a way."[190] It appears likely that new UKRI funding, such as the Strength In Places Fund and the Strategic Priorities Fund, will also put in place new infrastructure, which may exacerbate issues regarding future resource funding. However, it is not obvious from the infrastructure roadmap that the relationship between capital funding and resource spending is being addressed.

123. **We welcome the opportunity to redress reductions in capital investment for research. The UKRI roadmap represents an opportunity to consider where investment can be focused and most effective in contributing to ongoing research excellence and to the wider goals of the 2.4% target.** ***In order for UKRI to take ownership of the 'batteries not included' issue, we recommend that decisions for investment include consideration of the coordination of capital and revenue funding and the long-term requirements of new and existing investments. Major capital investment project plans should explicitly state assumptions regarding future QR or research council funding that may be required to staff or run them.***

Balance between domestic and overseas policy goals

124. Through the establishment of the UKRI-administered Global Challenges Research Fund and the Newton Fund (both described in the previous Chapter), UKRI claims to demonstrate the belief in the "importance of research and innovation to address global challenges and promote global economic development".[191]

125. Organisations such as the Royal Academy of Engineering expressed support for this stance, agreeing with the importance of the UK taking the lead in addressing global challenges such as access to clean water.[192] Universities UK also suggested that they represented "long-term investments, the benefits of which will not be realised in the short-term. It is therefore important that such schemes are maintained."[193]

126. However, the Russell Group suggested that funding sources tied to Overseas Development Assistance (ODA) had a similar effect to those of the National Productivity and Investment Fund, ring-fencing too much of the funding available to universities.[194] They suggested that the proportion of funding related to these schemes increased from 10% in 2017–18 to 19% in 2019–20. Excluding these funds, the core budget of five of the nine research councils would decline.[195] They also suggested that this would have an impact on the councils' ability to fund core activities, including responsive mode funding and post graduate research training.[196]

127. **There are concerns that ring-fencing of funds for specific goals such as overseas development assistance will further diminish the ability of universities to undertake responsive mode funding. This is related to wider concerns regarding quality-related funding and the implications for basic research from a perceived focus on application-led research.** ***Whilst we do not currently see this as a pressing concern, UKRI should continue to monitor this balance and detail the proportion of ring-fenced funding on ODA in its publications.***

190 Qq250–257
191 UK Research and Innovation (BER0063) para 21, BioIndustry Association (BER0030)
192 Royal Academy of Engineering (BER0061) para 14
193 Universities UK (BER0044) para 29
194 Russell Group (BER0060) para 5.1
195 Russell Group (BER0060) para 5.1
196 Russell Group (BER0060) para 5.3

5 Beyond UKRI—wider balance

128. UKRI investment in research and innovation will be a cornerstone of total R&D spending in the UK. However, there are other significant roles played by the Government. Departments other than UKRI are also responsible for innovation support and direct R&D spending, and there is wider public procurement that might drive innovation. Giving more emphasis to increasing demand for innovation by encouraging customer (i.e. Government) funding, rather than focusing on 'technology push' from university research, represents a potential shift in policy focus.[197] The Government also has a supportive role shaping the wider investment landscape, through rules and incentives that encourage firms to invest and undertake innovative practices. In this Chapter we explore the role for coordinating innovation across Government, specific support through the Small Business Research Initiative and other public procurement, financial incentives such as R&D tax credits, and regulation of longer-term investments or patient capital.

Wider support for innovation across Government

129. In both written and oral evidence the Campaign for Science and Engineering (CaSE) drew our attention to work they had undertaken cataloguing a list of Government backed sites or webpages detailing innovation support.[198] They suggested that whilst "there is a lot of good innovation support, infrastructure and incentives in the UK […] the UK does not effectively showcase or communicate the UK offer domestically or internationally."[199] This led to the recommendation that a 'one-stop shop' be created to gather this information from across Government:

> Government [should] create a digital 'shop window' that showcases in one place the many different incentives, funding, and initiatives for UK research and innovation support, providing sufficient resource for it to be maintained. This one link could then be easily shared to direct people to the array of support available. This is not just a communications challenge, but also should spur functional improvement and join up across different parts of national and local government systems, messages, portals and opportunities. This could be an opportunity to use SBRI to procure an innovative solution to the challenge.[200]

130. It is further recommended that this be part of a wider work programme to clarify and effectively communicate the UK offer at the top level, using differentiated and targeted communications to reach key audiences.[201] Whilst efficient firms may not struggle to navigate these alternative finance and support routes, it seemed likely that the additional complications would disproportionately affect and disincentivise small and medium enterprises.

197 Mr David Connell (BER0006)
198 Campaign for Science and Engineering, What Government support is available for research and innovation?, Sept 2018
199 Campaign for Science and Engineering (BER0065)
200 Campaign for Science and Engineering (BER0065)
201 Campaign for Science and Engineering (BER0065)

131. When this was raised with the then Minister, he agreed that there might be a possibility of creating a "more effective one-stop shop".[202] Following our evidence sessions, the CBI also stated support for a "digital one-stop shop" outlining the range of innovation support that business can access.[203]

132. **There are a myriad of funding sources for research and innovation, many of them provided by UKRI. However, Government departments outside of UKRI, notably the NHS and the Ministry of Defence, invest a significant amount in R&D. The Government needs to make it as easy as possible for businesses to locate and access these opportunities.**

133. ***The Government should conduct a review of all the funding streams and opportunities for R&D support advertised across Government. It should create a central linking point or web portal for access, and consider how this is advertised, particularly to SMEs.***

Existing Government demand for R&D

134. Latest ONS data for 2017 shows that the UK Government's expenditure on science, engineering and technology (SET) relating to research and development was £12.2 billion in 2017, representing 0.59% of GDP.[204] Within this, civil departments represented 30% and the Ministry of Defence 13%.[205] Dr Sarah Main of CaSE summarised this when saying "we know that UKRI is responsible for about 70% of public R&D spend. Other Government Departments are responsible for the other 30%. Defence and the NHS are significant players in that, but many Departments are responsible."[206]

135. The importance of this investment had been recognised previously. The NAO's analysis of cross-Government funding of R&D in 2017, for example, recommended that BEIS begin work on identifying areas of research that needed strategic leadership and co-ordination,[207] and elements of this appear to have informed the Industrial Strategy through the 'Grand Challenges' and Challenge Funds. But departments will continue to undertake their own investment and this should not be overlooked in the systematic approach the Government should be taking to reach its R&D target. BEIS director Jenny Dibden recognised this but also suggested that the creation of UKRI provided a greater opportunity for coordination, saying it was:

> absolutely right that other Departments have them, but there is something about the creation of UKRI and the fact that Innovate delivers on its behalf, which means you can begin to get more coherence, and that is absolutely a question we are looking at as part of the 2.4% road map.[208]

136. ***The Government strategy for reaching 2.4% R&D investment, which we hope will be illustrated in the promised roadmap, should highlight the cross-Government R&D investment that is undertaken, particularly by large departments such as the NHS***

202 Q464 [Chris Skidmore]
203 Confederation of British Industry, UK will not reach the Government's R&D spending target until 2053, 14 May 2019
204 ONS, Government expenditure on science, engineering and technology, UK: 2017, June 2019
205 Ibid
206 Q15
207 NAO Cross-government funding of research and development Nov 2017
208 Q464 [Jenny Dibden]

and Defence. The roadmap should include detail on UKRI's role in coordinating this investment. The creation of UKRI represents an opportunity for it to operate as the ultimate steward of this system.

137. ***While departments should be free to invest in areas of individual importance, UKRI should maintain a strategic overview of potential synergies with UKRI funding and the impact on skills and infrastructure that this creates. It should also analyse the potential impact of this cross-Government funding on dimensions of balance such as regional concentration of spending that we have addressed in this inquiry.***

The Small Business Research Initiative (SBRI)

138. Whilst the Government should not overlook the existing demand for innovation by departments discussed in the previous section, there are additional mechanisms through which demand for innovation could be stimulated. The main example identified in our inquiry was the SBRI, a programme aimed at helping small businesses take advantage of procurement contracts that the Government is offering, helping innovators to demonstrate and develop their new technologies and Government organisations to solve challenges by connecting them with innovative businesses.[209]

139. The Dowling Review singled out SBRI as an important mechanism for encouraging collaboration,[210] and this was endorsed by the Government's response to the Dowling Review in 2016.[211] However, David Connell led an independent review of SBRI that reported in November 2017, which found that these endorsements were not reflected in practice.[212] The use and method of implementation of SBRI varied widely across Government, highlighted by the fact that in 2015–16 funding through the scheme fell to only £63 million, a 25% reduction compared to the previous year's peak. The review made several recommendations on how to make better use of the opportunity presented by SBRI, including:

- the establishment of a central SBRI fund into which public sector organisations could bid to fund a programme of SBRI competitions, to reach around £250m per annum within six years;
- the establishment of a 'National SBRI Fund Board', comprising public and private sector representatives, to oversee the central SBRI fund, set funding conditions and guidelines for SBRI programmes and review departmental or agency programme proposals; and
- the introduction of a third phase of funding for a small number of projects, combined with a drive to ensure that funding for first and second phase projects meet guidelines (£50,000–100,000 for Phase 1 and £250,000–1m for Phase 2).[213]

209 The SBRI (delivered by Innovate UK) is a two-stage, contract-based programme to fund the development of innovative technology solutions to meet government needs - either for departments' own requirements or to meet policy challenges. Phase 1 contracts are worth £50–100,00 and Phase 2 £250,000 to £1 million, with project costs 100% funded.

210 BEIS Dowling Review of Business-University Research Collaborations July 2015, recommendation 29

211 BEIS Response to the Dowling Review of business-university research collaborations Dec 2016

212 BEIS Leveraging public procurement to grow the innovation economy Nov 2017

213 BEIS Leveraging public procurement to grow the innovation economy Nov 2017 pp14–17

140. The main Government response to the recommendations has been the creation of the GovTech Catalyst Fund, designed to "incentivise Britain's tech firms to come up with innovative solutions to improve public services"; it currently has four challenges, including tracking waste and cutting traffic congestion.[214]

141. This fund is significantly smaller than the Connell Review recommendations, standing at only £20 million. Professor Sir Mark Walport noted that "skills to procure innovation through SBRI are a scarce commodity, unfortunately", although through things like the GovTech Catalyst fund, "the Government are exploring ways to expand it".[215] Jenny Dibden of BEIS agreed that "it is small, but it demonstrates to people that it can work. There has been a huge amount of interest from a whole range of public sector organisations in receiving this money".[216] The then Minister agreed that the GovTech fund was essentially "testing the recommendation for a central fund".[217]

142. We have previously addressed these issues in our Quantum Technologies Report.[218] We now re-iterate those conclusions, as follows.

143. **We agree with the Connell Review that the Small Business Research Initiative has a "unique and valuable role to play in the innovation and procurement landscape", supporting UK businesses in developing innovative new products while enabling public sector bodies to source innovative solutions to the challenges they face. However, the Government's response to the Connell Review so far is limited.**

144. **The GovTech Catalyst only supports public bodies in sourcing digital technology solutions and the three-year, £20m GovTech Fund is significantly smaller than the £250m that the Connell Review recommended to be spent per annum through SBRI, or the £200m target the Government had for SBRI spending in 2014–15, and should not be viewed as a replacement.** ***We recommend that the Government fully adopts the recommendations of the Connell Review, and establishes a central SBRI fund with a National Board to oversee its delivery as part of the 2020 Spending Review.***

145. ***The Government should consider using the SBRI to procure the web portal for innovation support detailed in the recommendation at paragraph 133, allowing external experts and potential users to create an intuitive directory and system for coordinating future innovation support schemes.***

Public procurement

146. The SBRI is potentially an important tool, but as the Royal Academy of Engineering (RAEng) said, "it is important not to reduce public procurement to SBRI: procurement can be used beyond research and beyond small businesses".[219] The RAEng pointed to MoD projects and the Highways England Innovation Fund as important examples of procurement beyond SBRI.[220]

214 Government Digital Service GovTech Catalyst information
215 Q404
216 Q470
217 Q468
218 Science and Technology Committee, Twelfth Report of Session 2017–19, Quantum Technologies, HC 820
219 Royal Academy of Engineering (BER0061) para 35
220 Royal Academy of Engineering (BER0061) para 35

147. The Industrial Strategy Green Paper highlighted that the public sector as a whole spent around £268 billion per year on procurement, equivalent to around 14% of GDP.[221] The CBI agreed that this was an "important lever" for driving innovation and that with "government being such a powerful buyer in the UK economy, its actions can stimulate demand for new technologies, creating marketplaces that induce the development of innovative new products and services."[222] How to make this public procurement more 'innovation-friendly' was a key challenge, and the diversity of procurement opportunities might be glossed over in the search for one-size-fits-all models.[223]

148. However, the CBI surveys showed that only 5% of businesses agreed that current public procurement processes in the UK incentivised innovation. This was supported by RAEng who were concerned that whilst procurement had the potential to have a "disproportionately transformative effect on UK companies", procurement processes were a "significant barrier to increased R&D investment" due to the "focus on achieving the lowest cost, failure to develop collaborative relationships, restrictive rules on IP and the absence of incentives for companies to take risk and propose novel approaches".[224] They suggested the Government had "long recognised an unresolved challenge", a view supported by Professor Sir Mark Walport of UKRI.[225]

149. Felicity Burch of the CBI called for "a bigger, more strategic approach" to procurement:

> You need the Government Departments pulling together to deliver better procurement outcomes and more innovation through procurement […] The issue is whether SBRI is the right tool. Even £200 million will not be enough really to shift the dial on the UK landscape […] The Government need to take a more holistic look at their procurement practices. SBRI is probably part of it, but they should look at how they support research and innovation more generally. Departmental expenditure on R&D needs to be part of that mix. Potentially, it would be the bigger shift.[226]

150. The then Minister acknowledged the potential of procurement, stating:

> I see huge opportunities in looking at where, through public procurement, we can deliver potential opportunities for co-investment in future R&D. It has been tried before; it has not always been so successful, and I am trying to understand why.[227]

This analysis will be difficult given the quality of Government procurement data is relatively poor, as highlighted by the Institute for Government.[228] This illustrates an ongoing concern that we addressed in our Digital Government inquiry, which looked

221 BEIS, Building our Industrial Strategy, Jan 2017
222 The Confederation of British Industry (CBI) (BER0026)para 26
223 Uyarra & Flanagan (2010) Understanding the innovation impacts of public procurement, European Planning Studies, 18:1, 123–143
224 Royal Academy of Engineering (BER 0061) para 35
225 Q403
226 Q187
227 Q467
228 Institute for Government, Government Procurement: the scale and nature of contracting in the UK

at how well the Government and its agencies deployed their datasets to maximise their value for money, effectiveness and delivery, and how well 'open data' arrangements were operating.[229]

151. **The Industrial Strategy rightly recognises the power of public procurement as a demand-side driver of potential R&D spending. However, there does not appear to be any further development of the strategy to exploit this potential, despite it being a long-recognised issue.**

152. ***Alongside increasing the size and reach of SBRI, the Government should produce a procurement strategy and communications plan for addressing businesses that specifically identifies innovation opportunities and promotes innovation-friendly practices across all types of procurement. It should address barriers currently perceived by the business community, such as treatment of risk and intellectual property. The benefits of a central portal that collates procurement opportunities from across Government should be pursued.***

R&D tax credits

153. R&D tax credits are a tax relief designed to encourage greater R&D spending. There are currently two schemes for claiming relief, the SME Scheme, aimed at small and medium-sized enterprises, and the Research and Development Expenditure Credits scheme (RDEC) for larger companies, resulting in either a corporation tax reduction or a cash credit for loss-making firms.[230]

154. The latest HMRC Evaluation of R&D Tax Credits is from 2015 and estimates that for every pound spent on R&D tax credits, between £1.53 and £2.35 is additionally spent on R&D by UK companies, which appears in line with previous international studies.[231] Many of the written submissions to our inquiry quoted this evidence in their support for R&D tax credits.[232] The CBI explained that the system was "hugely valued" and that "in CBI surveys access to tax credits is one of the areas where businesses are most likely to rate the UK as world class".[233]

155. Despite this support, there were still suggestions for potential improvements. Submissions by Oxford University and the Russell Group highlighted that the system could be simplified, for example by making all company sponsorship of university research eligible for credit.[234] CaSE suggested that the definition of R&D for tax purposes needed to be updated as it was "currently too focused on physical products"; suggestions included the "purchase of data for research purposes and digital infrastructure to support R&D within the definition, as some other countries have done already."[235] Felicity Burch of the

229 Science and Technology Committee Digital Government inquiry launched
230 Relevant rates and qualification criteria for the different schemes are detailed on the Government R&D tax reliefs
231 HMRC, Evaluation of Research and Development Tax Credit, March 2015
232 UCL (BER0014); BioIndustry Association (BER0030); UK Research and Innovation (BER0063); Royal Society of Biology (BER0076)
233 The Confederation of British Industry (CBI) (BER0026)para 6
234 University of Oxford (BER0021)para 32; Russell Group (BER0060) para 6.3
235 Campaign for Science and Engineering (BER0065)

CBI suggested that "the R&D tax credit does not currently include the use of algorithms in research, but for a lot of businesses that is a new and growing area and could open up opportunities for the sector".[236]

156. However, we recognise that many of the organisations that support the tax credit system are those who currently benefit from the scheme, or those who could benefit in future. At the same time tax credits may be more important for international tax competition, for retaining R&D intensive firms in the UK or attracting new R&D investment, than for any intrinsic effectiveness in driving innovation. As a tax incentive it may also encourage gaming—a HMRC-HMT consultation in to preventing abuse of the R&D tax relief for SMEs ran from March to May 2019 and may be legislated for in the Finance Bill 2019–20.[237]

157. David Connell was more sceptical about the impact of R&D tax credit spending, suggesting that "the Government subsidy seems merely to have substituted for aggregate spending from company generated funds".[238] His evidence cited the UK's business R&D intensity, which was around 1.1% of GDP in 1999–2000 and at a similar level in 2015–16, despite more than £20bn being spent through the scheme, and he noted that industrial competitors such as Germany, Finland and Sweden have no such tax credits but maintain high levels of R&D. Analysis by the Institute for Public Policy Research, which built on HMRC's findings but incorporated methods used by the Irish Department of Finance, estimated that "between 57 and 80 per cent of R&D tax credits are deadweight, subsidising spending which would have happened anyway, at an annual cost of £1.8–1.9 billion."[239] The Academy of Social Sciences suggested that this analysis should encourage further work on how to stimulate private investment.[240]

158. David Connell suggested several possible improvements to the system, including making the credit applicable to only increases in R&D spend, and attempting to pay the credit as a voucher, which could be redeemed for development contracts with universities, independent research organisations or (other) SMEs.[241] These vouchers had the potential to be designed as regionally-specific to further encourage regional re-balancing in line with Government priorities.

159. **The Government has spent more than £20bn through the R&D tax credit scheme. It is popular and widely supported, but often this support is from those who have benefited from its generosity or focus on the quantity rather than quality of support. We welcome the Treasury consultation aimed at preventing abuse of the system.**

160. ***The Treasury and HMRC should undertake updated analysis of the tax credit system which addresses the issue of deadweight spending and reassesses current estimates of additionality of R&D spending by business. This analysis should also evaluate the benefit of other potential changes to the scheme to encourage additionality of spending, and methods of targeting credit for regional or sectoral priorities, to encourage alignment with the goals of the Industrial Strategy.***

236 Q212
237 HMT & HMRC, Preventing abuse of the R&D tax relief for SMEs: consultation, March 2019
238 Mr David Connell (BER0006)
239 IPPR Commission on Economic Justice, Industrial Strategy: Steering structural change in the UK economy, November 2017, p 4
240 Academy of Social Sciences (BER0034) para 5
241 Mr David Connell (BER0006) para 9.1

Patient capital

161. As described by the Financial Conduct Authority (FCA), 'patient capital' refers to a broad range of alternative investment assets intended to deliver long-term returns, including infrastructure, real estate, private debt or equity, and venture capital.[242] The Government's Patient Capital Review specifically sought to address the issues of financing growth in innovative firms.[243] Their consultation identified a range of indicators suggesting that the UK is lagging behind its potential in the longer-term process of scaling up successful start-ups.[244] Whilst venture capital investment in the UK is currently valued at around £4 billion per year, if the UK achieved the same level of investment as the USA relative to GDP, it would be around another £4 billion per year higher.

162. The review identified a number of causes for the lack of effective patient capital investment in the UK. One root cause was the UK's historically thin market for patient investment, stemming from a lack of critical mass in parts of the market. On the demand side there may be a lack of serial entrepreneurs and inconsistency in the success of University spin outs.

163. Following the publication of the Government's patient capital consultation, we wrote to the then Chancellor in September 2017, ahead of the first Autumn Budget. In this letter we agreed with the identification of pension funds as a potential untapped source of capital, with the UK defined-benefit pension funds holding around £1.3 trillion in assets but a low level of investment in patient capital, potentially as a result of perceived over-interpretation of the legal responsibility of pension fund trustees to act 'prudently'.[245]

164. At Budget 2018, the Government published an update to the consultation[246] which outlined its progress on implementing the patient capital action plan, and new measures were announced to support defined contribution (DC) pension schemes to invest in patient capital:[247]

- "through the British Business Bank, the government will support pension funds to invest in growing UK businesses. Several of the largest defined contribution pension providers in the UK have committed to work with the British Business Bank to explore options for pooled investment in patient capital";
- "the FCA will publish a discussion paper by the end of 2018 to explore how effectively the UK's existing fund regime enables investment in patient capital"; and
- "the FCA will consult by the end of 2018 on updating the permitted links framework to allow unit-linked pension funds to invest in an appropriate range of patient capital assets".

242 Financial Conduct Authority, Patient Capital and Authorised Funds, Dec 2018
243 HM Treasury, Patient Capital Review, Jan 2017
244 HMT Financing growth in innovative firms pp 11–12;namely a proportionally lower number of young large listed companies, a lower proportion of R&D being performed by younger companies, a lower number of "unicorn" firms" (a private company valued at more than $1 billion (US), fewer firms growing to scale, and a tendency for UK investors to exit at a relatively early stage, reducing firms' ability to scale up.
245 Letter from Rt Hon Norman Lamb MP to Rt Hon Philip Hammond MP, 12 Nov 2017
246 HMT Financing growth in innovative firms: one-year on
247 HMT Budget 2018 para 4.43

165. The British Business Bank launched the British Patient Capital[248] programme in 2018 to invest in commercially viable venture capital funds. It began with an initial £400 million seed finance, and an aim of investing £2.5 billion over the next decade, leveraging further private investment to create a £7.5 billion fund. This investment should help venture capital funds improve the breadth and depth of their experience. The FCA discussion[249] and consultation[250] papers have been published, with final rules (and attendant enhanced risk warnings) intended for publication in late 2019.

166. The evidence we received appeared broadly supportive of the Patient Capital Review analysis and recommendations,[251] with the BioIndustry Association in particular urging us to encourage the Government to act quickly to increase private investment by pension funds.[252] Universities UK suggested in their submission that the Patient Capital investment fund was a "positive step in the right direction", but what was needed now was a "coherent framework that sets out a strategy on stimulation of private investment in R&D".[253] The Academy of Medical Sciences called the establishment of British Patient Capital a "highly positive step", but stressed it was "vital" that investment was delivered across the whole country, as venture capital remains "extremely elusive outside of the South East of England".[254]

167. David Connell also suggested that there was a requirement for non-dilutive finance for start-ups "to help prevent successful entrepreneurs being forced by financial investors into early trade sales, with the resulting truncation of growth in UK based operations", adding that recent patient capital measures did not appear to address this.[255]

168. **The Patient Capital Review was a welcome step by the Government to identify important issues in the demand and supply of long-term capital. We welcome the subsequent work to help clarify the guidance for investors so as to make patient capital more accessible to pension funds, which we have previously also identified as a significant potential source of funding. However, such clarification may be insufficient to entice investors towards new assets and investments if they still perceive they are at a disadvantage due to information asymmetry and lack of experience. We hope that the launch of British Patient Capital and the work on pooled investment vehicles will address this issue. We also hope additional influence over dimensions of balance, such as regional concentration of funding, can further be addressed by this investment.**

169. ***We recommend that the Government act quickly on the recommendations of the FCA review of regulations relating to patient capital and permitted links, and publish a further update at Budget 2020 that details the additional pension fund investment that has been stimulated by these rule changes. Further review should be considered if there has not been a step change, maintaining a commitment to exploiting the considerable funding potentially available through both defined-contribution and defined benefit pension schemes.***

248 British Patient Capital
249 Financial Conduct Authority, Patient Capital and Authorised Funds, Dec 2018
250 Financial Conduct Authority, Consultation on proposed amendment of COBS 21.3 permitted links rules, Dec 2018
251 UCL (BER0014) para 30, University of Oxford (BER0021) para 32
252 BioIndustry Association (BER0030) para 7.10
253 Universities UK (BER0044) para 32
254 Academy of Medical Sciences (BER0069) para 60
255 Mr David Connell (BER0006)

Conclusions and recommendations

Level of ambition of the 2.4% target

1. Additional frontloaded funding will be key for reaching the 2.4% target, but it clearly is not sufficient. It is also important to ensure that the capacity of the UK economy and research system enables R&D expenditure to be used efficiently and effectively. Creating sufficient leverage of private sector investment will be crucial. *The Government should consider whether a separate Government R&D spending target, either as a proportion of GDP or in real terms, would benefit the current national target.* (Paragraph 27)

2. We welcome the Government's target for R&D spending which, if achieved, would represent a significant increase in the research intensity of the UK economy. However, the difficulty in achieving the target should not be underestimated, and will require successful coordination of public spending and further increases in private investment. (Paragraph 33)

3. We welcome the commitments by UKRI and BEIS to make a strong case at the Spending Review, which we had expected to be this autumn, for the additional funding required to reach the 2.4% target by 2027. Given the stretch of the target, it is apparent that additional public spending is likely to gain greater traction if it is undertaken earlier, thus increasing the potential for leveraging private sector spending. (Paragraph 34)

4. Both UKRI and BEIS have committed to publishing roadmaps to show the path to 2.4%. It is our understanding that given the nature of both public and private investment required to reach the target, these roadmaps will address the landscape influencing R&D spending, including the wider Government policies and pillars of the Industrial Strategy (ideas, people, infrastructure, business environment, and places). (Paragraph 35)

5. It is not clear whether the Government's recent commitment to "set out plans to significantly boost public R&D funding", which it had promised this autumn, relate specifically to the roadmaps, high-level long-term funding plans, or simply greater clarification of the BEIS capital budget for next year, which was not fully set in the recent Spending Round. *Assuming that a multi-year funding commitment is made, a "significant boost" should suitably reflect the frontloaded investment that we have established is required. We are pleased that such decisions will not be delayed until the 2020 Spending Review and urge UKRI and BEIS to make the 'strong case' we expect of them.* (Paragraph 36)

6. We hope that the promise of providing "greater long-term certainty to the scientific community" indicates both a long-term funding commitment and the detailed plans we expect to be contained in the roadmaps. *If not, we strongly recommend that both UKRI and BEIS publish their promised comprehensive roadmaps to illustrate the intended path to the 2.4% target as soon as possible, and no later than the end of 2019 following confirmation of Government funding plans. These should demonstrate an integrated approach between UKRI and BEIS that suitably reflects the strengths*

and prospects of the UK economy. These plans should also be developed beyond 2027 to ensure that travel towards the longer-term 3% target, indicating how momentum will be maintained and when more detailed plans for this target will be produced. (Paragraph 37)

UKRI and the R&D landscape

7. The complexity of the R&D ecosystem has been well documented and means that understanding the interaction of organisation, funding and policies is difficult. Some complexity may be inevitable given the diversity of policy goals and actors. (Paragraph 42)

8. *UKRI and BEIS should ensure that their roadmaps on how the UK will reach the 2.4% target detail key areas of potential conflict or policy overlap resulting from their choice of policy mix in this complex environment. Unnecessary complexities should be identified and removed as part of the mapping process. In order to aid public understanding they should update the Dowling Review schematic, including details of the main R&D funding streams available through the Industrial Strategy and UKRI.* (Paragraph 42)

9. The creation of UKRI created a significant opportunity for improving the strategy and coordination of research funding. However, there remain significant risks in introducing a new strategic oversight, and in gaining the support of the wide range of stakeholders, including the public, with whom UKRI will interact. The overall success of UKRI is dependent on overcoming these challenges at an early stage. (Paragraph 62)

10. We recognise the complexity of addressing the balance of funding of the dual support system and that this is a fundamental remit of UKRI. Creating a robust evidence base for this assessment will be crucial, and we recognise that UKRI strategy is to approach the task cautiously and without any sudden shifts in funding. (Paragraph 63)

11. *In line with the approach taken in this Report, UKRI should also assess and report on other dimensions of balance such as the regional concentration of funding, the balance between research and innovation, and the balance between capital and current spending, in a similar manner to its analysis of the dual support system. We believe more immediate changes to funding are appropriate to influence the current balance in these areas. There are many possible 'balances' or policy mixes, and this political choice should be transparently set out.* (Paragraph 64)

12. We support UKRI's commitment to evaluation, and understand the inherent difficulties in analysing the impact of research and innovation and attributing it to wider outcomes, which may occur after a significant time-lag. We recognise that in some cases evaluation will be impossible and UKRI should be explicit that this is the case and explain why. Unfortunately the current focus appears too strongly to follow traditional metrics, measuring outputs such as publications and patents that should only be one element of evaluation. (Paragraph 71)

13. *Research on research is an increasingly important field, and we recommend that UKRI consider a dedicated approach to supporting it, including how this research is incorporated into UKRI strategy and its assessment of the balance of R&D funding. Relatedly, UKRI should attempt to analyse the benefit gained by its creation through its enhanced ability to capture data across research councils and through cross-cutting funds.* (Paragraph 72)

14. *We recommend that UKRI also develops a 'big data' focus for evaluation. It should publish a plan for creating and investing in new data sources and analysis techniques beyond traditional measures of patents and publications.* (Paragraph 73)

UKRI influence on the balance of R&D spending

15. Decisions about what balances to strike are essentially political. The current balance and concentration of funding is the result of previous policy choices, and this should be explicitly recognised. But the various balances discussed in this Report should take account of current goals and needs rather than reflecting those of past decades. (Paragraph 80)

16. Finding the correct balance in each area may be impossible, but it is the policy mix needed to best support R&D that is important rather than just the performance of individual policies. Although optimal balance might not be identifiable, in many cases where evidence recommended a need for increased funding, such increases might be more feasible and palatable in an environment with an increasing spending envelope as they will not necessitate reallocation of funding from elsewhere. (Paragraph 81)

17. We recognise that the dual funding system of block grants and project-based research council funding has been crucial to the success of UK universities, and that maintaining this system with 'appropriate balance' will be a key function of UKRI. There may be no optimal balance, but trying to reach an appropriate balance in the light of current policy goals is a key political choice and should be made in a transparent and accountable fashion. *UKRI should continually monitor the appropriateness of balances struck in the operation of the dual support system and publish the advice given to the Government, alongside its analysis and commentary, at regular intervals.* (Paragraph 89)

18. The flat profile of QR funding in recent years suggests it has not been prioritised in funding decisions. The announcement of a £45 million increase in mainstream QR funding by Research England in July 2019 indicates that there may be a change in this focus, and a recognition of the benefits of un-hypothecated budgets which allow universities to maintain agility and develop their own areas of expertise. *We recommend that focus on QR funding is maintained in future considerations, and that QR should continue to be prioritised to address previous real-terms reductions in funding.* (Paragraph 90)

19. *UKRI should review the quality-related (QR) formula which has been responsible for increasing concentration of regional spending, paying attention to the formula used in Scotland which has been less geared towards driving concentration.* (Paragraph 91)

20. Whilst QR funding provides a stability of funding over the course of the seven-year REF cycle, we also recognise that these timeframes create barriers for smaller but potentially fast-growing institutions or areas of excellence who receive lower QR allocations. *We recommend that in UKRI's ongoing evaluation work it reviews whether additional support for these institutions should be provided, possibly through specific gearing of investment across the REF period, through additional review periods for smaller bodies, or through separate QR stream for smaller and specialist institutions.* (Paragraph 92)

21. Place is a key focus within both the Industrial Strategy and the UKRI strategic prospectus and development plan. In the context of the regional concentration of research funding, the aim should be to build further research excellence outside of its existing predominance in the South East of England. We strongly agree that additional regional funding should not be to the detriment of this 'golden triangle', and excellence in this area should continue to be rewarded, recognising that this is a tide that lifts all boats in terms of international recognition of the UK as a place of quality research. However, in order to contribute to the 2.4% R&D target, regional strengths will need to be harnessed and cultivated. (Paragraph 100)

22. For wider regional growth to succeed, expertise and infrastructure beyond universities will be required, as envisaged in the wider Industrial Strategy. For UKRI, the main lever with which to stimulate regional excellence is through the Strength in Places Fund (SIPF). The SIPF is still in its infancy, but its rationale and its goals remain somewhat opaque and it is too modest to drive any significant rebalancing of investment given the strength of existing drivers of increasing regional concentration in funding. Whilst the fund is still in its infancy, it appears to be a more innovation-orientated approach that appears too small to drive a significant re-balancing of investment given the current level of regional concentration in funding. (Paragraph 101)

23. *We recommend that UKRI and BEIS substantially increase the size of the Strength in Places Fund given it appears to be the primary lever through which it is attempting to influence the regional concentration of funding and create new centres of excellence beyond the golden triangle. It should further clarify the rationale and expectations of this expanded programme. This should include the intended evaluation approach and key metrics for assessing the level of regional concentration of funding and the outcomes of this funding.* (Paragraph 102)

24. We understand that the distinction between pure and applied research is a contested definition and as such it does not appear to be a dimension of balance on which funding decisions can usefully be made, whilst also understanding the importance of maintaining funding for pure research as a foundation of other benefits and dimensions of balance. (Paragraph 107)

25. Since the 1980s the UK has had a very different profile of scientific research spending versus technological development and innovation spending to other developed countries. As a result the public sector science base, and the dual support system, have been expected to do almost all the heavy lifting of driving and supporting innovation, together with an emphasis on commercialisation of academic science.

This generic science-based innovation policy may explain the paradox that the research focused UK system has felt progressively more 'applied' and directed to many of the researchers working within it. (Paragraph 111)

26. Since the global financial crisis successive Governments have made tentative steps back towards more active support for technological development, with milestones including the establishment of Innovate UK and the Catapult Network. The Industrial Strategy and the Industrial Strategy Challenge Fund are the latest milestones in this direction of travel. Funding for the development of new technologies is not the only way Governments support innovation, but is an important part of any Industrial Strategy. Continued growth in technological development and innovation funding should also allow a rethinking of the 'innovation focus' of the 'basic' public sector science base. (Paragraph 112)

27. The balance across research disciplines should be easier to monitor and adjust under UKRI. Historic patterns clearly should not be maintained for their own sake. However, we are concerned that the Strategic Priorities Fund (SPF) may have not been established in a way that effectively addresses this issue. *We recommend that UKRI review the SPF and ensure that individual research councils are not exerting excessive influence on what is intended to be a cross-council, multi-disciplinary focus.* (Paragraph 117)

28. *Future consideration of the balance between disciplines must include robust evaluation of research areas within each discipline. We find the case regarding entrenched concentration of research analysed in The Biomedical Bubble compelling. UKRI analysis should widen this approach and conduct relevant cost-benefit analysis of larger research areas within different disciplines to establish whether R&D spending remains productive.* (Paragraph 118)

29. We welcome the opportunity to redress reductions in capital investment for research. The UKRI roadmap represents an opportunity to consider where investment can be focused and most effective in contributing to ongoing research excellence and to the wider goals of the 2.4% target. *In order for UKRI to take ownership of the 'batteries not included' issue, we recommend that decisions for investment include consideration of the coordination of capital and revenue funding and the long-term requirements of new and existing investments. Major capital investment project plans should explicitly state assumptions regarding future QR or research council funding that may be required to staff or run them.* (Paragraph 123)

30. There are concerns that ring-fencing of funds for specific goals such as overseas development assistance will further diminish the ability of universities to undertake responsive mode funding. This is related to wider concerns regarding quality-related funding and the implications for basic research from a perceived focus on application-led research. *Whilst we do not currently see this as a pressing concern, UKRI should continue to monitor this balance and detail the proportion of ring-fenced funding on ODA in its publications.* (Paragraph 127)

Beyond UKRI–wider balance

31. There are a myriad of funding sources for research and innovation, many of them provided by UKRI. However, Government departments outside of UKRI, notably the NHS and the Ministry of Defence, invest a significant amount in R&D. The Government needs to make it as easy as possible for businesses to locate and access these opportunities. (Paragraph 132)

32. *The Government should conduct a review of all the funding streams and opportunities for R&D support advertised across Government. It should create a central linking point or web portal for access, and consider how this is advertised, particularly to SMEs.* (Paragraph 133)

33. *The Government strategy for reaching 2.4% R&D investment, which we hope will be illustrated in the promised roadmap, should highlight the cross-Government R&D investment that is undertaken, particularly by large departments such as the NHS and Defence. The roadmap should include detail on UKRI's role in coordinating this investment. The creation of UKRI represents an opportunity for it to operate as the ultimate steward of this system.* (Paragraph 136)

34. *While departments should be free to invest in areas of individual importance, UKRI should maintain a strategic overview of potential synergies with UKRI funding and the impact on skills and infrastructure that this creates. It should also analyse the potential impact of this cross-Government funding on dimensions of balance such as regional concentration of spending that we have addressed in this inquiry.* (Paragraph 137)

35. We agree with the Connell Review that the Small Business Research Initiative has a "unique and valuable role to play in the innovation and procurement landscape", supporting UK businesses in developing innovative new products while enabling public sector bodies to source innovative solutions to the challenges they face. However, the Government's response to the Connell Review so far is limited. (Paragraph 143)

36. The GovTech Catalyst only supports public bodies in sourcing digital technology solutions and the three-year, £20m GovTech Fund is significantly smaller than the £250m that the Connell Review recommended to be spent per annum through SBRI, or the £200m target the Government had for SBRI spending in 2014–15, and should not be viewed as a replacement. *We recommend that the Government fully adopts the recommendations of the Connell Review, and establishes a central SBRI fund with a National Board to oversee its delivery as part of the 2020 Spending Review.* (Paragraph 144)

37. *The Government should consider using the SBRI to procure the web portal for innovation support detailed in the recommendation at paragraph 133, allowing external experts and potential users to create an intuitive directory and system for coordinating future innovation support schemes.* (Paragraph 145)

38. The Industrial Strategy rightly recognises the power of public procurement as a demand-side driver of potential R&D spending. However, there does not appear to be any further development of the strategy to exploit this potential, despite it being a long-recognised issue. (Paragraph 151)

39. *Alongside increasing the size and reach of SBRI, the Government should produce a procurement strategy and communications plan for addressing businesses that specifically identifies innovation opportunities and promotes innovation-friendly practices across all types of procurement. It should address barriers currently perceived by the business community, such as treatment of risk and intellectual property. The benefits of a central portal that collates procurement opportunities from across Government should be pursued.* (Paragraph 152)

40. The Government has spent more than £20bn through the R&D tax credit scheme. It is popular and widely supported, but often this support is from those who have benefited from its generosity or focus on the quantity rather than quality of support. We welcome the Treasury consultation aimed at preventing abuse of the system. (Paragraph 159)

41. *The Treasury and HMRC should undertake updated analysis of the tax credit system which addresses the issue of deadweight spending and reassesses current estimates of additionality of R&D spending by business. This analysis should also evaluate the benefit of other potential changes to the scheme to encourage additionality of spending, and methods of targeting credit for regional or sectoral priorities, to encourage alignment with the goals of the Industrial Strategy.* (Paragraph 160)

42. The Patient Capital Review was a welcome step by the Government to identify important issues in the demand and supply of long-term capital. We welcome the subsequent work to help clarify the guidance for investors so as to make patient capital more accessible to pension funds, which we have previously also identified as a significant potential source of funding. However, such clarification may be insufficient to entice investors towards new assets and investments if they still perceive they are at a disadvantage due to information asymmetry and lack of experience. We hope that the launch of British Patient Capital and the work on pooled investment vehicles will address this issue. We also hope additional influence over dimensions of balance, such as regional concentration of funding, can further be addressed by this investment. (Paragraph 168)

43. *We recommend that the Government act quickly on the recommendations of the FCA review of regulations relating to patient capital and permitted links, and publish a further update at Budget 2020 that details the additional pension fund investment that has been stimulated by these rule changes. Further review should be considered if there has not been a step change, maintaining a commitment to exploiting the considerable funding potentially available through both defined-contribution and defined benefit pension schemes.* (Paragraph 169)

Formal minutes

Monday 9 September 2019

Members present:

Norman Lamb, in the Chair

Bill Grant	Stephen Metcalfe
Darren Jones	Graham Stringer

Draft Report (*Balance and effectiveness of research and innovation spending*), proposed by the Chair, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 169 read and agreed to.

Summary agreed to.

Resolved, That the Report be the Twenty-first Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available (Standing Order No. 134.).

[Adjourned to a day and time to be fixed by the Chair.

Witnesses

The following witnesses gave evidence. Transcripts can be viewed on the inquiry publications page of the Committee's website.

Tuesday 20 November 2018

Sir Paul Nurse, Director, The Francis Crick Institute, **Kirsten Bound**, Executive Director of Research, Analysis and Policy, Nesta, **Professor James Wilsdon**, Professor of Research Policy, University of Sheffield, and Chair, Academy of Social Sciences Policy Working Group, and **Dr Sarah Main**, Executive Director, Campaign for Science and Engineering	Q1–47
Ernesto Fernandez Polcuch, Chief of Section, Science Policy and Partnerships, UNESCO, Paris, **Professor Jakob Edler**, Executive Director, Fraunhofer Institute for Systems and Innovation Research, Germany, and **Dr Jos van den Broek**, Senior Researcher, Rathenau Instituut, Netherlands	Q48–102
Professor Paul Nightingale, Professor of Strategy, Science Policy Research Unit, University of Sussex, and (designate) Director of Strategy and Operations, ESRC, and **Professor Joanna Chataway**, Head of Department, Science, Technology, Engineering and Public Policy, University College London, and Deputy Director of Science Policy Research Unit, University of Sussex	Q103–137

Tuesday 18 December 2018

Keith Thompson, Chair, Catapult CEO network, and CEO, Cell and **Gene Therapy Catapult**, Professor Richard Brook, President, Association of Innovation, Research & Technology Organisations, **David Connell**, Senior Research Fellow, Centre for Business Research, Cambridge Judge Business School, and **Felicity Burch**, Director of Innovation and Digital, Confederation of British Industry	Q138–213
Dr Robert Massey, Deputy Executive Director, Royal Astronomical Society, **Professor Dame Ann Dowling**, President, Royal Academy of Engineering, **Professor Neil Hall**, Director, Earlham Institute, and **Dr Charmaine Griffiths**, Chief Operating Officer, The Institute of Cancer Research	Q214–263

Thursday 28 February 2019

Professor Graeme Reid, Professor of Science and Research Policy, UCL, **Professor Colette Fagan**, Russell Group, and **Gordon McKenzie**, Chief Executive, GuildHE	Q264–343
Dr Peter O'Brien, Executive Director, Yorkshire Universities, **Professor Jonathan Seckl**, Vice-Principal, Planning, Resources and Research Policy, University of Edinburgh, **Professor Anthony Hollander**, Pro-Vice Chancellor for Research and Impact, University of Liverpool, and **Sarah Haywood**, Chief Executive, MedCity	Q344–386

Tuesday 26 March 2019

Sir Mark Walport, Chief Executive, and **Rebecca Endean**, Director of Strategy, UK Research and Innovation — Q387–450

Chris Skidmore MP, Minister of State for Universities, Science, Research and Innovation, **Jenny Dibden**, Director, Science Research and Innovation, and **Harriet Wallace**, Director, International Science and Innovation Directorate, Department for Business, Energy and Industrial Strategy — Q451–501

Published written evidence

The following written evidence was received and can be viewed on the inquiry publications page of the Committee's website.

BER numbers are generated by the evidence processing system and so may not be complete.

1 Academy of Medical Sciences (BER0069)

2 Academy of Social Sciences (BER0034)

3 AIRTO Ltd (BER0013)

4 Alex Stobart (BER0102)

5 Alzheimer's Research UK (BER0027)

6 Anderson Law LLP (BER0001)

7 Association of Medical Research Charities (BER0049)

8 BAE Systems plc (BER0003)

9 BioIndustry Association (BER0030), (BER0101)

10 Campaign for Science and Engineering (BER0065)

11 Cancer Research UK (BER0043)

12 Coventry University (BER0023)

13 Denise Yates (BER0105)

14 Department for Business, Energy and Industrial Strategy (BER0064), (BER0090), (BER0096)

15 Design Council (BER0085)

16 Designability (BER0009)

17 Dr Rachel Oliver and others (BER0056)

18 Dr Stuart Calimport (BER0074)

19 Earlham Institute (BER0071), (BER0084), (BER0099)

20 Fight for Sight (BER0046)

21 Fleet Renewables Ltd (BER0100)

22 Greater London Authority and MedCity (BER0015)

23 GuildHE (BER0055)

24 GW4 Alliance (BER0045)

25 Iain MacKenzie (BER0104)

26 Imperial College London (BER0067)

27 Intergenerational Foundation (BER0103)

28 Jisc (BER0047)

29 John Innes Centre (BER0066)

30 King's College London (BER0054)

31 Knowledge Transfer Network (BER0048)

32 MedCity (BER0093)

33 Medical Schools Council (BER0028)

34 Miricyl (BER0106)
35 Mr David Connell (BER0006), (BER0082)
36 Mr Jasper Tomlinson (BER0007)
37 Mr Jerome Jackson (BER0092) (BER0094)
38 MSD (BER0041)
39 National Physical Laboratory (BER0031)
40 Nesta (BER0072), (BER0081)
41 Norwich Research Park (BER0079)
42 Photonics Leadership Group (BER0058)
43 PraxisAuril (BER0075)
44 Prime Minister's Council for Science and Technology (BER0088)
45 Productivity Insights Network and Innovation Caucus (BER0059)
46 Professor Andrew Webster (BER0077)
47 Professor Dame Athene Donald (BER0019)
48 Professor Evan Parker, University of Warwick (BER0010)
49 Professor Graeme Reid, University College London (BER0097)
50 Professor Joanna Chataway (BER0078)
51 Professor Jonathan Jones, The Sainsbury Laboratory (BER0020)
52 Professor Michael Ferguson (BER0005)
53 Professors Richard Jones and Professor James Wilsdon, University of Sheffield (BER0051)
54 Prospect (BER0017)
55 Rodney Basford (BER0095)
56 Rolls-Royce (BER0022)
57 Rothamsted Research (BER0057)
58 Royal Academy of Engineering (BER0061)
59 Royal Astronomical Society (BER0018)
60 Royal Society of Biology (BER0076)
61 Royal Society of Chemistry (BER0037)
62 Royal Society of Edinburgh / Learned Society of Wales (BER0073)
63 Russell Group (BER0060), (BER0091)
64 STOPAIDS (BER0083)
65 The Association of the British Pharmaceutical Industry (ABPI) (BER0062)
66 The British Academy (BER0042)
67 The British Academy of Management (BAM) and the Chartered Association of Business Schools (Chartered ABS) (BER0029)
68 The Catapult Network (BER0032)
69 The Confederation of British Industry (CBI) (BER0026)
70 The Geological Society (BER0053)

71 The Institute of Cancer Research (BER0025), (BER0086)
72 The Physiological Society (BER0039)
73 The Royal Society (BER0070)
74 The Shelford Group (BER0035)
75 TWI Ltd (BER0038)
76 UCL (BER0014)
77 UK Computing Research Committee (BER0004)
78 UK Innovation & Science Seed Fund (BER0050)
79 UK Research and Innovation (BER0063), (BER0098)
80 UNESCO (BER0080)
81 Universities Scotland (BER0016)
82 Universities UK (BER0044), (BER0089)
83 Universities Wales (BER0033)
84 University of Edinburgh (BER0008)
85 University of Nottingham (BER0052)
86 University of Oxford (BER0021)
87 University of Reading (BER0040)
88 Wellcome Trust (BER0068)
89 WMG (BER0012)
90 Yorkshire Universities (BER0024)

List of Reports from the Committee during the current Parliament

All publications from the Committee are available on the publications page of the Committee's website. The reference number of the Government's response to each Report is printed in brackets after the HC printing number.

Session 2017–19

First Report	Pre-appointment hearing: chair of UK Research & Innovation and executive chair of the Medical Research Council	HC 747
Second Report	Brexit, science and innovation	HC 705
Third Report	Genomics and genome editing in the NHS	HC 349
Fourth Report	Algorithms in decision-making	HC 351
Fifth Report	Biometrics strategy and forensic services	HC 800
Sixth Report	Research integrity	HC 350
Seventh Report	E-cigarettes	HC 505
Eighth Report	An immigration system that works for science and innovation	HC 1061
Ninth Report	Flu vaccination programme in England	HC 853
Tenth Report	Research integrity: clinical trials transparency	HC 1480
Eleventh Report	Evidence-based early years intervention	HC 506
Twelfth Report	Quantum technologies	HC 820
Thirteenth Report	Energy drinks and children	HC 821
Fourteenth Report	Impact of social media and screen-use on young people's health	HC 822
Fifteenth Report	Evidence-based early years intervention: Government's Response to the Committee's Eleventh Report of Session 2017–19	HC 1898
Sixteenth Report	'My Science Inquiry'	HC 1716
Seventeenth Report	Japanese knotweed and the built environment	HC 1702
Eighteenth Report	Digital Government	HC 1455
Nineteenth Report	The work of the Biometrics Commissioner and the Forensic Science Regulator	HC 1970
Twentieth Report	Clean Growth: Technologies for meeting the UK's emissions reduction targets	HC 1454
First Special Report	Science communication and engagement: Government Response to the Committee's Eleventh Report of Session 2016–17	HC 319
Second Special Report	Managing intellectual property and technology transfer: Government Response to the Committee's Tenth Report of Session 2016–17	HC 318

Third Special Report	Industrial Strategy: science and STEM skills: Government Response to the Committee's Thirteenth Report of Session 2016–17	HC 335
Fourth Special Report	Science in emergencies: chemical, biological, radiological or nuclear incidents: Government Response to the Committee's Twelfth Report of Session 2016–17	HC 561
Fifth Special Report	Brexit, science and innovation: Government Response to the Committee's Second Report	HC 1008
Sixth Special Report	Algorithms in decision-making: Government Response to the Committee's Fourth Report	HC 1544
Seventh Special Report	Research integrity: Government and UK Research and Innovation Responses to the Committee's Sixth Report	HC 1562
Eighth Special Report	Biometrics strategy and forensic services: Government's Response to the Committee's Fifth Report	HC 1613
Ninth Special Report	An immigration system that works for science and innovation: Government's Response to the Committee's Eighth Report	HC 1661
Tenth Special Report	Research integrity: clinical trials transparency: Health Research Authority Response to the Committee's Tenth Report	HC 1961
Eleventh Special Report	Quantum technologies: Government Response to the Committee's Twelfth Report	HC 2030
Twelfth Special Report	Impact of social media and screen-use on young people's health: Government Response to the Committee's Fourteenth Report	HC 2120
Thirteenth Special Report	Japanese knotweed and the built environment: Government Response to the Committee's Seventeenth Report	HC 2600