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1st Report of Session 2022–23

"Science and technology superpower": more than a slogan?

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Evidence is published online at https://committees.parliament.uk/work/6522/delivering-a-uk-science-and-technology-strategy/publications/ and available for inspection at the Parliamentary Archives (020 7219 3074).

Q in footnotes refers to a question in oral evidence

SUMMARY

There is an exceptional science and technology base in the UK, alongside a cross party consensus that science, technology and innovation have a key role to play in the delivery of economic growth, improved public services and strategic international advantage.

We take this opportunity to reiterate the crucial importance of science and technology to the future of the UK. We urge a new Prime Minister to maintain the positive aspects of science and technology policy identified in this report. The Government's ambitions must not be abandoned, but the focus should shift to delivery. A new Prime Minister should chair regular meetings of the sub-committee of cabinet, the National Science and Technology Council (NSTC), to drive progress towards science and technology targets nationally and across Government. We are concerned that there was, at the time of writing, no Minister for Science, Research and Innovation. It must be a priority for a new Prime Minister to appoint one to a cabinet-level position.

The Government has headline targets to increase the proportion of GDP spent on research and development (R&D) to 2.4% by 2027 and to make the UK a "science and tech superpower" by 2030. It has increased public funding for UK Research and Innovation (UKRI), government departments, and other funders of research. It has established the NSTC as a cabinet committee and it has created a new body, the Office for Science and Technology Strategy (OSTS), to prioritise science and technology at the heart of Government. Witnesses from the research and business communities have welcomed these developments, but there is much work to do to deliver on these targets. Despite welcome steps and laudable rhetoric, we are concerned that the Government is not on course to meet its ambitions. Evidence of sustained focus, implementation and delivery is lacking. Furthermore, it is not clear how value is added by the many layers of bureaucracy.

The Government appears to lack an overarching plan for the strategic development of UK science and technology. It recognises the UK cannot be "world-leading" in everything, but it has not identified the areas of science and technology that it wants the country to specialise in, nor has it been clear about how specific its priorities will be. There are welcome spending commitments, but the Government has identified few clear, measurable outcomes that it wants this funding to achieve. More than a year after the March 2021 announcement that the UK will become a "science and tech superpower by 2030" we were told that the metrics to define what this means will be available to accompany this objective by the end of the 2022. Unclear targets, and poor communication, jeopardise the achievement of the Government's ambitions.

There is a profusion of sectoral strategies in areas such as artificial intelligence and life sciences that need to be consolidated into a logical whole. There is little sense of how they fit into an overall plan. Initiatives such as the Plan for Growth, the Integrated Review and the Levelling Up White Paper recognise the contribution that science and technology can make to a range of policies but have meant that delivery bodies, particularly UKRI, are being pulled in numerous directions, with insufficient resources to meet the demand.

R&D is a long-term endeavour, requiring consistent support, funding and messaging from the Government. Instead, policies and priorities have changed rapidly, with supposedly decadal strategies, such as the Industrial Strategy,

abandoned after a few years. The reviews into aspects of science policy, such as the second Nurse review, the Tickell review into bureaucracy and the forthcoming review of the Research Excellence Framework, could drive welcome reform, but frequent reviews can be disruptive.

The NSTC and OSTS should provide an opportunity to address some of these issues, especially if they succeed in their aim to coordinate science and technology across government. They should provide a clear message from Government on science and technology and they should be accountable for implementing cross-governmental science and technology policies. But they have yet to make clear how they will fulfil their potential. We understand the NSTC has met only three times since it was established in July 2021, and the OSTS has yet to publish any substantive documents or to reveal what it intends to do. There is a lack of clarity on the respective roles of the key players within the science and technology system. Without this, we fear that these new bodies, which have been added to an already crowded science and technology landscape, could blur accountability and increase bureaucracy. The relationship between these bodies and key government agencies, particularly UKRI, needs to be clarified.

We heard repeatedly that the UK cannot be a "science and tech superpower" in isolation. But the Government's international science policy has been somewhat incoherent. It wants to "own", "collaborate" or "access" technologies with national security implications, but it has not identified the technologies to which each category will apply. The UK's reputation was damaged by cuts to Official Development Assistance, which meant ongoing projects were abandoned. Association with Horizon Europe has not been secured, which risks harming the UK's reputation further and jeopardising the quality of its science base. We are pleased association remains the Government's intention, but we reiterate that the UK cannot reproduce the benefits of Horizon with a domestic programme, even if it receives similar levels of funding. The UK's excellent science base should be a means of enhancing the UK's international reputation, but government actions have made the UK appear unreliable and unwelcoming. There is an urgent need to rebuild international relationships.

The target to increase UK R&D spending to 2.4% of GDP by 2027 is welcome. But international and domestic attempts to achieve this rate of increase have generally failed, and we have not heard enough to make us confident this time will be different. Private sector spending will be vital to reach the 2.4% target; and yet industry does not yet feel engaged with the strategy process. The Government has identified reform of public procurement, regulations and tax credits as levers for increasing private R&D investment. But these are areas in which there are perennial suggestions for reform, and the Government has set out few specific proposals. It must outline reforms commensurate with the ambition of the target and show that it is not just doing the same things and expecting a different outcome.

While the increase in public funding for R&D is welcome, we note that the increase this represents in real terms is being eroded by inflation. History tells us that R&D budgets are often cut in times of economic difficulty. This must be avoided.

A clear and consistent science and technology policy has the potential to unlock significant benefits for the UK, and many of the pieces are in place in to meet the Government's ambitions. But there must be a laser focus on implementation, or "science and tech superpower" will become an empty slogan.

"Science and technology superpower": more than a slogan?

CHAPTER 1: INTRODUCTION

1. The Government has high hopes for science and technology. It expressed an ambition to make the UK a "science and tech superpower by 2030" in the 2021 Integrated Review of Security, Defence, Development and Foreign Policy.[1] This document described an "own–collaborate–access" approach to important international technologies. In the 2017 Industrial Strategy, the Government set a target to increase the proportion of the UK's Gross Domestic Product (GDP) spent on research and development (R&D) to 2.4%. This was the average for Organisation for Economic Co-operation and Development (OECD) countries at that time.[2] The Government remains committed to achieving this target by 2027. In 2019, 1.74% of the UK's GDP was spent on R&D.[3]

2. To support these ambitions, in June 2021, the Government established the National Science and Technology Council (NSTC) as a committee, comprising cabinet members, chaired by the Prime Minister. The NSTC has a supporting Office of Science and Technology Strategy (OSTS) within the cabinet Office, under Sir Patrick Vallance, in his role as National Technology Adviser.[4] The Government also announced a substantial increase in public R&D funding. Public investment in R&D will rise to £20 billion by 2024–25 from £9 billion in 2017–18, according to the 2021 Spending Review.[5] This increased funding will go to the research councils which are gathered under UK Research and Innovation (UKRI), as well as to individual Government departments. Recent years have seen the publication of the R&D Roadmap

1 HM Government, *Global Britain in a competitive age: The Integrated Review of Security, Defence, Development and Foreign Policy* (March 2021) p 4: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/975077/Global_Britain_in_a_Competitive_Age-_the_Integrated_Review_of_Security__Defence__Development_and_Foreign_Policy.pdf [accessed 8 June 2022]

2 HM Government, *Industrial Strategy: Building a Britain fit for the future* (27 November 2017): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf [accessed 8 June 2022]

3 Office for National Statistics, 'Gross domestic expenditure on research and development, UK: 2019' (4 August 2021): https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/latest [accessed 8 June 2022]

4 Sir Patrick Vallance also serves as the Government's Chief Scientific Adviser, but these are separate roles that may be held by different individuals in the future.

5 HM Treasury, *Autumn Budget and Spending Review 2021: A stronger economy for the British people* (27 October 2021) HC 822: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1043688/Budget_AB2021_Print.pdf [accessed 8 June 2022]

(July 2020), the Innovation Strategy (July 2021) and the Plan for Growth (March 2021.)[6]

3. There are also ongoing reviews into aspects of science policy in the UK, many of which are due to be published in 2022. These include: the Nurse review into the Research, Development and Innovation Organisational Landscape; the Grant review into the operation of UK Research and Innovation; the Tickell review into research bureaucracy; and the Gluckman review of the 2021 Research Excellence Framework.[7] The Government has other long-term ambitions that relate to science and technology—such as levelling up the country and Britain's regulatory, trade, and foreign policy post-Brexit.

4. On 10 February 2022, we launched our inquiry into "Delivering a UK science and technology strategy." The call for evidence is in Appendix 3. We are grateful to all who provided their views in our seminars, and in oral or written evidence.

5. We heard evidence on subjects that are not covered in-depth in this report. The Committee will look at science and technology skills and careers in its next inquiry. The Research Excellence Framework, university—industry collaboration, and the role of public sector research and development organisations are vital issues, which we may return to once the ongoing reviews into them have concluded.

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6 Department for Business, Energy and Industrial Strategy, *UK Research and Development Roadmap* (July 2020): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/896799/UK_Research_and_Development_Roadmap.pdf; Department for Business, Energy and Industrial Strategy, 'UK Innovation Strategy: leading the future by creating it' (22 July 2021): https://www.gov.uk/government/publications/uk-innovation-strategy-leading-the-future-by-creating-it/uk-innovation-strategy-leading-the-future-by-creating-it-accessible-webpage; HM Treasury, 'Build Back Better: our plan for growth' (3 March 2021): https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth/build-back-better-our-plan-for-growth-html [accessed 8 June 2022]

7 Department for Business, Energy and Industrial Strategy, 'Terms of Reference: Review of the research, development and innovation organisational landscape' (20 January 2022): https://www.gov.uk/government/publications/research-development-and-innovation-organisational-landscape-an-independent-review/terms-of-reference-review-of-the-research-development-and-innovation-organisational-landscape; Department for Business, Energy and Industrial Strategy, 'Independent review of UK Research and Innovation (UKRI): terms of reference' (6 December 2021): https://www.gov.uk/government/publications/independent-review-of-uk-research-and-innovation-ukri/independent-review-of-uk-research-and-innovation-ukri-terms-of-reference; Department for Business, Energy and Industrial Strategy and UK Research and Innovation, 'Review of research bureaucracy: terms of reference' (12 January 2022): https://www.gov.uk/government/publications/review-of-research-bureaucracy/review-of-research-bureaucracy-terms-of-reference; UK Research and Innovation, 'Launch of the future research assessment programme' (19 May 2021): https://www.ukri.org/news/launch-of-the-future-research-assessment-programme/ [accessed 8 June 2022]. The Research Excellence Framework (REF) is the framework used by Research England to assess academics and universities.

CHAPTER 2: DEFINING A SCIENCE AND TECHNOLOGY STRATEGY

6. The Government has ambitious science and technology targets. These goals, and the recognition of the importance of science and technology to the future economic health and global influence of the UK, are welcome. In this chapter we consider whether the Government's strategy is clear, and whether it can deliver on its ambition.

The Government's strategy

7. The Government has headline ambitions for science and technology, such as the target to spend 2.4% of UK GDP on R&D by 2027. This target is ambitious and concerted effort will be required to achieve it. It is the focus of Chapter 3. Other targets are more loosely defined, such as the goal to become a "science and tech superpower" by 2030.[8] George Freeman MP, the then Parliamentary Under Secretary of State (Minister for Science, Research and Innovation), said that becoming a "science superpower" means "that UK science is punching above its weight in terms of global impact." It is "about talent and making sure that we build an open talent pathway for global talent to come here and for our scientists to go around the world and be international." He spoke of making "strategic choices on behalf of UK science and technology".[9]

8. A recurring point made by witnesses was that the UK is strong at science, especially considering its population size and its level of investment.[10] This is particularly true for its universities, some of which consistently rank amongst the best in the world.[11] Nevertheless, despite numerous claims of the UK being "world-beating"[12] at science and technology, we heard that "the UK cannot be a science superpower across all sectors of science [and technology], and will have to decide which have the most relevance to national priorities."[13]

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8 The Integrated Review defines the ambition as "[By 2030], we will be recognised as a Science and Tech Superpower remaining at least third in the world in relevant performance measures for scientific research and innovation, and having established a leading edge in critical areas such as artificial intelligence." It does not define the performance measures or critical areas that it will assess. HM Government, *Global Britain in a competitive age: The Integrated Review of Security, Defence, Development and Foreign Policy* (March 2021) p 7: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/975077/Global_Britain_in_a_Competitive_Age-_the_Integrated_Review_of_Security__Defence__Development_and_Foreign_Policy.pdf [accessed 8 June 2022]

9 QQ 81, 83 (George Freeman MP)

10 For example: Q 1 (Dr Beth Thompson MBE and Lord Willetts); Q 9 (Professor Sarah Main); and Q 64 (Sir Patrick Vallance)

11 'World University Rankings 2022', *Times Higher Education* (2 September 2021): https://www.timeshighereducation.com/world-university-rankings/2022/world-ranking#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/stats [accessed 24 June 2022]

12 For example, Q 66 (Sir Patrick Vallance): "It is very frequently stated in the UK that we are world class at something without a definition of what we mean by that, or indeed without any comparative data.". The 2020 Budget talked of the UK's "world-beating science and research base", and ministers have written about the UK's "world beating scientists." HM Treasury, 'Budget 2020' (12 March 2020): https://www.gov.uk/government/publications/budget-2020-documents/budget-2020; and Alok Sharma, 'Our world beating scientists will be vital to firing up the UK's economic recovery, *The Telegraph* (1 July 2020): https://www.telegraph.co.uk/opinion/2020/07/01/world-beating-scientists-will-vital-firing-uks-economic-recovery/ [accessed 24 June 2022]

13 Written evidence from the Royal Aeronautical Society (STS0041)

Priorities of a UK science and technology strategy

9. The Innovation Strategy identified seven "technology families" to "transform [the UK's] economy in the future". The areas were broad—for example "energy … environmental [and climate] technologies".[14] The Government considered the families a "starting point for prioritisation" and acknowledged that "attempting to lead in every technology within each family will likely prevent us [the UK] attaining a world-leading edge in any one area." It stated that the "National Science and Technology Council … will steer this crucial prioritisation process."[15] The Office for Science and Technology (OSTS), which supports the NSTC, has taken a broader view than the Innovation Strategy and it has defined four priority areas:

- "the sustainable environment [including net zero];
- health and life sciences;
- national security and defence, including space; and
- a digitally and data driven economy."[16]

10. It is unclear whether the OSTS will narrow down these priority areas further. Kwasi Kwarteng MP, Secretary of State for Business, Energy and Industrial Strategy, thought the priorities in the Innovation Strategy gave "a clear signal to the market and private investors as to what technologies could be best pursued here" and cautioned against being overly prescriptive.[17]

How directive will the Government be?

11. Andrew McCosh, Director-General, Office for Science and Technology Strategy, said the Government's strategy would involve making "big strategic choices across a small number of strategically significant technology families." But he did not envision setting "out a list of [individual] technologies."[18] The Government also told us it wanted to use procurement "to provide a route to market for innovative new products and services".[19] This suggests that Government will identify specific technologies that it wants the UK to develop. Lord Willetts, former Minister of State for Universities and Science, told us this was likely to be controversial: "I have this argument with colleagues in my own party,[20] where they say, "Government can't pick winners. We're terrible at it." However, he considered this to be "a pessimistic view of our [the UK's] history", citing Vodafone which was supported "partly … [by] a deliberate strategy of using our [the UK's] technical lead to shape

14 The seven areas identified were: "Advanced materials and manufacturing; AI, digital, and advanced computing; Bioinformatics and genomics; Engineering biology; Electronics, photonics, and quantum [technologies]; Energy … environmental, [and climate] technologies; and Robotics and smart machines." Department for Business, Energy and Industrial Strategy, 'UK Innovation Strategy: leading the future by creating it' (22 July 2021): https://www.gov.uk/government/publications/uk-innovation-strategy-leading-the-future-by-creating-it/uk-innovation-strategy-leading-the-future-by-creating-it-accessible-webpage [accessed 8 June 2022]

15 Department for Business, Energy and Industrial Strategy, 'UK Innovation Strategy: leading the future by creating it' (22 July 2021) p 85: https://www.gov.uk/government/publications/uk-innovation-strategy-leading-the-future-by-creating-it/uk-innovation-strategy-leading-the-future-by-creating-it-accessible-webpage [accessed 8 June 2022]

16 HM Government, 'Office for Science and Technology Strategy': https://www.gov.uk/government/groups/office-for-science-and-technology-strategy [accessed 8 June 2022]

17 QQ 132–136 (Kwasi Kwarteng MP)

18 Q 52 (Andrew McCosh)

19 Written evidence from the Department for Business, Energy and Industrial Strategy (STS0080)

20 Lord Willetts is in the Conservative Party.

international mobile phone regulations in a way that worked for Vodafone."[21] He suggested a similar approach could be taken with cell and gene therapies "where the UK ha[s] a distinct advantage."

12. The Council for Science and Technology, which advises the Prime Minister, wrote to the then Prime Minister about *The UK as a science and technology superpower* in July 2021.[22] Its letter contained recommendations to help the UK become a science superpower by 2030. Concerning industry, it urged the Government to explain in "which strategic technology areas will we [the UK] seek to be 'world-leading' and where will we aim for the UK to be a 'fast follower or adopter'?"

13. We heard concern from academic witnesses that a prescriptive government strategy might challenge the Haldane principle.[23] While others considered it a "red herring" that there might be a conflict between the Government setting priorities and the Haldane principle, arguing that "government being clearer about … knowledge needs … helps more fruitful engagement between evidence producers and users".[24] The Government stated its commitment to the principle, with Andrew McCosh saying it "still applies very strongly. One of the great strengths of the UK is its broad-based discovery science research … we change it at our peril."[25]

14. Professor Graeme Reid, Chair of Science and Research Policy, University College London, thought that the appropriate level of direction from the Government would depend on the sector. "I would expect government departments to be more prescriptive about the use of their budgets for public policy development and public service delivery, whereas in the university community I think that the greatest value to the taxpayer comes from releasing the curiosity and expertise of the academics."[26]

The benefits of clear targets

15. We heard that clearer targets incentivise stakeholders when they signal demand for specific technologies. Helen Kennett, Director, UK Government Relations, Rolls Royce plc, said "it is always great to have a target to work to, but the thing that really incentivises us is if there is a very clear demand signal for the use of the technology that we are developing." She pointed to the Ten

21 Q 6 (Lord Willetts)

22 Council for Science and Technology, 'The UK as a science and technology superpower' (22 July 2021): https://www.gov.uk/government/publications/the-uk-as-a-science-and-technology-superpower/the-uk-as-a-science-and-technology-superpower-accessible-html-version-of-letter [accessed 8 June 2022]. The members of the Council for Science and Technology are "senior figures from the fields of science, engineering and technology", chosen by the Prime Minister. It is chaired by Sir Patrick Vallance and Lord Browne of Madingley. The Council for Science and Technology, 'Membership': https://www.gov.uk/government/organisations/council-for-science-and-technology/about/membership [accessed 8 June 2022]

23 The Haldane principle means that decisions on what research to fund should be made by researchers, not politicians. It is an important protection of "blue skies" research—i.e. research that is curiosity driven and does not have an immediate practical application. For example in written evidence from the University of Edinburgh (STS0035) it said it "strongly supports" the principle and "would robustly defend any intervention which would erode this via setting of what may be relatively transient priorities between Governments"

24 Written evidence from Professor Annette Boaz and Dr Kathryn Oliver, London School of Hygiene and Tropical Medicine (STS0019)

25 Q 49 Andrew McCosh. A version of the Haldane principle is in the Higher Education and Research Act 2017. This formulation states the Secretary of State must "have regard" to the principle when making grants or giving directions to UK Research and Innovation. Higher Education and Research Act 2017, Section 103(3)

26 Q 15 (Professor Graeme Reid)

Point Plan for a Green Industrial Revolution as being the "demand signal" for the net zero by 2050 target.[27] The Council for Science and Technology argued likewise that "businesses need certainty of policy and incentives in order to support" priorities.[28]

16. Clear targets from the Government are also necessary in monitoring progress towards the delivery of a strategy. For Cancer Research UK, this was central: "at a minimum, delivery of a science and technology strategy requires specific, measurable, and timely goals and a system for evaluating progress towards those goals."[29] Andrew McCosh described metrics as "a work in progress". He hoped the OSTS would be in a position "by the end of the year" to set out the "main things that we will need to achieve over the next 10 years as a country to secure the advantage we want. We intend to put in place monitoring and evaluation of all the elements of that, and periodically or regularly return to the [National Science and Technology] Council and say, 'this is how we're doing.'".[30]

17. **We welcome the indication that the Government is thinking more strategically about UK science and technology and recognises that the UK cannot be "world-beating" at everything. But the ambition to become a science and technology superpower by 2030 risks not being realised, as there are few details about how this will be defined or delivered.**

18. **The priority areas of science and technology that the Government has outlined are very broad and it is unclear whether these areas will be narrowed down. A strategy needs specific, measurable outcomes and a delivery plan. *The Government should set out specifically what it wants to achieve in each of the broad areas of science and technology that it has identified. There should be a clear implementation plan including measurable targets and key outcomes in priority areas, and an explanation of how they will be delivered.***

19. The NCC Group, a UK based global cyber and software resilience business, said there should be "consideration of the benefits and feasibility of establishing one of the existing science and technology bodies, perhaps the Council for Science and Technology, on a statutory footing as an independent non-executive body tasked with driving forward a long-term science and technology strategy and hold the Government (no matter the administration) to account on progress. For example, it could be set up much in the same way the National Infrastructure Commission (NIC) or Climate Change Committee (CCC) have been, with progress reports submitted to Parliament on an annual basis."[31] Such an approach would rely on the OSTS setting measurable targets and timeframes for delivery. It would also require support for the targets from future administrations, but the experience of the CCC demonstrates the feasibility of such an approach.

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27 Q 33 (Helen Kennett); HM Government, *The Ten Point Plan for a Green Industrial Revolution* (November 2020): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf [accessed 8 June 2022]

28 Council for Science and Technology, 'The UK as a science and technology superpower' (22 July 2021): https://www.gov.uk/government/publications/the-uk-as-a-science-and-technology-superpower/the-uk-as-a-science-and-technology-superpower-accessible-html-version-of-letter [accessed 24 June 2022]

29 Written evidence from Cancer Research UK (STS0048)

30 Q 51 (Andrew McCosh)

31 Written evidence from the NCC Group (STS0011)

20. **We welcome the Office for Science and Technology Strategy's commitment to establish and to publish metrics, by the end of 2022, to define the "science and tech superpower" ambition. This is necessary if "science and tech superpower" is to become more than slogan. *The Government should update Parliament on its progress on developing metrics by the end of 2022. Once metrics are available, an independent body should be empowered to monitor progress towards the Government's science and technology targets and to report annually to Parliament and government.***

Consolidating other strategies

21. Sectoral strategies, varying from Life Sciences[32] to nuclear fusion[33] and AI,[34] provide more detailed policy focus in specific areas. We heard from the NCC Group, that sector-specific strategies often "are mature and have been well executed. However, taken together these do not equate to the clear, well-communicated strategy that is ultimately needed."[35] The Academy of Medical Sciences pointed to "over a dozen strategies and initiatives linking to research and innovation … published from 2017–2021" in the life sciences sector.[36]

22. Science and technology are recognised by the Government as central to other policy goals. The Academy for Medical Sciences welcomed the "attention" given to science in "Government documents from the R&D Roadmap to the Integrated Review and the Levelling Up White Paper."[37] But Gavin Costigan, Chief Executive, the Foundation for Science and Technology, said of the Integrated Review and the Levelling up White Paper that "if you read it as it is written, you would think you were being pulled in different directions."[38] The Association of Medical Research Charities called for an "overarching strategy backed up by a sustained implementation plan that links up these strategies to translate them into action."[39]

23. **The proliferation of disparate strategies is confusing and it raises concerns about a lack of coherence and delivery. *In defining an overarching implementation plan, the Government should consolidate existing sector-specific strategies that are working well and monitor progress against them to ensure that they provide a clear and consistent message.***

Importance of a long-term strategy

24. This is not the first attempt from a government to take a more strategic approach to science and technology. The *Science & innovation investment*

32 HM Government, *Life Sciences Vision* (6 July 2021): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1013597/life-sciences-vision-2021.pdf [accessed 8 June 2022]
33 Department for Business, Energy and Industrial Strategy, *Towards Fusion Energy: The UK Government's Fusion Strategy* (October 2021) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1022540/towards-fusion-energy-uk-government-fusion-strategy.pdf [accessed 14 June 2022]
34 HM Government, *National AI Strategy* (September 2021): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1020402/National_AI_Strategy_-_PDF_version.pdf [accessed 14 June 2022]
35 Written evidence from the NCC Group (STS0011)
36 Written evidence from the Academy of Medical Sciences (STS0074)
37 Written evidence from the Academy of Medical Sciences (STS0074)
38 Q 11 (Gavin Costigan)
39 Written evidence from the Association of Medical Research Charities (STS0036)

framework, 2004–2014 was published in 2004, when the percentage of GDP spent on R&D was 1.53% and contained a target for the UK to raise this to 2.5% of GDP by 2015.[40] Professor Graeme Reid said that "there seems to be a desire for each strategy to appear to be entirely new, when, actually, many of them are set against a history and a context that may not have changed as much as the authors would like us to believe."[41]

25. R&D works on long timescales. Professor Sarah Main, Executive Director, Campaign for Science and Engineering, said that what her organisation hears "from business organisations and universities is that the most important factor is that stability and long-term goal."[42] Government policies have not always lasted. For example, the 2017 Industrial Strategy identified four "Grand Challenges" for the UK and a timeline for their completion. However, in 2021, the Council monitoring the Industrial Strategy was disbanded and the strategy was replaced by the Plan for Growth.[43] This leaves the Government's continued commitment to the Grand Challenges, at best, unclear.[44] Gavin Costigan commented "it has a feeling of, 'what was that all about? Why did you get us excited about all of that?'"[45] The Government "absolutely agree that becoming a science superpower, achieving strategic advantage for the country in and through science and technology, is a long-term game. If it is vulnerable to changes in Government or changes to individual policies of individual Governments, it will not work."[46]

26. We heard of the desirability of a strategy remaining consistent despite changes of government. Professor Sarah Main pointed to "the pact for research and innovation, which is an initiative Germany has held since 2005. It sets out an annual increase in research and development budgets of 3% a year, and it is running until 2030. That is a crossparty, stable commitment."[47] Andrew McCosh considered the Government's objectives to be "fundamentally bipartisan propositions … They are a national endeavour to do well. The Government have been encouraging us to engage the Devolved

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40 HM Treasury, Department for Trade and Industry and Department for Education and Skills, *Science and innovation investment framework 2004–2014* (July 2004), p 7: http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/science_innovation_120704.pdf; GDP data taken from the OECD Key indicators: OECD, 'Gross domestic spending on R&D' (2022): https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm [accessed 8 June 2022]

41 Q 11 (Professor Graeme Reid)

42 Q 11 (Professor Sarah Main)

43 HM Government, *Industrial Strategy: Building a Britain fit for the future* (27 November 2017): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf; Jim Pickard and Daniel Thomas, 'Business dismay at decision to drop plan for UK industrial strategy', *Financial Times* (8 March 2021): https://www.ft.com/content/372ae7ec-0ad7-4111-b319-db0a8f4abb7b [accessed 24 June 2022]

44 This Committee dedicated a chapter of its report, *Ageing: Science, Technology, and Healthy Living*, to the Grand Challenge to ensure five years of extra healthy life by 2035. The Government's response noted that the Industrial Strategy had been replaced by the Plan for Growth and referred to activities related to the Ageing Society Grand Challenge in the past tense. In any case, the Committee found that the Government was "not on track" and did "not appear to be monitoring progress towards the mission." There was "no clear ownership" or "cross-government[al] strategy for achieving the mission." Science and Technology Committee, *Ageing: Science, Technology and Healthy Living* (1st Report, Session 2019–21, HL Paper 183); Government Response from the Department of Health and Social Care to the Science and Technology Committee, Ageing: Science, Technology and Healthy Living report (15 March 2021): https://committees.parliament.uk/publications/5115/documents/50490/default/ [accessed 8 July 2022]

45 Q 11 (Gavin Costigan)

46 Q 54 (Andrew McCosh)

47 Q 11 (Professor Sarah Main)

Administrations on this approach and to engage with opposition parties."[48] George Freeman "deliberately" used the phrase "innovation nation" because it was the title of a "Labour Party paper back in the 1990s … to signal that this is not a partisan project."[49]

27. **Research and development is a long-term endeavour. It has been undermined by frequent policy changes especially when strategies that are supposed to be long-term are abandoned after a few years. *The Government should make every effort to establish science and technology policy for the long term, building on existing policies and with clear, cross-party support.***

International science and technology strategy

28. We heard that the international element of a science and technology strategy will be vital for the UK. The Institute of Physics told us, "science is a global endeavour. … A strong international presence must be maintained, if we [the UK] are to remain in the vanguard of scientific discovery and innovation."[50] The Royal Academy of Engineering concluded: "succeeding as a science superpower won't happen in isolation."[51]

Own–collaborate–access

29. The Integrated Review set out the own–collaborate–access framework, to guide the Government's approach to international science and technology (see Box 1).

Box 1: The own–collaborate–access framework

"The UK will seek to establish a leading role in critical and emerging technologies where there is a realistic prospect of delivering strategic advantage. A new 'own–collaborate–access' framework will guide our approach:

- Own: where the UK has leadership and ownership of new developments, from discovery to large-scale manufacture and commercialisation. This will always involve elements of collaboration and access.
- Collaborate: where the UK can provide unique contributions that allow us to collaborate with others to achieve our goals.
- Access: where the UK will seek to acquire critical S&T from elsewhere, through options, deals and relationships."

Source: Cabinet Office, 'Policy paper: Global Britain in a Competitive Age: the Integrated Review of Security, Defence, Development and Foreign Policy', (2 July 2021): https://www.gov.uk/government/publications/global-britain-in-a-competitive-age-the-integrated-review-of-security-defence-development-and-foreign-policy/global-britain-in-a-competitive-age-the-integrated-review-of-security-defence-development-and-foreign-policy *[accessed 16 June 2022]*

30. We heard contrasting views on the clarity with which the UK needs to define its intention to own, collaborate or access. Sir Patrick Vallance thought that when it came to ministerial choices "we need to get to the specificity of the

48 Q 54 (Andrew McCosh)
49 Q 83 (George Freeman MP)
50 Written evidence from the Institute of Physics (STS0046). Similar sentiments were contained in numerous submissions, including: the British Heart Foundation (STS0028) "Medical research is international and hugely collaborative."
51 Written evidence from the Royal Academy of Engineering (STS0049)

aim: is it to own, collaborate or access?"[52] George Freeman MP similarly said "to be credible, one has to be clear about where one is collaborating and where one is competing."[53] Kwasi Kwarteng described "own–collaborate–access" as a guideline, rather than a "rigid framework" and cautioned against "putting things into different watertight pots."[54]

31. Witnesses generally welcomed the framework "as a starter" and hoped it could "focus minds on some of the … decisions that we need to make." [55] We heard that it could not be applied to all areas of science and technology. Professor James Wilsdon, Digital Science Professor of Research Policy at the University of Sheffield, thought that own–collaborate–access would apply only "to a specific subset of high-tech R&D debates."[56] Lord Willetts agreed that it would mostly be relevant to technologies with national security implications.[57]

32. We heard concerns about the "notion of the UK owning domains of science", with Professor Reid saying, "I just cannot work out how that operates."[58] By seeking to "own" an area of technology the UK could be cutting itself off from international progress because "collaboration across borders is increasingly important to be able to get the best out of research."[59] Professor Main thought that there was a risk that "co-operative efforts by other nations would … overtake what we [the UK] might do unilaterally."[60]

33. The situation with OneWeb demonstrated the importance of having a strategic framework for international science policy. In July 2020, the Government announced that it wanted to develop a "UK sovereign space capability" and it sought to do this, in part, by buying a stake in the satellite company, OneWeb.[61] But the company relied on Russian rockets to launch its satellites. Following Russia's invasion of Ukraine, the satellite launches were stopped in March 2022.[62] The Government's September 2021 National Space Strategy referred to the own-collaborate-access framework, but OneWeb's dependence on Russian infrastructure was not resolved.[63]

34. **The own–collaborate–access framework is a useful starting point for approaching international science and technology policy. But it is insufficiently understood and poorly applied. It is not clear whether decisions have been taken on how the framework will apply to specific technologies. *The Government must clarify the own–collaborate–access framework by publishing the areas of technology where it***

52 Q 66 (Sir Patrick Vallance)
53 Q 85 (George Freeman MP)
54 Q 143 (Kwasi Kwarteng MP)
55 Q 8 (Professor James Wilsdon); Q 112 (Professor Charlotte Watts)
56 Q 8 Professor James Wilsdon
57 Q 8 (Lord Willetts)
58 Q 14 (Professor Graeme Reid)
59 Q 8 (Dr Beth Thompson MBE)
60 Q 14 (Professor Sarah Main)
61 BBC, 'UK government takes £400m stake in satellite firm OneWeb' (3 July 2020): https://www.bbc.co.uk/news/science-environment-53279783 [accessed 24 June 2022]
62 BBC, 'OneWeb: UK satellite firm suspends use of Russian rockets' (3 March 2022): https://www.bbc.co.uk/news/uk-politics-60602512; Department for Business, Energy and Industrial Strategy, UK Space Agency, and The Rt Hon Alok Sharma MP, 'UK government secures satellite network OneWeb' (20 November 2020): https://www.gov.uk/government/news/uk-government-secures-satellite-network-oneweb [accessed 24 June 2022]
63 Department for Business, Energy and Industrial Strategy, Ministry of Defence and UK Space Agency, 'National space strategy' (1 February 2022): https://www.gov.uk/government/publications/national-space-strategy/national-space-strategy [accessed 22 June 2022]

will be applied, and by explaining how it intends to balance owning, collaborating or accessing in these areas.

International collaboration

35. Cancer Research illustrated the importance of international collaboration: "nearly half of all UK cancer research and 43% of CRUK-supported clinical trials are international … cancer research is highly reliant on international clinical trials."[64] The Government agree collaboration is important. George Freeman cited the European Space Agency and research into nuclear fusion, describing collaboration in these areas as "fundamental if we want to share economies of scale, share best practice and accelerate our pursuit of progress."[65] Sir Patrick Vallance emphasised the importance of the UK continuing to be attractive to international talent.[66]

36. We heard collaboration on science and technology offers diplomatic or soft power benefits.[67] These benefits may be particularly valuable to the UK following its departure from the European Union. Dr Marga Gual Soler, International Science Diplomacy Expert, described the use of "science … as a diplomatic tool to bring countries together, often in situations in which political, diplomatic or other relationships are not at their best."[68] Professor Charlotte Watts, Chief Scientific Adviser at the Foreign, Commonwealth and Development Office, said "the soft power benefits of our science collaborations are huge", citing the Oxford/Astrazeneca vaccine. She thought the Government was increasingly "recognising the geopolitical aspects of science, and diplomacy."[69]

Brexit and Horizon Europe

37. We heard that the UK is harder to collaborate with than previously. Dr Soler was concerned about "the UK's attractiveness as a partner for other countries to engage with … After Brexit, there are more challenges and bureaucracy."[70] Professor Sir Richard Friend, former Cavendish Professor of Physics, University of Cambridge, said that changes following Brexit gave "the impression that we are not quite as friendly a place to come to as we once were."[71] Alexandra Jones, Director of Science, Research and Innovation, Department for Business, Energy and Industrial Strategy (BEIS), thought that the UK remained "an attractive partner." She argued this was reflected in the amount of international research and development investment the UK attracted and the continued flow of talent to the UK.[72] Professor Friend agreed that it is not true that the UK is less friendly but said "we need to be careful when we have our internal debates … there is an international audience as well."[73]

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64 Written evidence from Cancer Research UK (STS0048)
65 Q 85 (George Freeman MP)
66 Q 79 (Sir Patrick Vallance). "A lot of the success in the UK has come from immigration." Similarly, Q 22 (Sir Adrian Smith) said: "Going forward, the key thing one would keep coming back to is talent and the flow of talent, and being internationally competitive in being able to recruit and retain talent"
67 Written evidence from the Institute of Physics (STS0046)
68 Q 57 (Dr Marga Gual Soler)
69 Q 112 (Professor Charlotte Watts)
70 Q 63 (Dr Marga Gual Soler)
71 Q 130 (Professor Sir Richard Friend)
72 Q 85 (Alexandra Jones)
73 Q 130 (Professor Sir Richard Friend)

38. Horizon Europe is the EU's "key funding programme for research and innovation with a budget of €95.5 billion."[74] The UK was a prominent participant before leaving the EU. "Between 2014 and 2020, UK researchers received over €7bn from the 'Horizon 2020' programme … 12.1% of all the funds awarded, second only to Germany."[75] Much of the evidence we received expressed concern about the UK's lack of association with Horizon Europe post-Brexit.[76]

39. The Government wants to associate, and association was agreed in principle under the Trade and Cooperation Agreement 2020.[77] However, it has not yet happened because of wider disagreements over the UK's relationship with the EU.[78] The Government has said it will spend the money currently earmarked for Horizon association on a "Plan B", if it is unable to associate, although reports from July 2022 suggest that equivalent funding may not be allocated.[79] Professor Chris Pearce, Vice-Principal for Research, University of Glasgow, summed up the situation: Horizon Europe "is one of the most successful, internationally collaborative research funding frameworks out there, and we are essentially being frozen out of it at the moment. Every university will give you examples of projects that are in limbo. We are not being included in new projects because we are seen as a risk. It is well documented that a number of ESRC grant holders are considering whether to take their prestigious awards elsewhere." [80] The European Research Council announced in June that it would terminate the preparation of 115 grants offered to UK-based

74 European Commission, 'Horizon Europe': https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en [accessed 21 June 2022]

75 Written evidence from the British Heart Foundation (STS0028)

76 For example Q 128 (Professor Sir Richard Friend): "The first thing one has to say is that many of us have spent most of our working careers getting along extremely well with Europe. It has been very attractive to be able to fish in a pond about the same size as the USA to find the collaborations we want. If you are in a smaller research field, which I have always been, it has been necessary to find collaborations on that scale. Of course we can look more broadly, but it is extremely important that we do not allow those excellent relationships to lapse. We have to make that work."; and written evidence from the Royal Society (STS0078): "Delivering on association is the best way to ensure UK and EU scientists maximise the rich collaborative opportunities the programme offers. Plan A still has the full support of the UK's research and innovation community."

77 European Commission, *Q&A on the UK's participation in Horizon Europe* (22 December 2021): https://ec.europa.eu/info/sites/default/files/research_and_innovation/strategy_on_research_and_innovation/documents/ec_rtd_uk-participation-in-horizon-europe.pdf [accessed 21 June 2022]; Declarations referred to in the Council Decision on the signing on behalf of the Union, and on a provisional application of the Trade and Cooperation Agreement and of the Agreement concerning security procedures for exchanging and protecting classified information, OJ L 444, 31 December 2020

78 Q 85 (George Freeman MP) "On Horizon, you have heard me say on record often that the Government's policy continues to be that we want to associate." Leonie Kijewski and Cristina Gallardo, 'Brexit tensions mean Brits won't get EU science cash, Brussels warns', *Politico* (19 May 2022): https://www.politico.eu/article/brexit-tensions-mean-brits-wont-get-eu-science-cash-brussels-warns/; and Letter from Rt Hon Elizabeth Truss MP, Secretary of State for Foreign, Commonwealth and Development Affairs to Lord Kinnoull, Chair of European Affairs Committee, 'The UK's participation in the Horizon Europe programme' (9 May 2022): https://committees.parliament.uk/publications/22195/documents/164588/default/ [accessed 21 June 2022]

79 Q 85 (George Freeman MP); Clive Cookson, 'UK sets out £6bn plan B science fund if EU blocks association with Horizon', *Financial Times* (6 February 2022): https://www.ft.com/content/de5bc998-f74c-4bda-99cc-8db14946a8e8 [accessed 21 June 2022]; and George Parker and Clive Cookson, 'UK science minister in dispute with Treasury over post-Brexit funding', *Financial Times* (2 July 2022) https://www.ft.com/content/f471d783-5942–4495–892a-361bb0b6aaf0 [accessed 5 July 2022]

80 Q 29 (Professor Chris Pearce)

researchers, and that 19 of the researchers had agreed to move abroad to keep their funding. [81]

Official Development Assistance

40. Official Development Assistance (ODA) is another component of the UK's international science funding. Part of ODA goes through UKRI to support research partnerships between UK-based academics and those in other countries. In March 2021, UKRI announced that cuts in ODA had led to a "£120m gap between allocations and commitments to grant holders."[82] This meant that the UK pulled out of projects that had already started. Professor Watts conceded that "the impacts of the cuts in ODA were difficult for everybody to manage." She noted that the Government had committed to return ODA spending to 0.7% of GDP.[83] Despite the commitment to return to 0.7%, Professor Pearce said the temporary cuts "were extremely damaging, stalled progress on very significant collaborative research programmes all over the world and ultimately undermined our international reputation."[84]

41. Gavin Costigan said the cuts to ODA, the failure to associate with Horizon Europe and the rhetoric used in recent years has meant that the "UK has a little bit of repairing of relationships" to do.[85] Of the UK's international strategy as a whole, Professor Wilsdon concluded, "we have ended up with an international R&D strategy that at the moment feels somewhat incoherent."[86]

42. **The Government's inconsistent approach to international scientific collaboration has severely undermined the aspiration to be a "science and tech superpower." The UK's reputation and scientific capability have been damaged by the cuts to Official Development Assistance and the ongoing lack of association with Horizon Europe. The UK must be seen as a reliable partner, and the Government must recognise that it cannot reproduce the benefits of international collaborations domestically. *A cross-Government science strategy must recognise the importance of international collaborations and steps must be taken to rebuild the UK's reputation as a partner.***

Organisations to deliver a UK science and technology strategy

43. Organisations and individuals in the science and technology landscape will be expected to deliver a UK science and technology strategy. These include the National Science and Technology Council, the Office for Science and Technology Strategy, UK Research and Innovation (UKRI), Government departments, the civil service as well as business.

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81 "The grants of 19 UK based researchers will be moved to a host institution in the EU or associated countries following the researchers' decisions to exercise their right to portability." David Matthews, 'European Research Council withdraws the grants of 115 researchers based in the UK, as 19 scientists decide to relocate', *Science Business* (30 June 2022): https://sciencebusiness.net/news/european-research-council-withdraws-grants-115-researchers-based-uk-19-scientists-decide [accessed 8 July 2022]

82 UK Research and Innovation, 'UKRI required to review Official Development Assistance funding' (11 March 2021): https://www.ukri.org/news/ukri-required-to-review-official-development-assistance-funding/ [accessed 21 June 2022]

83 Q 112 (Professor Charlotte Watts)

84 Q 29 (Professor Chris Pearce)

85 Q 14 (Gavin Costigan)

86 Q 1 (Professor James Wilsdon)

National Science and Technology Council and Office for Science and Technology Strategy

44. The new cabinet committee, the National Science and Technology Council (NSTC), and its supporting body, the Office for Science and Technology Strategy (OSTS) under the National Technology Adviser, are intended to direct the Government's strategic approach to science and technology. The objectives for the OSTS include "identifying and signalling UK priority outcomes from science and technology [and] defining and communicating the technologies that are critical to achieving these outcomes."[87] It will also "identify how the Government should use and direct their levers to optimise the S&T system."[88] The bodies will pull "together the different strands of policy … across government".[89] The OSTS has committed to publishing, by the end of 2022, clear targets and metrics to assess progress towards the ambition to make the UK a "science superpower".[90]

45. Many witnesses welcomed the establishment of the NSTC and the OSTS and hoped that, as a sub-committee of the cabinet, the NSTC would "promote science [and technology] within the centre of government."[91] Witnesses from other Government departments also welcomed the NSTC as a forum for discussing issues that cut across departments.[92] Professor Sarah Main hoped the establishment of the bodies signalled a "move from the idea of science and research being contained within a pocket of one part of the department to it being an asset" for "the whole of government and UK society."[93] Professor Graeme Reid was cautiously optimistic, noting that their creation does not solve issues "in itself, but it creates prospects for addressing … issues that we have not had before."[94]

Work of the National Science and Technology Council and the Office for Science and Technology Strategy

46. The OSTS has around 20 staff and should have 45 by the end of 2023, but it is yet to publish any substantive documents.[95] At the time of writing, we understand the NSTC has met three times since it was established in July 2021. Sir Patrick Vallance, Government Chief Scientific Adviser, wanted this to change, saying "it cannot be a once a year thing; it needs to be a very frequent committee."[96] Kwasi Kwarteng said "the number of meetings is not important; the agenda and focus are important. Some of the best committees I sit on meet three or four times a year. Some of the least effective probably meet much more frequently than that."[97]

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87 HM Government, 'Office for Science and Technology Strategy': https://www.gov.uk/government/groups/office-for-science-and-technology-strategy [accessed 8 June 2022]
88 Q 47 (Louise Dunsby)
89 HM Government, 'Office for Science and Technology Strategy': https://www.gov.uk/government/groups/office-for-science-and-technology-strategy [accessed 8 June 2022]; Q 47 (Andrew McCosh)
90 Q 51 (Andrew McCosh)
91 Q 7 (Dr Beth Thompson MBE). Lord Willetts described the establishment of the NSTC as an "excellent initiative" Q 7 (Lord Willetts); Professor James Wilsdon "welcome[d] the existence of the new committee" Q 7 (Professor James Wilsdon); and Professor Graeme Reid described its establishment as "a very good move." Q 9 (Professor Graeme Reid)
92 For example, Stuart Wainwright from the Government Office for Science and Technology said "the creation of OSTS is actually a really good thing for us. It gives us a strong new partner." Q 47 (Stuart Wainwright OBE)
93 Q 13 (Professor Sarah Main)
94 Q 9 (Professor Graeme Reid)
95 Q 47 (Andrew McCosh). This was the case as of 15 March 2022.
96 Q 77 (Sir Patrick Vallance)
97 Q 135 (Kwasi Kwarteng MP)

47. **We are concerned that the National Science and Technology Council has met only three times in the first year since it was established in July 2021.** ***The National Science and Technology Council should meet regularly and frequently. Given the importance of science and technology to the UK, ten to twelve times per year seems more appropriate than three or four.***

48. **We are also surprised that no substantive documents have been produced by the Office for Science and Technology Strategy.** ***The Office for Science and Technology Strategy should publish the outcomes of the Council's decisions, and its substantive plans for the specific areas of cross-government working that it has identified. It is critical that this strategy is communicated widely.***

Representation on the National Science and Technology Council

49. To co-ordinate science and technology across Government, the appropriate departments need to be represented on the NSTC. The Department for Environment, Food and Rural Affairs (DEFRA) is central to several Government targets, particularly net zero by 2050, and it sponsors important arms-length public bodies, such as Natural England. Sir Patrick Vallance said meeting the Government's ambitions "is reliant upon skills and talent" so he was "very encouraged by the fact that the DfE [Department for Education] is … linking very closely with the OSTS."[98] But neither of these departments is a full member of the NSTC. We heard that when an item of discussion at the NSTC is "particularly relevant" to a department, a representative would attend.[99] Kwasi Kwarteng said that the membership of the NSTC was not "set in stone" but the initial preference was for a smaller membership.[100]

50. **The right people and the right science and technology skills will be crucial to becoming a "science and tech superpower."** ***The Office for Science and Technology Strategy should include "people and skills" as a core strand in its work to coordinate a science and technology strategy across Government.***

51. **Given the centrality of the Department for Environment, Food and Rural Affairs and the Department for Education to science and technology, there is a compelling case that they should be present at every meeting of the National Science and Technology Council.** ***The Department for Environment, Food and Rural Affairs and the Department for Education should have representatives as full members of the National Science and Technology Council.***

Remits of the National Science and Technology Council and the Office for Science and Technology Strategy

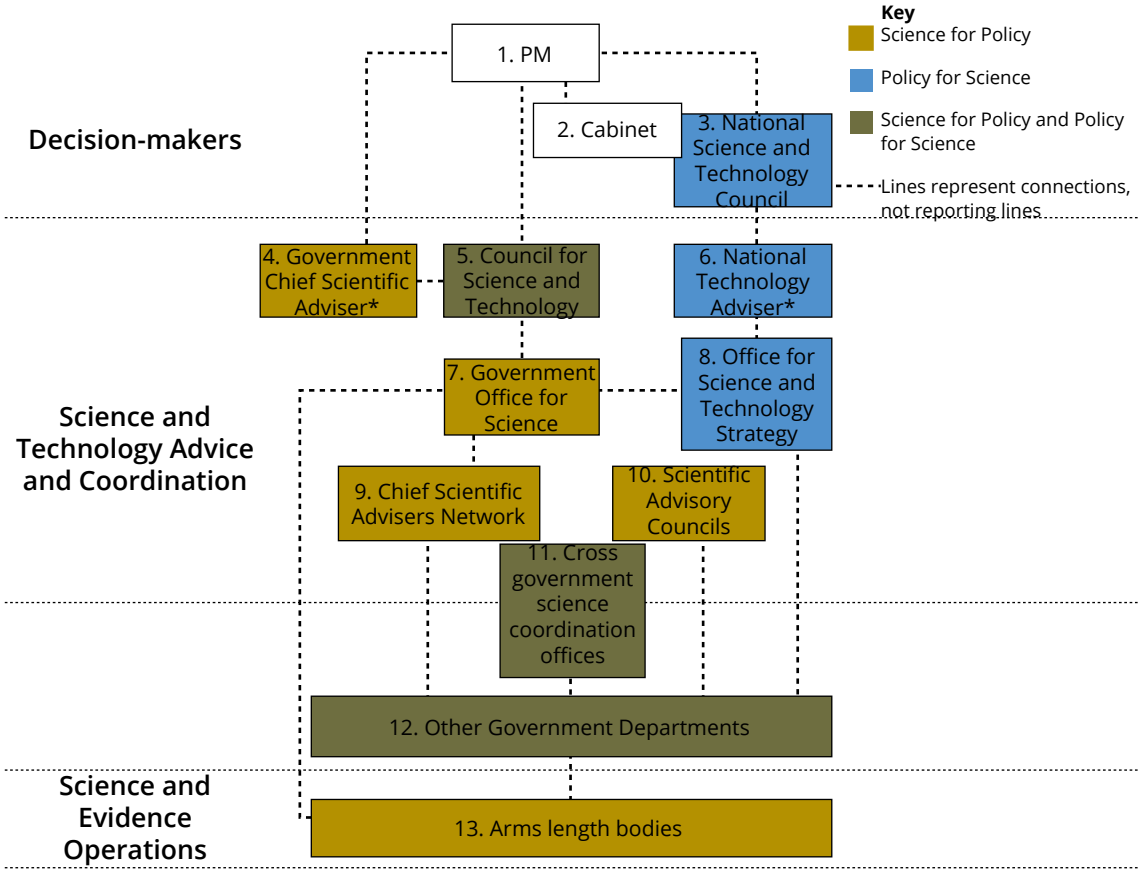
52. As Figure 1, from the Government Office for Science, sets out with important caveats, there are numerous science and technology bodies in, or linked to, the Government.[101] Witnesses described the "complexity of the research and innovation landscape in the UK."[102] The Royal Society of Edinburgh feared

98 Q 79 (Sir Patrick Vallance)
99 Q 101 (Professor Gideon Henderson)
100 Q 135 (Kwasi Kwarteng MP)
101 The caveats to keep in mind were summarised by the Government Office for Science: written evidence from the Government Office for Science (STS0086)
102 Q 93 (Professor Alison Park)

the NSTC and the OSTS "could further clutter" an "exceedingly complex" R&D system.[103] Lord Willetts welcomed the bodies, but said it "would be a disaster" if they just added "an extra tier of bureaucracy."[104] The National Aeronautical Society said the "terms of reference, aims, objectives, roles and responsibilities of each aspect" of the science and technology landscape need to be explained to avoid conflict and duplication.[105]

103 Written evidence from the Royal Society of Edinburgh (STS0075)
104 Q 7 (Lord Willetts)
105 Written evidence from the National Aeronautical Society (STS0041)

Figure 1: Organogram of bodies related to science and technology



Footnote (**Members of government in bold**, *external experts italics*)
1. **PM**.
2. **Cabinet**.
3. **The National Science and Technology Council (NTSC):** is the cabinet committee that considers matters relating to strategic advantage through science and technolgy.
4. **The Government Chief Scientific Adviser (GCSA):** head of GO-S and responsible for providing scientific advise to the Prime Minister and members of cabinet.
* Sir Patrick Vallance is currently both National Technology Adviser and the Government Chief Scientific Adviser.
5. *The Council for Science and Technology (CST):* advises he Prime Minister on science and technology policy issues across government.
6. **National Technology Adviser (NTA):** leads OSTS and is the principal adviser to the Prime Minister on science and Technology.
7. **The Government Office for Science (GO-S):** is an independent office, funded by BEIS and advises the Prime Minister and members of the Cabinet, to ensure that government policies and decisions are informed by the best scientific evidence and strategic long-term thinking.
8. **The Office for Science and Tecnology Stategy (OSTS):** informs and delivers the vision of the National Science and Technology Council.
9. **Chief Scientific Advisers Network:** the network advise the Government Chief Scientific Adviser on all aspects of policy on science andf technology.
10. *Science Advisory Councils (SACS):* advise across the whole of their sponsoring organisation's science remit, offering strategic direction and review.
11. **Cross government science coordination offices:** departmental based offices focussed on fostering cross-government coordination of science evidence, these include but are not limited to, the office for AI and the office for Strategic Coordination of Health Resources.
12. **Other Government Departments:** most departments have a complex science and evidence system which feeds into the flow of science and evidence in HMG, these include important functions like the Chief Medical Officer (CMO).
13. **Arms length bodies:** support government by providing science and evidence to policymakers, by acting as a strategic capability in policy delivery and by delivering scritical science services for government, business and society. There is much complexity not represented here including but not limited to UKRI, PSREs, National labs and regulatory bodies.

Source: Written evidence from the Government Office for Science (STS0086) requested by the Committee.

53. Rather than adding to complexity, some witnesses hoped that the establishment of cross-governmental bodies could "improve the coherence of the … science policy and funding landscape" by "presenting a more rationalised framework for how its constituent bodies interact with one another."[106] This seems to be the Government's intention: Andrew McCosh

106 Written evidence from the Royal Society of Edinburgh (STS0075)

acknowledged that "there is some overhead to having a central function, but our intention is that we make the overall process slicker, more efficient and more decisive."[107]

54. Sir Patrick Vallance said, "the only things that I think should come to the OSTS and the NSTC are things that do not sit in a single department."[108] Professor Dame Angela McLean, Chief Scientific Adviser, Ministry of Defence, hoped the NSTC and OSTS would be able to add value by leading on issues that sit between departments. She described the issue of "position, navigation and timing", where "because it is such a big issue for every department there is no emergent lead department."[109] While the NSTC and OSTS could add value here, we heard that it will be vital to have clarity on which Government bodies are accountable for meeting objectives. Sir Patrick Vallance identified the need for a "single point of accountability with an empowered leader" for the delivery of a specific goal as one of the key lessons learned from the COVID-19 vaccine rollout. He said this was "not an easy thing to do across Whitehall … but is important."[110]

55. We note that the minister responsible for science has not been a full member of cabinet since the remit was split from that of universities in 2020.[111] There have been six changes in the minister in charge of science since 2018 [112] At the time of writing, there was no science minister in post and it was unclear whether one would be appointed.

56. Gavin Costigan highlighted the importance of "the relationship between [the NSTC] and UKRI as the main funding agency."[113] We cover UKRI in detail in the next section, but it is responsible for the majority of public research and development funding, so its relationship with the NSTC will be critical. Figure 1 does not include "reporting lines" of accountability so it does not explain UKRI's relationship with the NSTC and OSTS, nor how accountability will be apportioned between these bodies.

57. **We welcome the establishment of a cabinet level committee for discussing and directing matters of science and technology in**

107 Q 47 (Andrew McCosh)
108 Q 65 (Sir Patrick Vallance)
109 Q 108 (Professor Dame Angela McLean)
110 Q 67 (Sir Patrick Vallance)
111 Éanna Kelly, 'UK government finally confirms new science minister', *Science Business* (20 February 2020): https://sciencebusiness.net/news/uk-government-finally-confirms-new-science-minister [accessed 15 July 2022]
112 Between January 2018 and February 2020, Sam Gyimah (then MP), Chris Skidmore MP, Lord Johnson of Marylebone, and then Chris Skidmore again held the post of Minister of State for Universities, Science, research, and Innovation. This was then split into the roles of Minister of State for Universities and Parliamentary Under-Secretary of State for Science, Research and Innovation, the latter of which was held by Amanda Solloway MP and then George Freeman MP until his resignation in July 2022. Department for Education and Department for Business, Energy and Industrial Strategy, 'Minister of State for Universities, Science, Research and Innovation', https://www.gov.uk/government/ministers/minister-of-state-for-universities-science-research-and-innovation; Department for Business, Energy and Industrial Strategy, 'Parliamentary Under Secretary of State (Minister for Science, Research and Innovation)', https://www.gov.uk/government/ministers/parliamentary-under-secretary-of-state-minister-for-science-research-and-innovation; and Jamie Durrani, 'UK without science minister as Horizon Europe uncertainty rumbles on', *Chemistry World* (11 July 2022): https://www.chemistryworld.com/news/uk-without-science-minister-as-horizon-europe-uncertainty-rumbles-on/4015921.article [accessed 15 July 2022]
113 Q 13 (Gavin Costigan) The Institute of Physics (STS0046), as an example, said: " The R&D ecosystem is broad and complex, and mission—and challenge-led innovation is vital to bring together cross-disciplinary researchers … to help solve … challenges, such as achieving net zero."

the form of the National Science and Technology Council and its supporting body the Office for Science and Technology Strategy. But, a year after their establishment, the remits of these bodies remain unclear. We do not know how they will interact with existing bodies, such as UK Research and Innovation. Without clarification we cannot be confident that they will add any value to an already complex landscape. ***We urge the Government to clarify the remits of the National Science and Technology Council and the Office for Science and Technology Strategy. It should set out how they interact with existing Government bodies, especially UK Research and Innovation. These organisations should simplify and organise the science and technology landscape, not complicate it further.***

58. **There need to be clear lines of accountability for policies that cut across departments. It should be clear which individual is accountable.** ***The National Science and Technology Council and Office for Science and Technology Strategy must identify the areas of cross-departmental work they will coordinate. They should identify individuals to be accountable for specific elements of the strategy, and ensure they have appropriate levers to do so.***

59. **We are concerned that the position of Minister for Science, Research, and Innovation was vacant at the time of writing.** ***Accountability for the delivery of the Government's overall science and technology strategy should sit with the minister responsible for science and technology, which should be a cabinet-level position.***

UK Research and Innovation

60. UKRI was established in 2018, following the 2015 Nurse Review.[114] UKRI is the main source of Government R&D funding. It unites the seven research councils, Research England and Innovate UK.[115] These bodies were combined to standardise the research funding landscape, to allow the research councils to collaborate more effectively and to encourage interdisciplinary research.[116] The projects and facilities it funds cover different areas of science and technology and different modes of research—for example, blue-skies and applied research, as well as support for entrepreneurs, and research and innovation in companies.

114 A Review of the UK Research Councils by Sir Paul Nurse, *Ensuring a successful UK research endeavour: A Review of the UK Research Councils*, (19 November 2015) Governance and Structures, Recommendation 8, page 33: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/478125/BIS-15-625-ensuring-a-successful-UK-research-endeavour.pdf [accessed 17 June 2022]

115 The seven councils are: Arts and Humanities Research Council (AHRC); Biotechnology and Biological Sciences Research Council (BBSRC); Engineering and Physical Sciences Research Council (EPSRC); Economic and Social Research Council (ERC); Medical Research Council (MRC); Natural Environment Research Council (NERC); and Science and Technology Facilities Council (STFC). Research England gives block grant (Quality Related) funding to universities and Innovate UK is the UK's innovation agency. Neither are "true" research councils, but they have been brought under UKRI to encourage collaboration.

116 A Review of the UK Research Councils by Sir Paul Nurse, *Ensuring a successful UK research endeavour: A Review of the UK Research Councils*, (19 November 2015) Recommendation 9, page 33: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/478125/BIS-15-625-ensuring-a-successful-UK-research-endeavour.pdf [accessed 17 June 2022]

61. Funding for UKRI rose from £7.7 billion in 2021–22 to £7.9 billion in 2022–23 and it will rise to £8.9 billion in 2024–25.[117] The newly announced funding allocations cover three years, compared with previous one-year allocations.[118] The longer funding period means that more of the budget is unallocated to ongoing, or already announced, activities. For 2024–25, 53% of the budget is not yet committed.[119]

What is expected of UKRI?

62. In March 2022 UKRI published a five-year strategy, which set out its priorities.[120] The objectives cut across policy areas and government departments, and include:

- "creating the conditions for increased private sector investment in R&D",
- "supporting … research and innovation clusters across the UK, creating diverse high value jobs and local economic growth",
- "enhancing our [the UK's] national security",
- "driving the development, adoption and diffusion of green technologies",
- "strengthening the deep and enduring international science and technology partnerships",
- "securing UK strategic advantage in game-changing technologies", and
- "developing preventative measures … and treatments to improve the nation's health and wellbeing."[121]

63. Some witnesses feared that UKRI was being asked to do too much beyond its core remit of funding excellent research. Gavin Costigan said: "we have asked [UKRI] to do a large number of things, some of which are not completely contradictory but certainly pull it in slightly different directions."[122]

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117 It is not possible to adjust for inflation, but this may not constitute a rise in real terms. Sophie Inge, 'Inflation fears mar 'record' UKRI budget', *Research Professional News* (01 June 2022): https://www.researchprofessional.com/0/rr/news/uk/research-councils/2022/6/Inflation-fears-mar--record--UKRI-budget.html; UK Research and Innovation, 'Professor Dame Ottoline Leyser PowerPoint presentation': https://www.foundation.org.uk/getattachment/13493519–80f9-45df-8e5f-337202e92688/ottoline-leyser-slides.pdf. Professor Dame Ottoline Leyser explained how the UKRI funding was allocated in the last financial year: "In 21/22 we will invest (% of budget): £690m in PhD students/skills (9%), £180m in fellowships (2%); £950m in responsive research (12%), £530m in research targeting priorities (7%), £1,680m in university research (QR) (21%); £980m in infrastructure (12%), £850m in research institutes (11%); £540m in challenge-led funding (Industrial Strategy Challenge Fund) (7%); £530m in responsive innovation (7%), £240m in Catapults (3%); £480m in international collaboration (6%); £390m in targeted Covid-19 funding (5%)."[accessed 28 June 2022]

118 UK Research and Innovation, 'UKRI's three-year budget is confirmed' (14 March 2022): https://www.ukri.org/news/ukris-three-year-budget-is-confirmed/ [accessed 17 June 2022]

119 UK Research and Innovation, *2022–23 – 2024–25 budget allocations for UK Research and Innovation*: https://www.ukri.org/wp-content/uploads/2022/05/UKRI-Budget-Allocations-2022–25_FINAL2.pdf [accessed 17 June 2022]

120 UK Research and Innovation, 'UKRI strategy 2022 to 2027' (17 March 2022): https://www.ukri.org/publications/ukri-strategy-2022-to-2027/ukri-strategy-2022-to-2027/ [accessed 17 June 2022]

121 UK Research and Innovation, 'UKRI strategy 2022 to 2027' (17 March 2022) "Outcomes and impacts from world-leading research and innovation": https://www.ukri.org/publications/ukri-strategy-2022-to-2027/ukri-strategy-2022-to-2027/ [accessed 16 June 2022]

122 Q 9 (Gavin Costigan)

In contrast, Kwasi Kwarteng argued: "given … the scale of the money we are spending … It is entirely fair for us to set quite stringent and ambitious goals."[123]

64. There is concern that asking UKRI to meet additional Government targets could endanger its support for blue-skies research. Professor Dame Ottoline Leyser, Chief Executive Officer, UK Research and Innovation acknowledged "feedback from the [research] community" that UKRI has "shifted the focus" away from basic discovery science and towards applied research to support the Government's policy priorities.[124] Professor Pearce said that "it feels as if the language we hear [from UKRI] is that it is always trying to protect that responsive [discovery] mode against other strategic imperatives".[125] Dame Ottoline emphasised that "the total amount invested in completely pure discovery science has gone up year on year through UKRI."[126]

65. Dame Ottoline agreed that UKRI was being asked to achieve a lot but said targets could be met by ensuring "every pound [is] doing multiple things".[127] She said that meeting the Government's targets will require new skills in UKRI, not just "handle-cranking and processing grants", but "high-quality analytical skills … to interface with government and our diverse communities".[128] She also said UKRI would require additional resources and appealed for "far fewer ring-fences" to allow for more flexibility in awarding funding that achieves multiple objectives.[129]

Science policy reviews

66. Since December 2021, Sir David Grant has led an independent review into UKRI and it is expected to report in summer 2022.[130] The ongoing Tickell review into bureaucracy, the Gluckman review into the Research Excellence Framework, and the Nurse review into the R&D landscape all relate to UKRI.[131] We heard concerns that these reviews were coming too soon after UKRI had been established; that they would create more work for UKRI; and that they may lead to an unfairly negative impression of it.[132] Kwasi

123 Q 141 (Kwasi Kwarteng MP)
124 Q 117 (Professor Dame Ottoline Leyser)
125 Q 26 (Professor Chris Pearce)
126 Q 117 (Professor Dame Ottoline Leyser)
127 Q 114 (Professor Dame Ottoline Leyser)
128 Q 120 (Professor Dame Ottoline Leyser)
129 Q 120 (Professor Dame Ottoline Leyser). Dame Ottoline also said UKRI's "data systems are in desperate need of upgrades" to allow it to create the "information resource, which is key to our investment strategy."
130 Department for Business, Energy and Industrial Strategy, 'Independent review of UK Research and Innovation (UKRI): terms of reference' (6 December 2021): https://www.gov.uk/government/publications/independent-review-of-uk-research-and-innovation-ukri/independent-review-of-uk-research-and-innovation-ukri-terms-of-reference [accessed 16 June 2022]. The review would investigate whether UKRI was achieving its core objectives and how it compared to similar organisations internationally.
131 Department for Business, Energy and Industrial Strategy and UK Research and Innovation, 'Review of research bureaucracy: terms of reference' (12 January 2022): https://www.gov.uk/government/publications/review-of-research-bureaucracy/review-of-research-bureaucracy-terms-of-reference; Department for Business, Energy and Industrial Strategy, 'Research, development and innovation organisational landscape: an independent review' (20 January 2022): https://www.gov.uk/government/publications/research-development-and-innovation-organisational-landscape-an-independent-review; and UK Research and Innovation, 'Launch of the future research assessment programme' (19 May 2021): https://www.ukri.org/news/launch-of-the-future-research-assessment-programme/ [accessed 16 June 2022]. The REF review affects UKRI because the REF determines how Research England allocates its funding.
132 Q 98 (Professor Sir Duncan Wingham)

Kwarteng described how the science and technology landscape is "drowning in a swelter of reviews."[133] George Freeman agreed "that for scientists who just want it to work and want to be allowed get on it is frustrating."[134] But he argued that the reviews were needed to ensure the system was working well ahead of it receiving additional funding. He explained that his "ambition is that this summer, the three reviews of UKRI—the Grant, Tickell, and the Nurse reviews—will have landed and will have been adopted … UKRI will be able to breathe."[135]

67. **UK Research and Innovation is expected to deliver on a range of Government priorities as well as its core function of funding excellent research. It has to respond to priorities from multiple bodies, including the Department for Business, Energy and Industrial Strategy, its research councils, and now potentially the National Science and Technology Council and Office for Science and Technology Strategy.** ***The role and accountabilities of UK Research and Innovation and its board, particularly as they apply to wider Government policies, must be clarified. It is critical that the organisation is sufficiently and flexibly resourced, and well-connected across government. It should not lose focus on funding blue-skies research.***

68. **UK Research and Innovation is affected by numerous reviews despite only being established in 2018. It is not realistic to expect it to function as well as it could in such a context.** ***Once the reviews are finished, UK Research and Innovation should be allowed to operate in a more certain policy environment.***

Government departments

69. As part of the Government's heightened ambitions for science and technology, R&D budgets for Government departments will increase under the 2021 Spending Review.[136] BEIS has published detailed allocations of its spending plans, including a three-year funding settlement and how it will be apportioned between the bodies it supports.[137] But other departments have not provided as much information. Some of these departmental research budgets are likely to be allocated to public sector research and development organisations, which play an important role in UK science and technology. As they are being reviewed under the Nurse review and by the cabinet Office in response to the science capability review recommendations, we do not consider them in depth in this report.

133 Q 140 (Kwasi Kwarteng MP)
134 Q 89 (George Freeman MP)
135 Q 89 (George Freeman MP)
136 HM Treasury, *Autumn Budget and Spending Review 2021: A stronger economy for the British people* (27 October 2021) HC 822: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1043688/Budget_AB2021_Print.pdf [accessed 8 June 2022]
137 Department for Business, Energy and Industrial Strategy, 'BEIS research and development (R&D): partner organisation allocation 2022–2023 to 2024–2025' (30 May 2022): https://www.gov.uk/government/publications/beis-research-and-development-rd-partner-organisation-allocation-2022-to-2025/beis-research-and-development-rd-partner-organisation-allocation-20222023-to-20242025 [accessed 13 June 2022]

Table 1: Departmental capital budgets for research and development (R&D)

£ billion (2021 prices)	2021–22	2022–23	2023–24	2024–25
Total R&D expenditure	14.8	16.1	19.4	20.0
Department for Business, Energy and Industrial Strategy	11.3	11.9	13.7	14.2
Of which: core research	4.8	5.2	5.8	5.9
Of which: Innovate UK	0.7	0.7	0.8	1.1
Of which: EU programme association[138]	1.3	1.2	2.3	2.1
Department of Health and Social Care	1.4	1.5	1.5	2.0
Other[139]	2.1	2.8	4.1	3.8
(Total R&D Official Development Assistance)[140]	0.6	0.8	0.9	1.0

Source: Reproduced from Table 2.2 of the 2021 Spending Review. HM Treasury, Autumn Budget and Spending Review 2021: A stronger economy for the British people (27 October 2021) HC 822, p 54: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1043689/Budget_AB2021_Web_Accessible.pdf *[accessed 13 June 2022]*

70. Although planned budgetary increases are substantial, we heard they are often undoing departmental research budgets cuts since 2010.[141] Sir Duncan Wingham, Executive Chair, Natural Environment Research Council, described the increases as a "restocking of those budgets."[142] Professor Gideon Henderson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs, noted that "in 2008 … we [DEFRA] had an R&D budget of £198 million … by 2019, it had shrunk to £53 million." This damaged "a department with a substantive science need". He welcomed that "by the end of the spending review period, it will be £236 million."[143]

71. Lord Willetts noted that "departments cut their R&D budgets when they are under public spending pressure," so the worsening economic context is

138 Third-country EU programme (Horizon, Euratom, ITER) participation contributions. Estimates are forecast in line with the terms agreed in the Trade and Cooperation Agreement, and using latest EU Budget and UK/EU27 economic data. Does not include Department for Environment, Food and Rural Affairs funding for Copernicus, which is calculated by the same methodology. The Government has committed to spending substantial funding on an alternative 'Plan B' scheme if the UK cannot associate with Horizon Europe. Clive Cookson, 'UK sets out £6bn plan B science fund if EU blocks association with Horizon', *Financial Times* (6 February 2022): https://www.ft.com/content/de5bc998-f74c-4bda-99cc-8db14946a8e8 [accessed 13 June 2022]

139 Includes Cabinet Office; Department for Digital, Culture, Media and Sport; Department for Education; Department for Environment, Food and Rural Affairs; Department for Transport; Department for Work and Pensions; Foreign, Commonwealth and Development Office; HM Revenue and Customs; Home Office; Ministry of Defence; Ministry of Justice; and Single Intelligence Account.

140 R&D Official Development Assistance across: Department for Business, Energy and Industrial Strategy; Department for Environment, Food and Rural Affairs; Department of Health and Social Care; and Foreign, Commonwealth and Development Office.

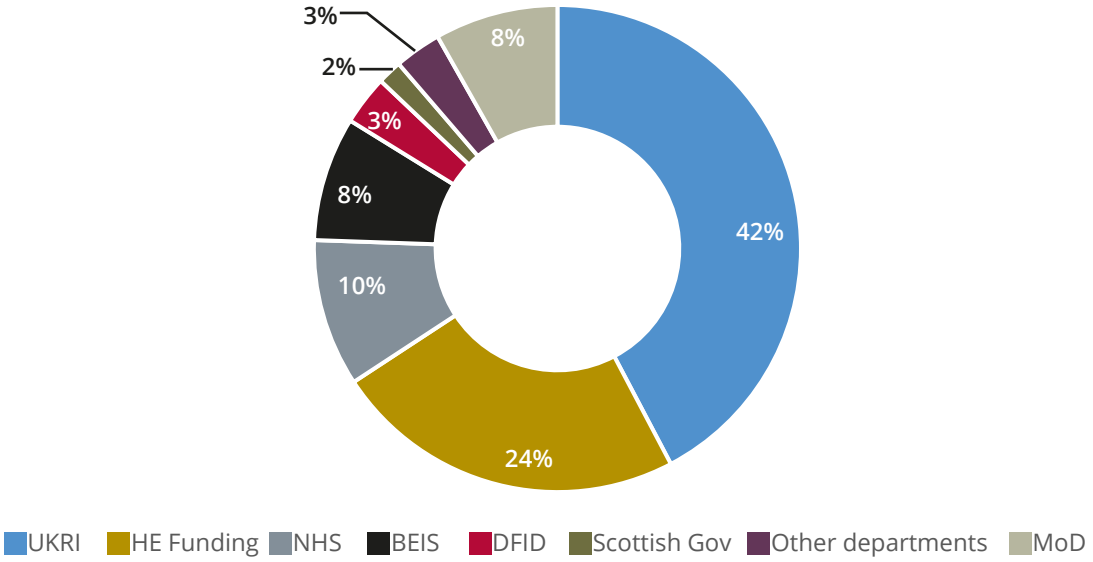
141 Campaign for Science and Engineering, 'CaSE analysis of 2021 Spending Review' (28 October 2021): https://www.sciencecampaign.org.uk/news-media/case-comment/case-analysis-of-2021-spending-review.html; and 'Government R&D hit by disproportionate cuts' (10 October 2012): https://www.sciencecampaign.org.uk/news-media/case-comment/government-r-d-hit-by-disproportionate-cuts.html [accessed 13 June 2022]

142 Q 94 (Professor Sir Duncan Wingham)

143 Q 100 (Professor Gideon Henderson)

of concern.[144] Professor Paul Monks, Chief Scientific Adviser, Department for Business, Energy, and Industrial Strategy, thought that "if we … can demonstrate the value of departmental R&D as distinct in what it can deliver, that will make the case for its continuation stronger."[145]

Figure 2: UK Government R&D funding by delivery body (2019)



Source: Office for National Statistics, 'Research and development expenditure by the UK government: 2019' (16 April 2021): https://www.gov.uk/government/statistics/research-and-development-expenditure-by-the-uk-government-2019 *[accessed 13 June 2022]*

Note the majority is allocated via UKRI or directly to higher education institutions.[146]

72. Witnesses welcomed the increased R&D funding for Government departments as allowing space for more collaboration between research councils and government.[147] But we heard concern of duplication if coordination between departments and research bodies was inadequate. Lord Willetts hoped that "rather than creating … extra bureaucracy inside each department, they can use UKRI as a delivery agency."[148] Kwasi Kwarteng expected NSTC discussions would lead to "greater co-ordination between R&D budgets across departments."[149]

73. Sir Patrick Vallance told us that "we have … asked that each department publishes its areas of research interest annually, so that it can say to the outside world, academia and others what it does not know about and how it cares about it."[150] Not all departments have published areas of research

144 Q 2 (Lord Willetts)
145 Q 100 (Professor Paul Monks)
146 Office for National Statistics, 'Research and development expenditure by the UK government: 2019' (16 April 2021): https://www.gov.uk/government/statistics/research-and-development-expenditure-by-the-uk-government-2019 [accessed 13 June 2022]
147 Q 100 (Professor Paul Monks); Q 113 (Professor Dame Ottoline Leyser); Q 10 (Gavin Costigan); and Q 94 (Professor Allison Park) said the budgets would be "an excellent opportunity to try to expand … collaboration" between research councils and departments. Similarly, Q 94 (Professor Sir Duncan Wingham): "we are going back to a welcome situation of working together more with them [Government departments] now."
148 Q 3 (Lord Willetts)
149 Q 142 (Kwasi Kwarteng MP)
150 Q 72 (Sir Patrick Vallance)

interest and others have not updated them since 2017.[151] We heard from the Campaign for Science and Engineering that "more needs to be done to make the most of" areas of research interest.[152]

74. **We welcome the increase in research and development funding for Government departments. But we are concerned that this could result in duplication of work being done by UK Research and Innovation. Some departments have published areas of research interest, but some have not, and many have not updated them for some time. *Departments should co-ordinate with UK Research and Innovation on research activities to address their areas of research interest, and on managing grants, to avoid duplication. Departmental areas of research interest should be updated annually and specific research questions identified.***

Science advice in Government

75. We heard that as departmental research and development budgets increase, scientific expertise will be needed to ensure departments can be "intelligent customers."[153] Witnesses highlighted the importance of science advice during the COVID-19 pandemic.[154] Science advice across Government is largely provided by the Government Office for Science. Within departments it is the responsibility of the departmental Chief Scientific Adviser.

76. The Government Office for Science "advises the Prime Minister and members of the Cabinet, to ensure that government policies and decisions are informed by the best scientific evidence and strategic long-term thinking."[155] It is headed by Sir Patrick Vallance as Chief Scientific Adviser. This means that he currently has a role both in providing the advice for science policy and in defining science policy through his role as National Technology Adviser, heading the Government's separate Office for Science and Technology Strategy. He indicated that different people may fill these roles in the future.[156] The Government Office for Science also supports the Council for Science and Technology, and the Scientific Advisory Group for Emergencies.[157]

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151 Government Office for Science and Cabinet Office, 'Areas of research interest (ARI)' (28 January 2022): https://www.gov.uk/government/collections/areas-of-research-interest [accessed 13 June 2022]

152 Written evidence from Campaign for Science and Engineering (STS0026)

153 Q 100 (Professor Gideon Henderson)

154 The Science Council thought that "the essential role played by scientists, technologists, technicians and researchers in Government has never been more obvious than during the COVID-19 pandemic.". Written evidence from the Science Council (STS0070). Stuart Wainwright said the COVID-19 pandemic had "shown to every government department how intrinsically important science and engineering is to policy-making and delivery in government." Q 53 (Stuart Wainwright OBE)

155 It lists its main priorities as "supporting national growth and increasing the UK's productivity by linking science, innovation and industrial enterprise; supporting regional growth by building on existing science and innovation activity across the country; using technology to develop modern and cheaper public services; preventing or addressing emergencies and mapping national security risks" Government Office for Science, 'About us': https://www.gov.uk/government/organisations/government-office-for-science/about [accessed 16 June 2022]

156 YouTube video on 'How can the NSTC and the OSTS direct S&T priorities?' by the Foundation for Science and Technology (26 January 2022): https://www.youtube.com/watch?v=eUUI1xIhBWI [accessed 13 June 2022]

157 The Scientific Advisory Group for Emergencies is commonly known by its acronym: SAGE.

77. There are 20 Chief Scientific Advisers across "nearly all departments."[158] They are also in other public bodies, such as the police. The role of Chief Scientific Adviser varies between departments but their core functions are similar:

- supporting the department's policies with scientific and engineering advice,
- advising ministers and senior officials on science,
- acting as head of the science profession within the department; and
- working with other Chief Scientific Advisers to share good practice and resolve cross-departmental problems.[159]

Box 2: Realising our ambition through science: A review of Government science capability

In November 2019, the Government Office for Science published *Realising our ambition through science: A review of Government Science Capability*. This made "recommendations for enhancing the use of science to promote government effectiveness and better policy-making". On Chief Scientific Advisers it recommended:

- "Departmental Chief Scientific Advisers (CSAs) need to provide leadership for science in government and beyond. They should act as a team/pool across government, with the appropriate resource and provide an authority for science in their departments. Chief Scientific Advisers should sign-off departmental science research plans and the resource requirements and use. The outcomes of science must be assessed."

Source: Government Office for Science, Realising our ambition through science: A review of Government Science Capability (November 2019) p 3: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/844502/a_review_of_government_science_capability_2019.pdf *[accessed 13 June 2022]*

78. The review of Government science capability (see Box 2) made a powerful case for enhancing the role of departmental Chief Scientific Advisers. It found that one function they could usefully perform was signing off departmental research plans. Professor Watts said that she has "prime responsibility" for the "earmarked capital budget" for research and development.[160] In the Ministry of Defence, 1.2% of the budget is reserved for "science and technology under the control of the CSA."[161] Other Chief Scientific Advisers do not appear to have equivalent responsibilities.

79. The Government science capability review also recommended that Chief Scientific Advisers should be used to align science policy across Government. We heard that this is already happening to some extent—it was described as

158 Q 72 (Sir Patrick Vallance) According to the Government's website, as of June 2022, the Ministry of Defence (Nuclear), Ministry of Justice, and Northern Ireland Executive CSA roles are vacant. It is unclear which additional bodies may ultimately have a Chief Scientific Adviser role. For example, the Food Standards Agency as a non-ministerial department has one, but the National Crime Agency does not. HM Government, 'Chief Scientific Advisers': https://www.gov.uk/government/groups/chief-scientific-advisers [accessed 16 June 2022]

159 For more please see Science and Technology Select Committee, *The role and functions of departmental Chief Scientific Advisers* (4th Report, Session 2010–12, HL Paper 264)

160 Q 106 (Professor Charlotte Watts)

161 Q 107 (Professor Dame Angela McLean)

a "very strong network" that meets once a week.[162] There are also "regular meetings between the CSAs and the chairs of the research councils to look at areas of government interest and UKRI spend and try to make sure that we get those joined up."[163] Professor Dame Angela Mclean described this as a "great basis … but it needs more." She explained that "most CSAs are not career civil servants. We are not here for all that long."[164] It is inadequate to rely on personal relationships, especially where people are not in post for long.[165] The "right infrastructure" will be required.[166] Dame Angela hoped that the OSTS could play a role in building "at officials level an absolutely rock-solid set of interactions across departments."[167]

80. **The Chief Scientific Adviser network is effective and well-coordinated. It presents an important opportunity to align scientific objectives across Government and to support the role of the National Science and Technology Council. *The Government science capability review recommendations on Chief Scientific Advisers should be implemented. Every department should have an independent, external expert as Chief Scientific Adviser, and departments should be able to hire additional science advisers if expertise is required on a topic. Part of the role of a Chief Scientific Adviser should be in approving departmental research and development spending.***

Science and technology in the civil service

81. The importance of the national science and technology strategy, and the increased departmental science and technology budgets, means that Government must be an intelligent customer for science and technology. Stuart Wainwright, Director, Government Office for Science, said that the Government Office for Science is "trying to encourage all the civil service to have more scientists, engineers and other experts within it."[168] We heard that the network of scientists and engineers in BEIS had over 300 members, but the specialisms or total number of scientists and engineers is not recorded. There are plans to improve data collection that "will go some way towards answering [such] questions" in the future. It is unclear whether other departments have such data.[169]

82. Sir Patrick Vallance and Stuart Wainwright thought the civil service fast stream should be used to increase the number of scientists in the civil service. There is a specific science and engineering fast stream which "has more than doubled in the last few years."[170] However, this is small compared

162 Q 108 (Professor Lucy Chappell and Professor Dame Angela McLean)
163 Q 72 (Sir Patrick Vallance)
164 Q 108 (Professor Dame Angela McLean)
165 According to the Government's advice on Chief Scientific Advisers, they are "normally in post for a period of 3 to 5 years." Government Office for Science, *Guidance for government Chief Scientific Advisers and their Officials: Chief Scientific Advisers and their officials: an introduction* (January 2020) p 21: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/856166/chief-scientific-advisers-and-their-officials-an-introduction.pdf [accessed 13 June 2022]
166 Q 108 (Professor Lucy Chappell)
167 Q 108 (Professor Dame Angela McLean)
168 Q 53 (Stuart Wainwright OBE)
169 Supplementary written evidence from the Department for Business, Energy and Industrial Strategy (STS0088)
170 Q 74 (Sir Patrick Vallance)

to the overall size of the fast stream.[171] The general fast stream is open to any graduate, but it does not recruit a high proportion of science graduates. Sir Patrick noted that the number of individuals in the general stream with science and engineering degrees "has not budged much" from 10% in 2019. He said that "there is a clear ambition now to get that … heading up towards 50%."[172] Since we heard from Sir Patrick Vallance, the Government announced that, as part of efforts to reduce the number of civil servants by 91,000, recruitment via the fast stream will be paused in 2023.[173]

83. Stuart Wainwright pointed to initiatives beyond the fast stream to encourage scientists into Government: "the other thing we are trying to do is smooth out the interchange, allow easier, freer mechanisms to come into government. We have established some of these things ourselves in GO-Science in the last few years."[174] Sir Patrick Vallance described how he is "co-sponsoring a piece of work with Sarah Healey from DCMS [Department for Digital, Culture, Media and Sport] on greater … movement between academia, high tech and the civil service".[175]

84. While directly hiring more scientists would be welcome, we heard that developing cross-cutting expertise is important. Louise Dunsby said: "You really need scientists and engineers who understand the policy and political landscape, and policy people who can talk intelligently to scientists and engineers."[176] The Science Capability Review was clear that scientific knowledge should not be confined to specialists recruited to science roles, but those in policy roles should be scientifically literate and training could be offered to that effect.[177]

85. **The civil service needs more science capability, not just in specialist roles and not only by direct employment. It needs effective processes for drawing on outside expertise. The Government acknowledges the need for more scientists in the civil service and the ambition that we heard from Sir Patrick Vallance to approach 50 per cent of science and engineering graduates for recruitment to the civil service generalist fast stream is welcome. This target needs regular monitoring and reporting.**

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171 Statistics from 2021 showed that the science and engineering fast stream had 51 successful applicants, compared with 1,072 fast streamers in total and 404 "generalist" fast streamers. Cabinet Office, Civil Service HR, and Government Skills and Curriculum Unit, *Civil Service Fast Stream Recruitment Data 2021, Table 33* (10 December 2021): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1039977/2021-CS-Fast-Stream-External-Annual-Report-Tables-pdf-15.11.21.pdf [accessed 10 June 2022]

172 Q 74 (Sir Patrick Vallance)

173 Eleanor Langford and Adam Payne, 'Angry Civil Servants Say They Were Blindsided By Plans To Suspend Graduate Scheme', *PoliticsHome* (19 May 2022): https://www.politicshome.com/news/article/civil-service-graduate-scheme-scrapped; and Emily McGarvey, 'Civil service pauses fast-track graduate scheme to cut staff numbers', *BBC* (31 May 2022): https://www.bbc.co.uk/news/uk-61641930 [accessed 10 June 2022]

174 Q 53 (Stuart Wainwright OBE)

175 Q 74 (Sir Patrick Vallance)

176 Q 53 (Louise Dunsby)

177 "The Government Science and Engineering (GSE) Profession Board should work with the Analysis Function Board to ensure that the civil service as a whole has the scientific skills it needs and the mechanisms to deploy them effectively through the wider civil service functional agenda being led by the Cabinet Office. Plans should be developed to remedy any shortages (working with UKRI and the Department for Education where appropriate), reporting early in 2020." Government Office for Science, *Realising our ambition through science: A review of Government Science Capability* (November 2019) p 9: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/844502/a_review_of_government_science_capability_2019.pdf [accessed 10 June 2022]

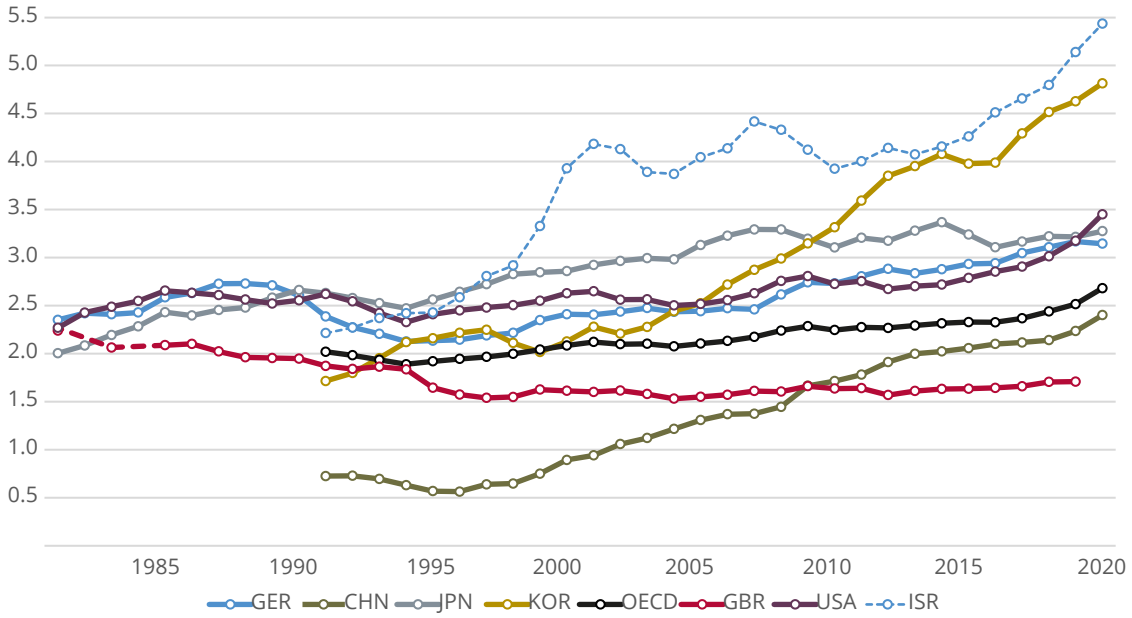
86. ***The Office for Science and Technology Strategy should monitor progress towards the target to increase the number of science and engineering graduates on the fast stream. The Government should record the number of scientists and engineers in departments and their specialisms.***

CHAPTER 3: THE 2.4% TARGET

Research intensity targets

87. The percentage of gross domestic product (GDP) spent on R&D is sometimes called "research intensity." In the 2017 Industrial Strategy the Government stated an ambition to increase the UK's research intensity to 2.4% of GDP by 2027 and a longer-term target of 3%.[178] In the UK in 2019, total public and private expenditure on R&D was £38.5 billion, around 1.74% of GDP. Of this, public sector expenditure was £10.85 billion.[179] Figure 3 shows that research intensity in the UK has been roughly constant at 1.6 to 1.7% of GDP for the last 25 years. The UK's investment in R&D as a percentage of GDP is lower than the OECD average both in the public and private sectors, but significantly lower in the private sector (Figure 4.)[180]

Figure 3: International comparison of research intensity (OECD average and selected countries)



Source: OECD Key Indicators Organisation for Economic Co-operation and Development (OECD), 'Gross domestic spending on R&D' (2022): https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm#indicator-chart *[accessed 8 July 2022]. Countries illustrated: Germany, China, Japan, South Korea, the OECD average, the UK, the USA and Israel.*

88. In the Industrial Strategy, the Government set an intermediate target to increase public R&D expenditure from £9 billion in 2017 to £22 billion by 2024–25. In the 2021 Spending Review this target was deferred to 2026–

178 HM Government, *Industrial Strategy, Building a Britain fit for the future* (November 2017): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/730048/industrial-strategy-white-paper-web-ready-a4-version.pdf [accessed 21 June 2022]

179 Office for National Statistics, 'Gross domestic expenditure on research and development, UK: 2019' (4 August 2021): https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/latest [accessed 21 June 2022]

180 The Organisation for Economic Co-operation and Development has 38 member countries.

27.[181] Investment in R&D reached £14.9 billion in 2021–22.[182] Modelling shows that over the first four years of since the 2.4% target was set, research intensity rose from 1.78% in 2017–18 to 1.94% in 2021–22.

89. To meet its research intensity target, the Government requires public investment in R&D to stimulate private sector investment. Analysis from the Campaign for Science and Engineering suggests that the proposed increase in public sector spending could stimulate an increase in private sector spending, which together would take the UK to 2.33% of GDP by 2027–28.[183]

Meeting and explaining the 2.4% target

90. The 2.4% target was generally welcomed by witnesses. Lord Willetts thought that meeting the target would be "a hell of a sight better than 1.7 or 1.8%, which is where we are now". However, he noted that it was set to match the OECD average in 2017, which had increased to 2.68% by 2020, so the UK will still be behind comparable countries.[184]

91. Professor Main welcomed the ambition of the 2.4% target as "transformative" but cautioned that it would be difficult to achieve. This was because "the UK's gross expenditure on R&D over 20 years has been almost completely flat", despite numerous pledges to increase it[185] and "only a small number of countries have achieved that kind of economic transformation."[186] Research by Adão Carvalho, Professor of Economics at the Universidade de Evora, Portugal, found that, across 112 R&D intensity targets set by 45 countries, 84% were missed, including the UK's target in 2004 to increase research intensity to 2.5%.[187]

92. Professor Graeme Reid explained that how the 2.4% target was met could lead to "profoundly different versions" of the UK economy. "There is a version of 2.4% that is reached by keeping the shape of the research community intact and having every bit of it expand in equal proportion.

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181 Bethan Staton, George Parker and Clive Cookson, 'Science bodies urge UK chancellor not to roll back on R&D target', *Financial Times* (13 October 2021): https://www.ft.com/content/e9c7add7-9b02-4f8a-af76-9177e0d39599 [accessed 21 June 2022]

182 HM Treasury, *Autumn Budget and Spending Review 2021: A stronger economy for the British people* (27 October 2021), HC 822: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1043688/Budget_AB2021_Print.pdf [accessed 21 June 2022]

183 The methodology of this analysis can be found here: Campaign for Science and Engineering, 'CaSE analysis of 2021 Spending Review' (28 October 2021): https://www.sciencecampaign.org.uk/news-media/case-comment/case-analysis-of-2021-spending-review.html [accessed 20 June 2022]

184 Q 5 (Lord Willetts). OECD Data, 'Gross domestic spending on R&D' (2022): https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm [accessed 8 July 2022]

185 Q 9 (Professor Sarah Main). The then Government in 2004 set a target to increase research intensity to 2.5% of GDP by 2014, alongside an increase in public R&D funding, but policies were not able to leverage the required private R&D funding and research intensity only increased from 1.61% to 1.7%. HM Treasury, Department for Trade and Industry and Department for Education and Skills, *Science and innovation investment framework 2004–2014* (July 2004): http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/science_innovation_120704.pdf; and Nick Hillman, 'The road to 2.4% is long, bumpy and full of obstacles—and we may never arrive', *Higher Education Policy Institute* (18 May 2021): https://www.hepi.ac.uk/2021/05/18/the-road-to-2-4-is-long-bumpy-and-full-of-obstacles/ [accessed 21 June 2022]

186 Q 9 (Professor Sarah Main)

187 The research found that major factors often included growth in GDP that outpaced growth in R&D spending, a lack of public spending, business investment failing to keep up or unrealistic targets which are "too ambitious and unreachable, or … not appropriate for the country's industrial structure." Adão Carvalho, 'Wishful thinking about R&D policy targets: what governments promise and what they actually deliver', *Science and Public Policy*, vol. 45, Issue 3 (June 2018) pp 373–391: https://academic.oup.com/spp/article-abstract/45/3/373/4600797?redirectedFrom=fulltext&login=false [accessed 28 June 2022]

There is another version of 2.4% where you keep the academic research base as it stands right now and concentrate all the expansion into higher levels of business investment … [or] you put all the emphasis on the Government's policy priorities, be it net zero, public health or cybersecurity, and drive it that way."[188]

93. Since the 2.4% target was announced there have been significant economic challenges, including the COVID-19 pandemic and high inflation. We heard that "departments cut their R&D budgets when they are under public spending pressure."[189] Lord Willetts said that a "boom/bust cycle in science funding [is] really dangerous."[190] Professor Main thought that communicating how meeting the target will benefit society could ensure it is supported. "It really must work for the public … this strategy is not just about trying to achieve those economic [metrics] … [but] about making a meaningful and material transformation in people's prosperity and livelihoods."[191]

94. **We welcome the substantial planned uplift in Government spending on research and development towards the 2.4% of GDP target. It has the potential to be transformational for UK science and technology, even though it would still leave the UK behind other OECD countries. But increasing research intensity to such an extent is highly ambitious and previous attempts have failed. It will not be achievable with business as usual policies.**

95. **We are concerned that the economic context may threaten the Government's commitment to research and development. *A boom-and-bust cycle in research and development funding must be avoided. The Government should go beyond an abstract percentage of GDP target and explain what benefits it wants to achieve with the additional funding.***

Private sector investment in research and development

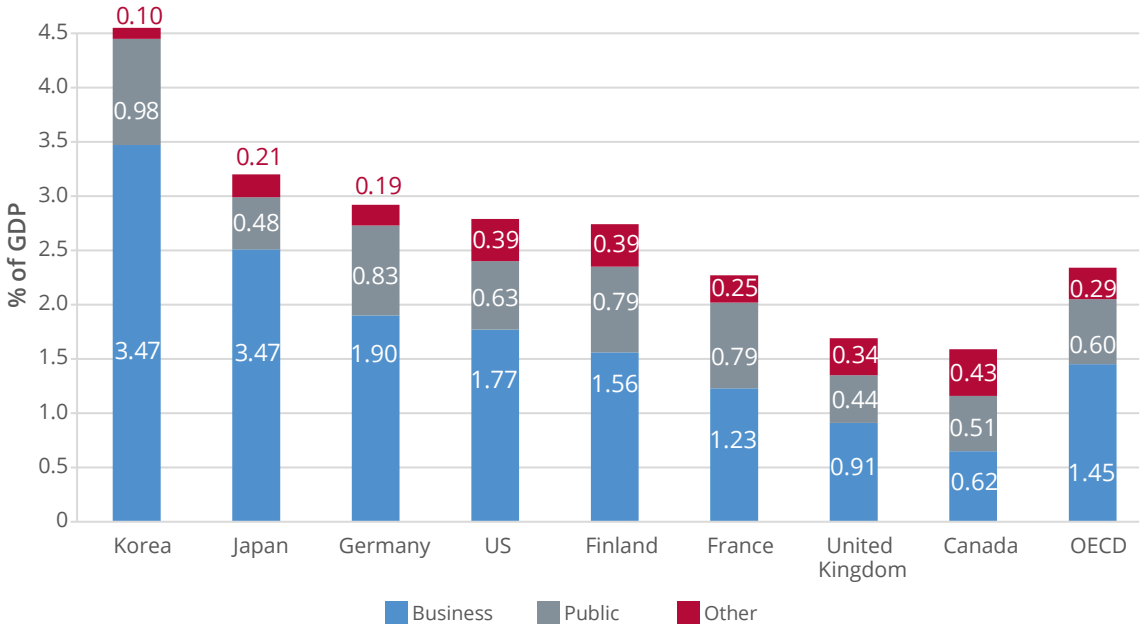
96. Sir Patrick Vallance told us that "countries that have managed to increase their R&D spend" to the extent required to meet the 2.4% target "achieved it with a very big increase in private sector investment … the leverage ratio of private sector to public sector has always been increased … something like three to one."[192] The UK is not as successful at leveraging private sector investment as other countries. The Chancellor of the Exchequer in his Spring Statement 2022 noted "right now, we know that the amount businesses spend on R&D as a percentage of GDP is less than half the OECD average. And that is despite us spending more on tax reliefs than almost every other country. Something is not working."[193]

97. The ratio of private to public investment in R&D in the UK is around 2.06:1, compared with an OECD average of 2.41:1 (see Figure 4). The planned increase in public R&D funding should stimulate sufficient private sector investment to come close to the 2.4% target if the ratio of public to private

188 Q 12 (Professor Graeme Reid)
189 Q 2 (Lord Willetts)
190 Q 2 (Lord Willetts)
191 Q 11 (Professor Sarah Main)
192 Q 64 (Sir Patrick Vallance)
193 HM Treasury and The Rt Hon Rishi Sunak MP, 'Spring Statement 2022 speech' (23 March 2022): https://www.gov.uk/government/speeches/spring-statement-2022-speech [accessed 20 June 2022]

spending is maintained.[194] But uncertain economic conditions make it unclear whether it is realistic to expect private sector investment, which has been relatively flat for many years (see Figure 5), to increase to the extent needed.

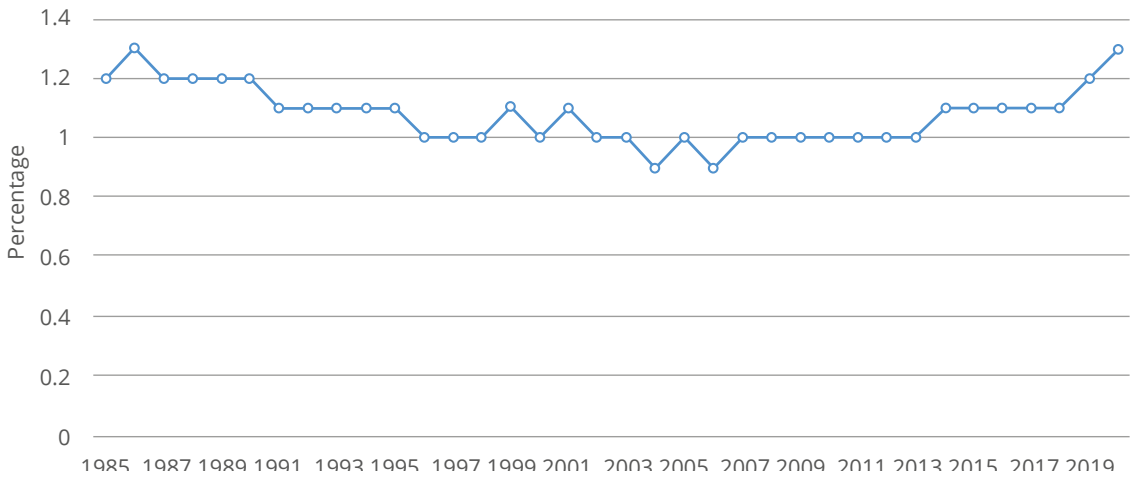
Figure 4: International R&D spending in the private and public sectors



Source: Royal Academy of Engineering. The numbers for the UK are from the Office for National Statistics in 2019; other countries provide the most recent year available. There are other comparative charts that differ slightly and include other OECD countries—including in the 2017 Industrial Strategy. A graph with more nations included is on page 24 of the Commons library briefing. House of Commons Library, Research and Development funding policy, Library Note, CBP 7237, May 2022

194 Campaign for Science and Engineering, 'CaSE analysis of 2021 Spending Review' (28 October 2021): https://www.sciencecampaign.org.uk/news-media/case-comment/case-analysis-of-2021-spending-review.html [accessed 20 June 2022]

Figure 5: Private sector expenditure on R&D as a percentage of GDP in the UK



Source: ONS data for private sector expenditure on R&D as a percentage of GDP. Office for National Statistics, 'Business enterprise research and development, UK: 2020' (19 November 2021): https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/businessenterpriseresearchanddevelopment/2020 *[accessed 20 June 2022] Expenditure on R&D performed by UK businesses as a percentage of GDP is recorded under ONS data code 2.*

Government levers to increase research and development spending

98. Andrew McCosh told us that increasing private investment in R&D would not be achieved by "a single panacea" but a combination of approaches.[195]

Tax credits

99. In the year ending March 2020, UK companies claimed around £7.4 billion in R&D tax credit relief.[196] As noted by the Chancellor, tax credits in the UK do not leverage private finance as effectively as in other countries. The Chancellor's Spring Statement in 2022 therefore committed to "reform R&D tax credits so that they're effective and better value for money." The Chancellor said "we'll expand the generosity of the reliefs to include data, cloud computing, and pure maths. And we'll consider, in the autumn,

195 Q 55 (Andrew McCosh) "It has something to do with encouraging, as the Prime Minister, Chancellor and others have done, UK institutional capital to invest in different asset classes. It has something to do with attracting the best tech investors to the UK and growing our own tech investment talent. It would have something to do with how we harness the £300 billion worth of government procurement every year to the task of de-risking some early-stage companies for private investment, showing early revenue, putting on a kitemark and regulating in ways that balance the protection of the individual with the opportunities we wish to create in the market for growth."

196 HM Revenue and Customs, 'Research and Development Tax Credits Statistics: September 2021' (26 April 2022): https://www.gov.uk/government/statistics/corporate-tax-research-and-development-tax-credit/research-and-development-tax-credits-statistics-september-2021 [accessed 20 June 2022] R&D tax credits allow a company to either receive a payment or reduce its tax bill for conducting R&D.

whether to make the R&D expenditure credit more generous."[197] George Freeman said he had "signalled to the Treasury that if we really are to unlock the £100 billion over the next six years to get us to 2.4%, one key lever is R&D tax credits. We need to think about how best to deploy them."[198] Kwasi Kwarteng described an "ongoing review on R&D tax credits" in the Treasury.[199]

Pension funds

100. We heard that pension funds could be better used to support research and development. George Freeman said that regulations introduced after the 2008 financial crash had "inadvertently" hindered the ability of pension funds to invest in smaller, innovative companies. He was "working with the Chancellor on changing the rules on institutional pension funds so they can invest" in "UK equities and high-growth" companies.[200] Suranga Chandratillake, General Partner, Balderton Capital agreed that "pension fund asset allocation in the UK versus similar-sized economies" was risk averse, with "more in bonds, less in equities, and, in particular, less in private equity". Suranga Chandratillake explained that "some of that is regulatory. It is to do with transparency, fee regulations and so on, and some of it is cultural."[201]

101. The Government is exploring changes to pension fund rules. Options include:

- removing performance-based fees from the charge cap;[202]
- recreating the "French Tibi scheme … a matched investment scheme with government and the private sector in life sciences";[203] and
- reforming the EU Solvency II legislation (which is transposed into domestic law), on which the Government announced a consultation in April 2022.[204]

197 HM Treasury and The Rt Hon Rishi Sunak MP, 'Spring Statement 2022 speech' (23 March 2022): https://www.gov.uk/government/speeches/spring-statement-2022-speech. The specific announcements in the Spring Statement 2022 around innovation are in section 4.41 onwards, but do not yet stretch far beyond including data, cloud computing, pure maths and some overseas research as eligible expenditures for R&D tax relief, with an intention to further review the system in autumn 2022. HM Treasury, *Spring Statement 2022* (March 2022) CP 653: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1062486/Spring_Statement_2022_Web_Accessible.pdf. These policies were also proposed in the 2020 R&D Roadmap. Department for Business, Energy and Industrial Strategy, 'UK Research and Development Roadmap' (21 January 2021): https://www.gov.uk/government/publications/uk-research-and-development-roadmap/uk-research-and-development-roadmap [accessed 20 June 2022]

198 Q 87 (George Freeman MP)

199 Q 133 (Kwasi Kwarteng MP)

200 QQ 87, 81 (George Freeman MP)

201 QQ 42, 44 (Suranga Chandratillake OBE)

202 At present, there is a charge cap which, by default, means that no more than 0.75% of pension contributions can be spent on investment fees and charges. Many private market assets such as venture capital funds charge performance fees if they generate high returns on investments. Excluding these from the charge cap could allow pension funds to invest in a greater proportion of more risky private assets which charge performance fees.

203 Q 133 (Kwasi Kwarteng MP)

204 HM Treasury, 'UK Government powers on with reforms to Solvency II' (28 April 2022): https://www.gov.uk/government/news/uk-government-powers-on-with-reforms-to-solvency-ii [accessed 20 June 2022]

102. The Government is consulting on whether these changes would have the desired effect. The consultation acknowledges that the effects of deregulation are difficult to predict and that it is an uncertain way of directing investment.[205]

Role of regulation

103. The Government has an ambition for "global regulatory leadership" across sectors including artificial intelligence, space and life sciences.[206] George Freeman said the UK could "develop competitive advantage" if it could "move more quickly and be more agile" than other countries.[207] BEIS said that the UK should "seize the opportunity of post-Brexit regulatory … freedoms."[208] George Freeman mentioned the work of the Taskforce on Innovation, Growth and Regulatory Reform. A Taskforce report in June 2021 identified areas of post-Brexit regulatory reform that could encourage innovation, some of which are now being acted upon.[209]

104. We heard of a tension between regulatory divergence, where the hope is to achieve competitive advantage, and regulatory convergence, which eases international trade. Helen Kennett explained that "if the UK wants to be a regulatory superpower, it needs to understand how it works with the other international players … there is no point in having a regulation that works perfectly in the UK but which we cannot use globally."[210] George Freeman explained that his "instincts are strongly for convergence" in sectors with an "established major industrial base", such as "the automotive sector, the aerospace sector, the life sciences sector." But he thought that the UK should identify areas where divergence could provide an advantage.[211] He wanted the UK to be a "global digital testbed for the technologies of tomorrow", that would attract companies to generate data and conduct research on new technologies.[212]

105. Since the UK's departure from the EU, much rhetoric has focused on cutting regulation to support innovation.[213] But we heard from Mike Biddle, Programme Director, Industrial Strategy Challenge Fund, Innovate UK, that "regulation, if done well, can drive innovation". He described the efforts of the Regulators' Pioneer Fund to look at how regulation can be developed proactively in emerging areas of technology to encourage innovation.[214]

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205 Department for Works and Pension, 'Consultation on enabling investment in productive finance' (30 March 2022): https://www.gov.uk/government/consultations/enabling-investment-in-productive-finance/consultation-on-enabling-investment-in-productive-finance [accessed 20 June 2022] "41. We also want to understand the extent to which this proposed change would trigger reform, by private equity and venture capital managers, from existing fee structures. If yes, would this therefore trigger greater investment in such assets by DC schemes? If no, would this make any difference to trustees' appetite for such investments?"

206 Q 87 (George Freeman MP); and written evidence from the Department for Business, Energy and Industrial Strategy (STS0080)

207 Q 87 (George Freeman MP)

208 Written evidence from the Department for Business, Energy and Industrial Strategy (STS0080)

209 Rt Hon Sir Iain Duncan Smith MP, Rt Hon Theresa Villiers MP and George Freeman MP, *Taskforce on Innovation, Growth and Regulatory Reform (TIGRR)* (May 2021): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994125/FINAL_TIGRR_REPORT__1_.pdf [accessed 20 June 2022]

210 Q 35 (Helen Kennett)

211 Q 87 (George Freeman MP)

212 Q 87 (George Freeman MP)

213 Steven Swinford, 'Jacob Rees-Mogg calls for bonfire of EU rules to power Brexit innovations', *The Times* (30 May 2022): https://www.thetimes.co.uk/article/5e231c76-df87-11ec-8bdd-c253e043f5f0 [accessed 20 June 2022]

214 Q 42 (Mike Biddle)

Helen Kennett described regulation as a "great innovation driver if it sets the direction of travel, the demand signal".[215] Industry witnesses did not identify many areas where they thought the UK's regulatory regime needed overhauling.[216]

106. To identify regulations to improve, techUK, a technology membership organisation with over 850 members, suggested that "the Government should establish a series of taskforces aimed at … streamlining regulatory processes … [for] emerging technologies, … such as quantum technologies [and] artificial intelligence … Modelled on the work of the Regulatory Horizons Council, these taskforces should be a partnership between industry and Government that seek to identify … [regulatory barriers and] expand existing innovation schemes … such as regulatory sandboxes … [and] test beds."[217] Sir Adrian Smith as head of the Turing Institute gave a sector-specific example: "we have a fantastic opportunity in the UK to lead on things such as AI governance, regulation and standards".[218]

107. **The Government wants to become a "regulatory superpower". Regulations can make countries more attractive to investors, but companies operating in international markets are concerned about regulatory divergence.** ***The Government should work with industry and the research base to identify the areas, such as artificial intelligence, in which the UK can take a global lead in regulation.***

108. **Deregulation for its own sake will not automatically spur innovation, and regulations can incentivise innovators by providing a clear direction of travel. It is not at all clear what role the Government envisages for regulatory reform in a science and technology strategy.** ***Sector-based taskforces should be established, providing a single point of contact with industry, to identify opportunities for regulatory reform, explaining how they will encourage innovation.***

Public procurement

109. Beyond stimulating private sector investment, the Government wants to use public money, through public procurement, to incentivise R&D. BEIS described "enormous potential to make better use" of public procurement to support R&D and to improve public services.[219] The Council on Science and Technology similarly recommended that the Government should integrate "research, innovation and growth investment by joining up all government research efforts, using government procurement as a catalyst."[220]

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215 Q 35 (Helen Kennett)

216 Nigel Toon did "not think there are significant regulatory barriers" for start-ups. Q 42 (Nigel Toon). Dr Garry Pairaudeau, Chief Technology Officer at Exscientia, a life-sciences unicorn using artificial intelligence to aid drug discovery, thought that the regulatory processes for clinical trials could be shortened, as was done during the COVID-19 pandemic. Q 35 (Dr Garry Pairaudeau). Helen Kennett and Simon Bennett, Head of Research, AVEVA, were of a similar view. Q 35 (Helen Kennett and Simon Bennett)

217 Written evidence from techUK (STS0047)

218 Q 22 (Sir Adrian Smith)

219 Written evidence from the Department for Business, Energy and Industrial Strategy (STS0080)

220 Council for Science and Technology, 'The UK as a science and technology superpower' (22 July 2021): https://www.gov.uk/government/publications/the-uk-as-a-science-and-technology-superpower/the-uk-as-a-science-and-technology-superpower-accessible-html-version-of-letter [accessed 20 June 2022]

110. There are few details on how public procurement rules will change. BEIS wants to ensure procurement is "proactive and long-term, signalling to industry our direction of travel … UK Government departments and public sector delivery bodies will, where appropriate, produce a clear overall policy problem statement that describes the priority outcomes that they want to [achieve]." BEIS is "continuing to work with colleagues in the Cabinet Office, IPA [Infrastructure and Projects Authority] and other Government departments … to drive innovation through procurement."[221] It is not clear how many policy problem statements have been published.

111. Sir Patrick Vallance pointed to Israel, which "focuses on four areas: cybersecurity, desalination … agriculture, and defence … it uses Government procurement as a way to pull those through." He noted that the UK's Vaccine Taskforce was set up to bring together "R&D, procurement, and manufacturing" to support the rapid development of technologies from concept to deployment. He described the value of identifying other areas where such an approach could be applied.[222] He thought that "procurement … to signal clear long-term intent … does not happen … absent something like the NSTC … to pull it together".[223]

112. When George Freeman was asked for details on how public procurement would change, he referred to the importance of "culture change" and "regulatory change", arguing that "we are no longer subject to the same state aid rules [as in the EU]. We are much freer to be more strategic in our own interests."[224] Alex Jones of the Cabinet Office said that "it is striking that we have been trying to reform procurement for a long time … the Cabinet Office post-EU exit [is] looking at ongoing reform of procurement, simplifying process, increasing flexibility, helping public bodies procure more innovative solutions, and looking at regulation."[225]

113. The Government announced a Procurement Bill in the 2022 Queen's Speech.[226] It is intended to support innovation by "allowing buyers to tailor procurement to their exact needs" and eliminating "complicated and bureaucratic rules" associated with procurement under the EU. It would allow buyers to reserve competitions for contracts below a certain threshold for UK suppliers and small and medium-sized enterprises, while maintaining value for money as the "highest priority in procurement."[227] Government departments will be required to "take account of national strategic priorities" in considering procurement decisions.[228]

114. Government procurement, and subsequent approval of funds, is guided by value for money principles: "the over-riding procurement policy requirement is that all public procurement must be based on value for money, defined as 'the best mix of quality and effectiveness for the least outlay over the period

221 Written evidence from the Department for Business, Energy and Industrial Strategy (STS0080)
222 Q 67 (Sir Patrick Vallance)
223 Q 65 (Sir Patrick Vallance)
224 Q 83 (George Freeman MP)
225 Q 83 (Alexandra Jones)
226 The Procurement Bill [HL] [Bill 4 (2022–23)] was introduced in the House of Lords on 11 May 2022.
227 Cabinet Office, The Rt Hon Jacob Rees-Mogg MP and The Rt Hon Steve Barclay MP, 'Simpler, more flexible and transparent procurement' (12 May 2022): https://www.gov.uk/government/news/simpler-more-flexible-and-transparent-procurement [accessed 20 June 2022]
228 Cabinet Office, The Rt Hon Jacob Rees-Mogg MP and The Rt Hon Steve Barclay MP, 'Simpler, more flexible and transparent procurement' (12 May 2022): https://www.gov.uk/government/news/simpler-more-flexible-and-transparent-procurement [accessed 20 June 2022]

of use of the goods or services bought'".[229] This could exclude supporting, or continuing to support, high risk, but innovative, UK R&D as the benefits are uncertain or may accrue only in the long term.

115. Risk aversion may have increased following the COVID-19 pandemic, when public procurement, and wider spending, came under scrutiny amid concerns about waste. Inquiries were conducted by the National Audit Office and the Public Accounts Committee.[230] In this context, and amid economic difficulties, we heard that encouraging a riskier but more innovative culture of procurement may be difficult.[231] Kwasi Kwarteng recognised the tension in trying to use procurement to support objectives alongside value for money: "you can have more risk appetite, but there are dangers with that." He referred to "some anomalies" that had arisen after previous efforts to "procure through small companies."[232] Andrew McCosh spoke of "shift[ing] the culture" in departments to ensure procurement was "geared to a spread bet of risk in earlier, more innovative technologies."[233]

116. **The Government wants to use public procurement to encourage the development and deployment of new technologies, but has not identified the technologies that will be supported. Value for money rules governing expenditure of public money are vital, but they do not always work for investments in developing companies and technologies: risk is inherent in the process and benefits may accrue only in the long-term. *The role that public procurement will play in a science and technology strategy needs to be clarified. The Government should set out which technologies, or areas of technology, it will support through public procurement. A proportion of public procurement spending should be set aside to support defined areas of technological priority, with the value for money rules being interpreted appropriately. The flexible interpretation of value for money rules should apply to future funding decisions, not just the initial procurement decision.***

117. **The Government has identified risk aversion as a cultural factor that limits investment in research and development in the UK. This may be true, but we have not heard any concrete proposals on how to change it. *The Government must explain how it will address any cultural risk aversion in the UK. It needs to set out its own approach to risk when it comes to public money. It should adopt a portfolio approach to risky investments, supported by appropriate expert input, and it must acknowledge that some failed ventures are an inevitable part of the process.***

229 Crown Commercial Service, 'Public procurement policy' (8 January 2021): https://www.gov.uk/guidance/public-sector-procurement-policy [accessed 20 June 2022]

230 Public Accounts Committee, *COVID-19: Government procurement and supply of Personal Protective Equipment* (Forty-Second Report, Session 2019–21, HC 928)

231 We heard in written evidence from the Catapult Network (STS0045) about some of the challenges in achieving cultural change in public procurement: "The public sector is often a very risk averse customer; hence not often an early adopter of new offerings. Public procurement expertise in procuring R&D needs to be enhanced, as this route is inherently riskier and less certain than typical commercial supply contracts. Procurement processes tend to be conservative and incentivise 'tried and tested' vs innovative solutions. Expanding the use of processes which encourage new approaches and allowing public bodies to directly procure the solution developed should be encouraged."

232 Q 134 (Kwasi Kwarteng MP)

233 Q 56 (Andrew McCosh)

118. **The Government has identified potential levers to increase research and development spending, such as tax credits, reforming pension fund rules and public procurement. But many of these areas for reform are perennial suggestions and we heard concerningly few specifics about why this attempt will be different.** ***The Government should work with stakeholders to identify how tax credits, pension fund rules and public procurement will need to change, how these changes would support innovation and how this would lead to different outcomes from past attempts to stimulate business research and development investment. These changes must be communicated clearly to potential investors.***

119. ***Reforms to tax credits, intellectual property regulations and public procurement could be driven by government taskforces in each area, providing a single point of feedback for stakeholders to propose reforms. These should be headed by individuals given accountability for the delivery of each element of reform across government.***

Industry engagement

120. Reaching the 2.4% target depends on a strong response from industry. Lord Browne of Madingley, Co-Chair of the Prime Minister's Council on Science and Technology, said that reaching 2.4% would require "much more fully developed" interaction between business and government.[234] He praised the increases in public spending but said: "what is missing is any real connection with business and industry … there is something really missing in … the integration of people [across] government and business."[235]

121. The lack of clarity in the definition of a science and technology strategy may hinder industry engagement. Lockheed Martin, an aerospace, defence, and technology corporation with a large UK subsidiary, said "it is unclear how the [NSTC] and the [OSTS] intend to engage with industry … Incentivising private research spending in the UK requires clarity of priorities … Compared to other countries … the UK's science and technology priorities are not as clear."[236] Professor Main said the "critical thing to learn from how previous strategies have been addressed and what we could do differently this time is to involve those different communities and stakeholders from the beginning … so that people feel ownership and engagement."[237] The OSTS has said it will "work collaboratively with government departments, think tanks, academia [and] industry", but it is unclear whether this will be during the development or implementation of a strategy.[238]

122. Andrew McCosh felt that it was important to co-design the Government's science strategy with people with knowledge "in how markets work, particularly innovation and [venture capital] markets. As you say, if we will outsource the delivery of this strategy, and the outcomes we want are fundamentally going to be delivered by academia and the market, incentivised by government, we need to understand better what incentivises people and listen to those communities."[239] He welcomed the appointment

234 Q 118 (Lord Browne of Madingley)
235 Q 113 (Lord Browne of Madingley)
236 Written evidence from Lockheed Martin UK (STS0060)
237 Q 11 (Professor Sarah Main)
238 HM Government, 'Office for Science and Technology Strategy': https://www.gov.uk/government/groups/office-for-science-and-technology-strategy [accessed 8 July 2022]
239 Q 53 (Andrew McCosh)

of the Chief Scientific Adviser for National Security who had joined from Amadeus Capital Partners—"one of the country's leading VC investors in technology".[240]

123. Some witnesses suggested that engagement between government and industry was made more difficult "because we do not have the halfway houses … [of] corporate labs or national labs."[241] George Freeman said "the Catapults are our clutch plate for deep industrial R&D engagement."[242] However, the Catapults focus only on nine areas and they were described as operating on a "miniscule scale" by Professor Friend.[243] This Committee considered Catapults in detail in the report *Catapults: bridging the gap between research and industry*.[244] Kwasi Kwarteng said that there had been "huge engagement from BEIS" with companies on specific strategies such as the "energy White Paper and the net zero strategy". However, he conceded that engagement with the NSTC might not have been as effective because it is "quite a new organisation."[245]

124. **To increase private sector research and development spending towards the 2.4% target, a step change in the level of engagement with industry is needed. Industry witnesses welcomed the idea of a strategic approach to science and technology, but were often unclear about the Government's plans and policies. *The Office for Science and Technology must engage intensively with industry to define and implement a science and technology strategy in order to meet the 2.4% of GDP target.***

Services sector and the structure of the UK economy

125. It is unclear what role the Government sees for the service sector within the science and technology strategy. Service companies invest less in R&D than those in manufacturing (Table 2) but they account for around 80% of the UK's GDP.[246] Lord Browne of Madingley told us that while the UK is "number three in unicorn generation in the world … when you actually look at them … almost three-quarters—are in fintech and e-commerce."[247] It is not clear whether the Government wants to encourage service-based companies to conduct more R&D, to shift the economy by growing more research-intensive sectors or a combination of these approaches.

240 Q 53 (Andrew McCosh)
241 Q 127 (Professor Sir Richard Friend) He cited the lack of a national laboratory on solar cell research, and noted that "we have only recently done something [the Faraday Institute] on batteries, but that only has a five-year lifetime. If one contrasts that with what is present in the USA or Germany, you can see that it hurts us."
242 Q 86 (George Freeman MP)
243 Q 127 (Professor Sir Richard Friend); Catapult Network, 'Our Catapult Centres': https://catapult.org.uk/about-us/our-centres/ [accessed 20 June 2022] (The nine areas are: Cell and Gene Therapy; Compound Semiconductor Applications; Connected Places; Digital; Energy Systems; High Value Manufacturing; Medicines Discovery; Offshore Renewable Energy; Satellite Applications)
244 Science and Technology Committee, Catapults: bridging the gap between research and industry, (2nd Report, Session 2019–21, HL Paper 218)
245 Q 144 (Kwasi Kwarteng MP)
246 Written evidence from the British Academy (STS0085)
247 Q 118 (Lord Browne of Madingley)

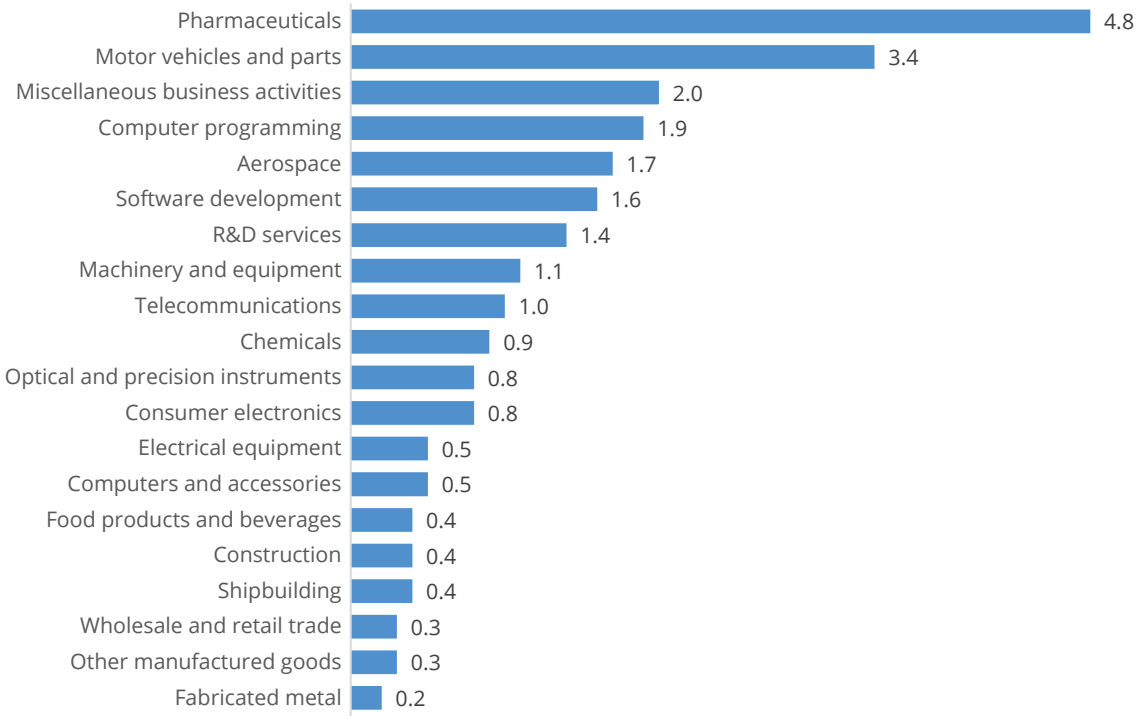
Table 2: UK Companies investing in R&D in 2019

World rank in R&D investment	Company	Industry	Global R&D investment (£, billion)	Revenue (£, billion)[248]	Percentage revenue spent on R&D
29	GlaxoSmithKline	Pharmaceuticals	4.47	33.8	13.2
32	Astrazeneca	Pharmaceuticals	4.23	19.0	22.3
84	HSBC	Banks	1.64	44.0	3.7
123	Rolls-Royce	Aerospace and Defence	1.15	15.4	7.5
135	Lloyds Banking	Banks	1.06	42.4	2.5
160	APTIV	Automobiles & Parts	0.91	11.3	8.1
169	Barclays	Banks	0.88	21.6	4.0
193	Royal Dutch Shell	Oil & Gas Producers	0.76	344.9	0.2
198	Unilever	Food Producers	0.74	45.6	1.6
253	BT	Telecommunications	0.56	23.4	2.4

Source: European Commission, House of Commons Library. House of Commons Library, Research and development spending, Library Note, SN04223*, September 2021. $ figures converted to £ using average 2019 exchange rate of $1 = £0.7835. EUR converted to £ using average 2019 exchange rate of 1EUR = £0.877*

248 GSK, *Annual Report 2019*: https://www.gsk.com/media/5894/annual-report.pdf; AstraZeneca, 'What science can do: Annual Report and Form 20-F Information 2019' https://www.astrazeneca.com/investor-relations/annual-reports/annual-report-2019.html#revenue-and-cash-0; HSBC, 'Annual Results 2019': https://www.hsbc.com/investors/results-and-announcements/all-reporting/annual-results-2019-quick-read; Rolls-Royce, 'Rolls-Royce Holdings Plc 2021 Full Year Results': https://www.rolls-royce.com/media/press-releases/2022/24-02-2022-rr-holdings-plc-2021-full-year-results.aspx; Hargreaves Lansdown, 'Lloyds Banking Group plc (LLOY) Ordinary 10p': https://www.hl.co.uk/shares/shares-search-results/l/lloyds-banking-group-plc-ordinary-10p/financial-statements-and-reports; APTIV, 'Aptiv Reports Fourth Quarter and Full Year 2019 Financial Results': https://www.aptiv.com/en/newsroom/article/aptiv-reports-fourth-quarter-and-full-year-2019-financial-results; Hargreaves Lansdown, 'Barclays plc (BARC) Ordinary 25p': https://www.hl.co.uk/shares/shares-search-results/b/barclays-plc-ordinary-25p/financial-statements-and-reports; Royal Dutch Shell plc, 'Shell Annual Report 2020': https://reports.shell.com/annual-report/2020/consolidated-financial-statements/statement-of-income.php; Hargreaves Lansdown, 'Unilever plc (ULVR) Ordinary 3.11p': https://www.hl.co.uk/shares/shares-search-results/u/unilever-plc-ordinary-3.11p/financial-statements-and-reports; Hargreaves Lansdown, 'BT Group plc (BT.A) Ordinary 5p': https://www.hl.co.uk/shares/shares-search-results/b/bt-group-plc-ordinary-5p/financial-statements-and-reports [accessed 17 June 2022]

Figure 6: Annual R&D spending by sector in the UK. (Figures in £ billions)



Source: Research and development spending from the House of Commons Library. House of Commons Library, Research and development spending, Library Note, SN04223, September 2021

126. Witnesses diverged on whether meeting the 2.4% target would require a move away from services in the UK economy. Professor Reid thought that "a heavily service based economy is highly innovative by its very nature."[249] The British Academy cautioned against fixating on purely scientific or technological R&D: "the UK's current research and economic strengths sit across the breadth of disciplinary research, including the humanities and social sciences; the economy is 80% services based with a fast growing and internationally competitive creative industries sector."[250]

127. Other witnesses thought that shifting the economy towards more research-intensive industries would be required and welcome. Professor Friend said that, apart from in life sciences, R&D spending "has dropped below the levels of our international competitors." He thought that the UK had "exited quite large sectors of the economy rather carelessly" and welcomed renewed support for them.[251] Sir Patrick Vallance noted that "eight out of the 10 biggest companies in the world are very dependent on intangible assets—intellectual property and discovery—as part of their businesses. We do not have as much of that as we probably could have, given our science base."[252] Kwasi Kwarteng said the Government's ambitions do "not mean … we are reordering the UK economy … we want to see an increase in the proportion of manufacturing, but clearly at 10% [of the economy] we are not going to change the economy overnight."[253]

249 Q 12 (Professor Graeme Reid). Q 66 (Sir Patrick Vallance) said: "There is a lot of innovation, science and technology going on in services"
250 Written evidence from the British Academy (STS0085)
251 Q 128 (Professor Sir Richard Friend)
252 Q 66 (Sir Patrick Vallance)
253 Q 133 (Kwasi Kwarteng MP)

128. **Outside the life sciences sector, the UK has a limited manufacturing base. A successful science and technology strategy will need to recognise the existing structure of the UK economy and have a plan to grow the UK's manufacturing base, if that is the intention. *The Government should explain what role the services sector will play in increased research and development spending and outline how the 2.4% target fits with the structure of the UK's economy.***

Scale-up funding

129. We heard that the UK "is a very good place to launch a start-up. It is a less good place to build that start-up into a large, enduring business … Where it really falls off is late-stage investing. If you look at funding rounds for companies that are raising £100 million or more, at that point the vast majority of the capital that British companies raise comes from abroad." Suranga Chandratillake explained that this leads to founders "ultimately … moving their companies to other countries."[254]

130. This is a long-standing problem, recognised by successive governments: the Scale-Up Report was commissioned in 2014,[255] and its associated Scale Up Institute has published annual reports since 2016.[256] Additional reports such as the 2017 Patient Capital Review[257] and the 2020 Future of Growth Capital[258] made recommendations on how to increase scale-up capital. Andrew McCosh noted that "at scale-up … around nine times more" investment flows into companies in the US than in the UK.[259]

131. We heard that part of the issue is that the "average late-stage investor in the UK" is "typically someone who has no background in technology, science or innovation."[260] This leads to a situation that Kwasi Kwarteng described where "one of the biggest inhibitors to scale-up here in the UK is the fact that investors—people who are in charge of deploying capital—simply do not understand or are not interested in the technology."[261] Andrew McCosh

254 Q 41 (Suranga Chandratillake OBE); Similarly, Q 55 (Andrew McCosh) said "We do not have as good a track record as, for example, the United States in attracting capital into start-ups or scale-ups."

255 ScaleUp Institute, *The Scale-up report on UK Economic Growth* (November 2014): https://www.scaleupinstitute.org.uk/wp-content/uploads/2019/12/scaleup-report_2014.pdf [accessed 17 June 2022]

256 The 2021 report, which is the most recent, is summarised here: ScaleUp Institute, 'Explore the ScaleUp Annual Review 2021—Executive Summary': https://www.scaleupinstitute.org.uk/scaleup-review-2021/executive-summary/ [accessed 17 June 2022]

257 HM Treasury and Department for Business, Energy and Industrial Strategy, 'Patient Capital Review' (22 November 2017): https://www.gov.uk/government/publications/patient-capital-review [accessed 17 June 2022]. The Government appeared to accept the recommendation from the Patient Capital Review by establishing British Patient Capital in 2018. It also announced a recent £375m Future Fund: Breakthrough to serve as a patient capital investment vehicle. But its total budget of £2.5bn over ten years falls short of the £1bn per annum scale recommended by the Patient Capital Review. Deloitte, Innovate Finance and ScaleUp Institute, 'The Future of Growth Capital—Recommendations' (August 2020): https://growthcapital.report/recommendations/; British Business Bank, 'Future Fund: Breakthrough': https://www.british-business-bank.co.uk/ourpartners/future-fund-breakthrough/; *Patient Capital Review: Industry Panel Response* (October 2017): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/661397/PCR_Industry_panel_response.pdf; and British Patient Capital, 'Our history' (2022): https://www.britishpatientcapital.co.uk/about/our-history/ [accessed 17 June 2022]

258 Deloitte, Innovate Finance and ScaleUp Institute, 'The Future of Growth Capital—Recommendations' (August 2020): https://growthcapital.report/recommendations/ [accessed 17 June 2022]

259 Q 55 (Andrew McCosh)

260 Q 44 (Suranga Chandratillake OBE)

261 Q 139 (Kwasi Kwarteng MP)

thought that the UK should assess whether it had "enough expertise with respect to deep technologies" in its institutional and private capital markets.[262]

132. Lord Browne of Madingley and Government witnesses thought that investors in the UK were risk averse, particularly compared with those in the US.[263] Suranga Chandratillake thought the science and technology expertise among US investors meant they "understand technology and its value, and the direction that technology is taking us, and so are very excited to be able to invest."[264] Andrew McCosh said the UK needed to develop "belief at every level that great things can happen if people take risks and invest in deep technologies."[265]

133. Policy options to increase scale-up are similar to those that could incentivise private investment generally. Andrew McCosh said that the Government would explore "the regulatory incentives that make the UK a more attractive place to invest".[266] He spoke of "encouraging … UK institutional capital to invest in different asset classes" and "attracting the best tech investors to the UK and growing our own tech investment talent".[267] In the Life Sciences Vision, published in 2021, the Government said that it would establish a Life Sciences Scale-up Taskforce.[268] This was referred to by Kwasi Kwarteng and George Freeman in evidence and it has reported to the Secretary of State, but its recommendations have not been made public.[269]

134. Economic realities mean some start-up companies will move abroad to larger or more specialised economies. But when such companies have received taxpayer support, we heard concerns this represents a poor use of public money. Dr Ami Appelbaum, CEO of the Israel Innovation Authority, explained that grants and investment from the Israeli government "are conditional on the IP and the jobs that will be created staying in Israel. We are not funding companies that move their IP overseas. However, they have a way … to buy it out from the Government. Typically, they have to pay three to six times what we provided them."[270]

135. **The UK supports many start-ups, but companies often leave when they reach a certain size because of the capital or expertise available in countries like the United States. This is a long-standing problem which has proved difficult to address. It is welcome that the Government has identified mechanisms to increase scale-up funding, but specific policy changes in these areas have not been set out. *The Government must develop clear incentives to encourage late-stage investors and support companies to scale-up. The recommendations of the Life Sciences Scale-up Taskforce should be published. The Government***

262 Q 55 (Andrew McCosh)
263 Q 118 (Lord Browne of Madingley) "The stock markets here are particular … They take a slightly different and lower-risk approach to activity than markets elsewhere"; Q 139 (Kwasi Kwarteng MP) "investors in the UK … are more risk averse"; and Q 55 (Andrew McCosh)
264 Q 44 (Suranga Chandratillake OBE)
265 Q 55 (Andrew McCosh)
266 Q 55 (Andrew McCosh)
267 Q 55 (Andrew McCosh)
268 Department for Business, Energy and Industrial Strategy and Office for Life Sciences, 'Life Sciences Vision' (6 July 2021): https://www.gov.uk/government/publications/life-sciences-vision/life-sciences-vision-html [accessed 17 June 2022]
269 Q 133 (Kwasi Kwarteng MP); Q 86 (George Freeman MP); and Written Ministerial Statement, HWS110353, Session 2021–22
270 Q 58 (Dr Ami Appelbaum)

should explore mechanisms to recoup investments from companies that have received public money if they move abroad.

The Government as an investor

136. The Government has a number of schemes to invest directly in R&D. These include programmes delivered by Innovate UK[271] and the Future Fund: Breakthrough from the British Business Bank.[272] Such schemes invest in technologies at different "readiness levels" (see Figure 7) and companies at different stages of development, with varying levels of risk.

137. We heard how government funding helps to attract private sector investment to a company. Mike Biddle described how a company that has received direct government funding will have passed "technical due diligence through the assessment process."[273] Investors know that the tests conducted before public money is provided to a company are rigorous, so it gives them the confidence to invest and reduces the need for them to conduct their own checks.

Investment at later technology readiness levels

138. Some witnesses suggested that the Government could play a valuable role as a late-stage investor. Scale-up funding is difficult to attract in the UK; direct funding from Government could alleviate this to a degree. Government funding predominantly focuses on small-to-medium grants to early-stage businesses; for example, its open competition "Smart Grants" range from £25,000 to £2 million.[274] Suranga Chandratillake said "there is absolutely an opportunity for some form of government-funded, late-stage investment fund, [such as] a sovereign wealth fund … [it] could be tied particularly to things like the industrial strategy, focused on areas where, as a country, we have decided that we would like to … double down on … expertise."[275] Professor Monks explained how a goal in a defined area, such as net zero by 2050, enables BEIS to invest in later technology readiness levels: "in the net-zero innovation portfolio, much of that is higher [Technology Readiness Level] research—levels 6, 7 or 8. Much of it is procured from companies to do demonstration-style projects and the like around … technology for heat engines or CO_2 direct air capture."[276]

271 UK Research and Innovation, 'Innovate UK': https://www.ukri.org/councils/innovate-uk/ [accessed 17 June 2022]
272 British Business Bank, 'Future Fund: Breakthrough': https://www.british-business-bank.co.uk/ourpartners/future-fund-breakthrough/ [accessed 17 June 2022]
273 Q 40 (Mike Biddle)
274 Innovate UK, 'Innovate UK Smart Grants: August 2020' (28 August 2020): https://apply-for-innovation-funding.service.gov.uk/competition/701/overview [accessed 17 June 2022]
275 Q 44 (Suranga Chandratillake OBE)
276 Q 104 (Professor Paul Monks)

Figure 7: Technology Readiness Levels

Source: CloudWATCH2, 'A brief refresher on Technology Readiness Levels (TRL)': https://web.archive.org/web/20200126083540/https://www.cloudwatchhub.eu/exploitation/brief-refresher-technology-readiness-levels-trl *[accessed 16 June 2022]*

139. Although there is scope for greater use of direct government funding, we heard of problems. Nigel Toon, CEO and co-founder of Graphcore, a British semiconductor "unicorn" start-up company, said that receiving government funding was more bureaucratic than private funding: "with 15 PowerPoint slides we can raise $30 million of venture capital, whereas with 200 slides we might be able to get a few hundred thousand from a UK scheme."[277] Suranga Chandratillake described this experience as "very typical" with few companies pursuing "large volumes of capital" through government funding. However, he praised "programmes such as the Future Fund", which allowed the Government to supplement existing private investors, as "much more lightweight … and … therefore used by more companies".[278] Mike Biddle said

277 Q 40 (Nigel Toon), Q 40 (Suranga Chandratillake OBE)

278 Q 40 (Suranga Chandratillake OBE). The Future Fund is a government scheme to support UK-based companies ranging from £125,000 to £5 million, subject to at least equal match funding from private investors. The Future Fund scheme is being delivered by the British Business Bank. British Business Bank, 'Future Fund': https://www.british-business-bank.co.uk/ourpartners/coronavirus-business-interruption-loan-schemes/future-fund/ [accessed 17 June 2022]

Innovate UK was responding to recommendations from the Public Accounts Committee, including on making recruitment and grant allocations faster.[279]

140. We heard that the range of schemes offered by the Government is overly complex. George Freeman said there are "too many" Innovate UK funds "to mention … That is partly a credit to Innovate UK's creativity, but it is a problem unless we have quite a strong and consistent offer and people know what they are getting." He wanted to make "that landscape a bit more coherent and clearer."[280]

141. There will need to be a shift in attitudes to risk if Government funding is to be used more widely. Sir Patrick Vallance described the difficulties in balancing the risk portfolio of companies that the Government invests in: "you cannot use the government approach for innovation without expecting a number of them to fail. That requires an adjustment of approach in thinking about how then to account for the public money in that system. Innovation cannot happen without failure."[281] The Council for Science and Technology recommended that the "Government should adopt a more business-friendly, 'investment portfolio' approach to funding for development and implementation activities."[282]

142. **The Government discusses using public funding in a number of ways: to support companies in their early stages; to de-risk investments for the private sector; to provide later-stage capital for a smaller number of focus areas; and to encourage scale-up of industries in the UK. It is not clear how the Government sees its role as a technology investor. *The Government should explain what it wants public innovation investment to achieve, which technologies and sectors it wants to support, and which mechanisms it will use to provide funding in each case.***

279 Q 42 (Mike Biddle)
280 Q 87 (George Freeman MP)
281 Q 67 (Sir Patrick Vallance)
282 Council for Science and Technology, 'The UK as a science and technology superpower' (22 July 2021): https://www.gov.uk/government/publications/the-uk-as-a-science-and-technology-superpower/the-uk-as-a-science-and-technology-superpower-accessible-html-version-of-letter [accessed 17 June 2022]

CHAPTER 4: KEY FINDINGS

Table 3: Summary of key findings

Reaction	Development
Positive	• 2.4% target, including increasing public investment in R&D • Establishment of cabinet sub-committee and secretariat (NSTC and OSTS) • Effective network of Chief Scientific Advisers • Suggestion of a more strategic approach with metrics to measure progress • Intention to increase scientific expertise in the civil service • Some areas of policy reform identified to help achieve the 2.4% target
Negative	• Potential exclusion from Horizon, resulting in loss of collaboration and capacity • Cuts to Official Development Assistance budget • Frequent policy changes • Proliferation of sector-specific strategies • Additional layers of bureaucracy without clear reporting lines and accountability • Lack of engagement with industry on 2.4% target • Lack of output from Cabinet subcommittee and secretariat • 2.4% target is still behind comparable nations
Queries	• Absence of specific reforms to regulation, procurement, and tax credits • Lack of clarity about relationship between UKRI and department research • Lack of clear long-term commitment to R&D • Unclear how R&D targets fit into overall economic plan • Unclear how Government will overcome risk aversion in R&D investment

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Defining a science and technology strategy

1. We welcome the indication that the Government is thinking more strategically about UK science and technology and recognises that the UK cannot be "world-beating" at everything. But the ambition to become a science and technology superpower by 2030 risks not being realised, as there are few details about how this will be defined or delivered. (Paragraph 17)

2. The priority areas of science and technology that the Government has outlined are very broad and it is unclear whether these areas will be narrowed down. A strategy needs specific, measurable outcomes and a delivery plan. (Paragraph 18)

3. *The Government should set out specifically what it wants to achieve in each of the broad areas of science and technology that it has identified. There should be a clear implementation plan including measurable targets and key outcomes in priority areas, and an explanation of how they will be delivered.* (Paragraph 18)

4. We welcome the Office for Science and Technology Strategy's commitment to establish and to publish metrics, by the end of 2022, to define the "science and tech superpower" ambition. This is necessary if "science and tech superpower" is to become more than slogan. (Paragraph 20)

5. *The Government should update Parliament on its progress on developing metrics by the end of 2022. Once metrics are available, an independent body should be empowered to monitor progress towards the Government's science and technology targets and to report annually to Parliament and government.* (Paragraph 20)

6. The proliferation of disparate strategies is confusing and it raises concerns about a lack of coherence and delivery. (Paragraph 23)

7. *In defining an overarching implementation plan, the Government should consolidate existing sector-specific strategies that are working well and monitor progress against them to ensure that they provide a clear and consistent message.* (Paragraph 23)

8. Research and development is a long-term endeavour. It has been undermined by frequent policy changes especially when strategies that are supposed to be long-term are abandoned after a few years. (Paragraph 27)

9. *The Government should make every effort to establish science and technology policy for the long term, building on existing policies and with clear, cross-party support.* (Paragraph 27)

10. The own–collaborate–access framework is a useful starting point for approaching international science and technology policy. But it is insufficiently understood and poorly applied. It is not clear whether decisions have been taken on how the framework will apply to specific technologies. (Paragraph 34)

11. *The Government must clarify the own–collaborate–access framework by publishing the areas of technology where it will be applied, and by explaining how it intends to balance owning, collaborating or accessing in these areas.* (Paragraph 34)

12. The Government's inconsistent approach to international scientific collaboration has severely undermined the aspiration to be a "science and tech superpower." The UK's reputation and scientific capability have been

damaged by the cuts to Official Development Assistance and the ongoing lack of association with Horizon Europe. The UK must be seen as a reliable partner, and the Government must recognise that it cannot reproduce the benefits of international collaborations domestically. (Paragraph 42)

13. *A cross-Government science strategy must recognise the importance of international collaborations and steps must be taken to rebuild the UK's reputation as a partner.* (Paragraph 42)

14. We are concerned that the National Science and Technology Council has met only three times in the first year since it was established in July 2021. (Paragraph 47)

15. *The National Science and Technology Council should meet regularly and frequently. Given the importance of science and technology to the UK, ten to twelve times per year seems more appropriate than three or four.* (Paragraph 47)

16. We are also surprised that no substantive documents have been produced by the Office for Science and Technology Strategy. (Paragraph 48)

17. *The Office for Science and Technology Strategy should publish the outcomes of the Council's decisions, and its substantive plans for the specific areas of cross-government working that it has identified. It is critical that this strategy is communicated widely.* (Paragraph 48)

18. The right people and the right science and technology skills will be crucial to becoming a "science and tech superpower." (Paragraph 50)

19. *The Office for Science and Technology Strategy should include "people and skills" as a core strand in its work to coordinate a science and technology strategy across Government.* (Paragraph 50)

20. Given the centrality of the Department for Environment, Food and Rural Affairs and the Department for Education to science and technology, there is a compelling case that they should be present at every meeting of the National Science and Technology Council. (Paragraph 51)

21. *The Department for Environment, Food and Rural Affairs and the Department for Education should have representatives as full members of the National Science and Technology Council.* (Paragraph 51)

22. We welcome the establishment of a cabinet level committee for discussing and directing matters of science and technology in the form of the National Science and Technology Council and its supporting body the Office for Science and Technology Strategy. But, a year after their establishment, the remits of these bodies remain unclear. We do not know how they will interact with existing bodies, such as UK Research and Innovation. Without clarification we cannot be confident that they will add any value to an already complex landscape. (Paragraph 57)

23. *We urge the Government to clarify the remits of the National Science and Technology Council and the Office for Science and Technology Strategy. It should set out how they interact with existing Government bodies, especially UK Research and Innovation. These organisations should simplify and organise the science and technology landscape, not complicate it further.* (Paragraph 57)

24. There need to be clear lines of accountability for policies that cut across departments. It should be clear which individual is accountable. (Paragraph 58)

25. *The National Science and Technology Council and Office for Science and Technology Strategy must identify the areas of cross-departmental work they will coordinate. They should identify individuals to be accountable for specific elements of the strategy, and ensure they have appropriate levers to do so.* (Paragraph 58)

26. We are concerned that the position of Minister for Science, Research, and Innovation was vacant at the time of writing. (Paragraph 59)

27. *Accountability for the delivery of the Government's overall science and technology strategy should sit with the minister responsible for science and technology, which should be a cabinet-level position.* (Paragraph 59)

28. UK Research and Innovation is expected to deliver on a range of Government priorities as well as its core function of funding excellent research. It has to respond to priorities from multiple bodies, including the Department for Business, Energy and Industrial Strategy, its research councils, and now potentially the National Science and Technology Council and Office for Science and Technology Strategy. (Paragraph 67)

29. *The role and accountabilities of UK Research and Innovation and its board, particularly as they apply to wider Government policies, must be clarified. It is critical that the organisation is sufficiently and flexibly resourced, and well-connected across government. It should not lose focus on funding blue-skies research.* (Paragraph 67)

30. UK Research and Innovation is affected by numerous reviews despite only being established in 2018. It is not realistic to expect it to function as well as it could in such a context. (Paragraph 68)

31. *Once the reviews are finished, UK Research and Innovation should be allowed to operate in a more certain policy environment.* (Paragraph 68)

32. We welcome the increase in research and development funding for Government departments. But we are concerned that this could result in duplication of work being done by UK Research and Innovation. Some departments have published areas of research interest, but some have not, and many have not updated them for some time. (Paragraph 74)

33. *Departments should co-ordinate with UK Research and Innovation on research activities to address their areas of research interest, and on managing grants, to avoid duplication. Departmental areas of research interest should be updated annually and specific research questions identified.* (Paragraph 74)

34. The Chief Scientific Adviser network is effective and well-coordinated. It presents an important opportunity to align scientific objectives across Government and to support the role of the National Science and Technology Council. (Paragraph 80)

35. *The Government science capability review recommendations on Chief Scientific Advisers should be implemented. Every department should have an independent, external expert as Chief Scientific Adviser, and departments should be able to hire additional science advisers if expertise is required on a topic. Part of the role*

of a Chief Scientific Adviser should be in approving departmental research and development spending. (Paragraph 80)

36. The civil service needs more science capability, not just in specialist roles and not only by direct employment. It needs effective processes for drawing on outside expertise. The Government acknowledges the need for more scientists in the civil service and the ambition that we heard from Sir Patrick Vallance to approach 50 per cent of science and engineering graduates for recruitment to the civil service generalist fast stream is welcome. This target needs regular monitoring and reporting. (Paragraph 85)

37. *The Office for Science and Technology Strategy should monitor progress towards the target to increase the number of science and engineering graduates on the fast stream. The Government should record the number of scientists and engineers in departments and their specialisms.* (Paragraph 86)

The 2.4% target

38. We welcome the substantial planned uplift in Government spending on research and development towards the 2.4% of GDP target. It has the potential to be transformational for UK science and technology, even though it would still leave the UK behind other OECD countries. But increasing research intensity to such an extent is highly ambitious and previous attempts have failed. It will not be achievable with business as usual policies. (Paragraph 94)

39. We are concerned that the economic context may threaten the Government's commitment to research and development. (Paragraph 95)

40. *A boom-and-bust cycle in research and development funding must be avoided. The Government should go beyond an abstract percentage of GDP target and explain what benefits it wants to achieve with the additional funding.* (Paragraph 95)

41. The Government wants to become a "regulatory superpower". Regulations can make countries more attractive to investors, but companies operating in international markets are concerned about regulatory divergence. (Paragraph 107)

42. *The Government should work with industry and the research base to identify the areas, such as artificial intelligence, in which the UK can take a global lead in regulation.* (Paragraph 107)

43. Deregulation for its own sake will not automatically spur innovation, and regulations can incentivise innovators by providing a clear direction of travel. It is not at all clear what role the Government envisages for regulatory reform in a science and technology strategy. (Paragraph 108)

44. *Sector-based taskforces should be established, providing a single point of contact with industry, to identify opportunities for regulatory reform, explaining how they will encourage innovation.* (Paragraph 108)

45. The Government wants to use public procurement to encourage the development and deployment of new technologies, but has not identified the technologies that will be supported. Value for money rules governing expenditure of public money are vital, but they do not always work for investments in developing companies and technologies: risk is inherent in the process and benefits may accrue only in the long-term. (Paragraph 116)

46. *The role that public procurement will play in a science and technology strategy needs to be clarified. The Government should set out which technologies, or areas of technology, it will support through public procurement. A proportion of public procurement spending should be set aside to support defined areas of technological priority, with the value for money rules being interpreted appropriately. The flexible interpretation of value for money rules should apply to future funding decisions, not just the initial procurement decision.* (Paragraph 116)

47. The Government has identified risk aversion as a cultural factor that limits investment in research and development in the UK. This may be true, but we have not heard any concrete proposals on how to change it. (Paragraph 117)

48. *The Government must explain how it will address any cultural risk aversion in the UK. It needs to set out its own approach to risk when it comes to public money. It should adopt a portfolio approach to risky investments, supported by appropriate expert input, and it must acknowledge that some failed ventures are an inevitable part of the process.* (Paragraph 117)

49. The Government has identified potential levers to increase research and development spending, such as tax credits, reforming pension fund rules and public procurement. But many of these areas for reform are perennial suggestions and we heard concerningly few specifics about why this attempt will be different. (Paragraph 118)

50. *The Government should work with stakeholders to identify how tax credits, pension fund rules and public procurement will need to change, how these changes would support innovation and how this would lead to different outcomes from past attempts to stimulate business research and development investment. These changes must be communicated clearly to potential investors.* (Paragraph 118)

51. *Reforms to tax credits, intellectual property regulations and public procurement could be driven by government taskforces in each area, providing a single point of feedback for stakeholders to propose reforms. These should be headed by individuals given accountability for the delivery of each element of reform across government.* (Paragraph 119)

52. To increase private sector research and development spending towards the 2.4% target, a step change in the level of engagement with industry is needed. Industry witnesses welcomed the idea of a strategic approach to science and technology, but were often unclear about the Government's plans and policies. (Paragraph 124)

53. *The Office for Science and Technology must engage intensively with industry to define and implement a science and technology strategy in order to meet the 2.4% of GDP target.* (Paragraph 124)

54. Outside the life sciences sector, the UK has a limited manufacturing base. A successful science and technology strategy will need to recognise the existing structure of the UK economy and have a plan to grow the UK's manufacturing base, if that is the intention. (Paragraph 128)

55. *The Government should explain what role the services sector will play in increased research and development spending and outline how the 2.4% target fits with the structure of the UK's economy.* (Paragraph 128)

56. The UK supports many start-ups, but companies often leave when they reach a certain size because of the capital or expertise available in countries like the

United States. This is a long-standing problem which has proved difficult to address. It is welcome that the Government has identified mechanisms to increase scale-up funding, but specific policy changes in these areas have not been set out. (Paragraph 135)

57. *The Government must develop clear incentives to encourage late-stage investors and support companies to scale-up. The recommendations of the Life Sciences Scale-up Taskforce should be published. The Government should explore mechanisms to recoup investments from companies that have received public money if they move abroad.* (Paragraph 135)

58. The Government discusses using public funding in a number of ways: to support companies in their early stages; to de-risk investments for the private sector; to provide later-stage capital for a smaller number of focus areas; and to encourage scale-up of industries in the UK. It is not clear how the Government sees its role as a technology investor. (Paragraph 142)

59. *The Government should explain what it wants public innovation investment to achieve, which technologies and sectors it wants to support, and which mechanisms it will use to provide funding in each case.* (Paragraph 142)

APPENDIX 1: LIST OF MEMBERS AND DECLARATIONS OF INTEREST

Members

Baroness Blackwood of North Oxford
Baroness Brown of Cambridge (Chair)
Viscount Hanworth
Lord Holmes of Richmond
Lord Krebs
Baroness Manningham-Buller
Lord Mitchell
Lord Patel (co-opted)
Lord Rees of Ludlow
Baroness Rock
Lord Sarfraz (Member until 28 April 2022)
Baroness Sheehan
Baroness Walmsley
Baroness Warwick of Undercliffe
Lord Wei (Member since 12 May 2022)
Lord Winston

Declaration of Interest

Baroness Blackwood of North Oxford
Chair, Genomics England
Chair, Oxford University Innovation
Director, The Alan Turing Institute
Baroness Brown of Cambridge
Non-executive director of:
Ceres Power Holdings
Frontier IP
Ørsted
Shareholdings:
Rolls-Royce plc
Viscount Hanworth
Professor Emeritus (Computational Statistics and Data Analysis) at the University of Leicester
Lord Holmes of Richmond MBE
Advisor to:
Boston Ltd: IT hardware
RTGS Global: Financial technology
Circulor: supply chain traceability
Lord Krebs
Fellow of Royal Society
Fellow of Academy of Medical Sciences
Emeritus Professor of Zoology, Oxford University
Foreign member of US National Academy of Sciences
Foreign member of German National Academy (Leopoldina)
Scientific advisor on sustainability of biofuels to Drax PLC
Scientific advisor to Marks and Spencer PLC
Member of Max Planck Society

Baroness Manningham-Buller LG DCB

Fellow of Academy of Medical Sciences

Member of Royal Society Advisory Board

Chair of Advisory Group NIHR Protection Unit on Emergency Preparedness and Response

Lord Mitchell

Member of the Board of International Governors of the Weizmann Institute in Israel

Lord Patel KT (co-opted)

Fellow, Royal Society of Edinburgh

Fellow, Academy of Medical Sciences

Emeritus Professor, University of Dundee

Lord Rees of Ludlow

Member of Cambridge University

Former President of Royal Society

Baroness Rock

Senior Adviser, Newton Europe

Board member, Centre for Data Ethics and Innovation

Non-Executive Director, Keller Group plc

Non-Executive Director, Unbound Group plc

Lord Sarfraz (Member until 28 April 2022)

Venture Partner at Draper Associates, an early-stage technology venture capital fund

Co-founder in early stage technology businesses, such as Gigamine (battery recycling) and Better Grain (agricultural technology)

Baroness Sheehan

No relevant interests declared

Baroness Walmsley

No relevant interests declared

Baroness Warwick of Undercliffe

No relevant interests declared

Lord Wei (Member since 12 May 2022)

Adviser, Future Planet Capital (VC fund investing in impactful start-ups from innovation clusters globally)

Director and Project Adviser, Sweetbridge EMEA Ltd (fintech start-up developing supply chain solutions, recipient of Innovate UK funds)

Adviser/investor in various tech-based businesses such as Crayfish, Dot Investing, Mployble harnessing mainly digital platforms for delivery

Lord Winston

Professor of Science and Society, Imperial College London

Hon Fellow, Royal Academy of Engineering

Fellow, Academy of Medical Sciences

Member, Council of Data Ethics and Innovation

Co-Chairman, UK-Israel Science Council

A full list of Members' interests can be found in the Register of Lords Interests: https://members.parliament.uk/members/lords/interests/register-of-lords-interests.

APPENDIX 2: LIST OF WITNESSES

Evidence is published online at https://committees.parliament.uk/work/6522/delivering-a-uk-science-and-technology-strategy/publications/ and available for inspection at the Parliamentary Archives (020 7219 3074).

Evidence received by the Committee is listed below in chronological order of oral evidence session and in alphabetical order. Those witnesses marked with ** gave both oral evidence and written evidence. Those marked with * gave oral evidence and did not submit any written evidence. All other witnesses submitted written evidence only.

Oral evidence in chronological order

*	Professor James Wilsdon, Digital Science Professor of Research Policy, University of Sheffield	QQ 1–8
*	Dr Beth Thompson MBE, Associate Director, Policy, Wellcome Trust	
*	Rt Hon Lord Willetts, former Minister of State for Universities and Science, May 2010 to July 2014, Department for Business, Innovation and Skills	
**	Professor Sarah Main, Executive Director, Campaign for Science and Engineering (CaSE)	QQ 9–15
*	Gavin Costigan, Chief Executive, Foundation for Science and Technology	
*	Professor Graeme Reid, Chair of Science and Research Policy, University College London	
**	Sir Adrian Smith, Director and Chief Executive, Alan Turing Institute	QQ 16–22
*	Dr Paul Bate, CEO, UK Space Agency	
*	Chris Wigley, CEO, Genomics England	
*	Professor Anne Ferguson-Smith, Pro-Vice-Chancellor for Research and the Arthur Balfour Professor of Genetics, University of Cambridge	QQ 23–31
*	Professor Chris Pearce, Vice-Principal for Research, University of Glasgow	
*	Dr Garry Pairaudeau, Chief Technology Officer, Exscientia	QQ 32–39
*	Helen Kennett, Director, UK Government Relations, Rolls-Royce plc	
*	Simon Bennett, Head of Research, AVEVA	
*	Nigel Toon, CEO and co-founder, Graphcore	QQ 40–46
*	Suranga Chandratillake OBE, Partner, Balderton Capital	
*	Mike Biddle, Programme Director, Industrial Strategy Challenge Fund, Innovate UK	

*	Andrew McCosh, Director-General, Office for Science and Technology Strategy	QQ 47–56
**	Stuart Wainwright OBE, Director, Government Office for Science	
*	Louise Dunsby, Deputy Director, Office for Science and Technology Strategy	
*	Dr John Holdren, Former Science Adviser to President Obama and Research Professor, Kennedy School of Government, Harvard University	QQ 57–63
*	Dr Marga Gual Soler, International Science Diplomacy Expert	
*	Dr Ami Appelbaum, Chair of the Board, Israel Innovation Authority and Chief Scientist, Ministry of Economy and Industry	
*	Sir Patrick Vallance, Government Chief Scientific Adviser, Head of the Government Science and Engineering Profession and National Technology Adviser	QQ 64–80
**	George Freeman MP, then Parliamentary Under-Secretary of State (Minister for Science, Research and Innovation), Department for Business, Energy and Industrial Strategy	QQ 81–89
*	Alexandra Jones, Director of Science, Research and Innovation, Department for Business, Energy and Industrial Strategy	
*	Professor Alison Park, Interim Executive Chair, Economic and Social Research Council (ESRC)	QQ 90–98
**	Professor Fiona Watt, Former Executive Chair, Medical Research Council (MRC)	
*	Professor Sir Duncan Wingham, Executive Chair, Natural Environment Research Council (NERC)	
**	Professor Paul Monks, Chief Scientific Adviser, Department for Business, Energy, and Industrial Strategy	QQ 99–105
*	Professor Gideon Henderson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs	
*	Professor Charlotte Watts, Chief Scientific Adviser, Foreign, Commonwealth and Development Office	QQ 106–112
**	Professor Dame Angela McLean, Chief Scientific Adviser, Ministry of Defence	
*	Professor Lucy Chappell, Chief Scientific Adviser, Department of Health and Social Care	
*	Professor Dame Ottoline Leyser, Chief Executive Officer, UK Research and Innovation	QQ 113–121

*	Lord Browne of Madingley, Co-Chair, Council for Science and Technology	
*	Dr Beth Mortimer, Royal Society University Research Fellow	QQ 122–131
*	Professor Sir Richard Friend, Former Cavendish Professor of Physics, University of Cambridge	
**	Rt Hon Kwasi Kwarteng MP, Secretary of State for Business, Energy and Industrial Strategy	QQ 132–144
*	Alexandra Jones, Director of Science, Research and Innovation, Department for Business, Energy and Industrial Strategy	

Alphabetical list of witnesses

	Academy of Medical Sciences	STS0074
	ADS Group and UKspace	STS0006
	AIRTO Ltd	STS0021
**	Alan Turing Institute (QQ 16–22)	STS0076
	Amazon UK	STS0037
	Animal Free Research UK	STS0010
*	Dr Ami Appelbaum (QQ 57–63)	
	Association of Medical Research Charities (AMRC)	STS0036
	Association of the British Pharmaceutical Industry (ABPI)	STS0050
*	AVEVA (QQ 32–39)	
	Professor Wendy Bickmore and Professor Margaret Frame, University of Edinburgh	STS0004
	BioIndustry Association (BIA)	STS0077
	Black Kite Ltd	STS0065
	Professor Annette Boaz and Dr Kathryn Oliver, London School of Hygiene and Tropical Medicine	STS0019
	BRE (Building Research Establishment) Group	STS0071
	The British Academy	STS0085
	British Heart Foundation (BHF)	STS0028
	British Science Association	STS0081
	British Society for Immunology	STS0005
**	Campaign for Science and Engineering (CaSE) (QQ 9–15)	STS0026
	Cancer Research UK (CRUK)	STS0048
	Catapult Network	STS0045

	Dr Emma Cavan, Imperial College London and Dr Katharine Hill, National Oceanography Centre	STS0055
	Centre for Long-Term Resilience	STS0003
*	Suranga Chandratillake OBE (QQ 40–46)	
	Connected Places Catapult	STS0083
*	Council for Science and Technology (QQ 113–121)	
	Daphne Jackson Trust	STS0027
**	Department for Business, Energy and Industrial Strategy (QQ 81–89) (QQ 99–105) (QQ 132–144)	STS0080 STS0088
*	Department for Environment, Food and Rural Affairs (QQ 99–105)	
*	Department of Health and Social Care (QQ 106–112)	
*	Economic and Social Research Council (ESRC) (QQ 90–98)	
	Engineering Professors' Council	STS0051
	Ethical Medicines Industry Group	STS0013
	European Marine Energy Centre (EMEC) Ltd	STS0061
*	Exscientia (QQ 32–39)	
	Faculty of Pharmaceutical Medicine	STS0054
	Falmouth University	STS0016
	The Faraday Institution	STS0031
*	Professor Anne Ferguson-Smith, University of Cambridge (QQ 23–31)	
*	Foreign, Commonwealth and Development Office (QQ 106–112)	
*	Foundation for Science and Technology (QQ 9–15)	
	Professor Margaret Frame and Professor Wendy Bickmore, University of Edinburgh	STS0004
	The Francis Crick Institute	STS0044
	Fraunhofer UK Research Ltd	STS0068
*	Professor Sir Richard Friend, University of Cambridge (QQ 122–131)	
*	Genomics England (QQ 16–22)	
**	Government Office for Science (QQ 47–56)	STS0086
*	Graphcore (QQ 40–46)	
	Dr Katharine Hill, National Oceanography Centre and Dr Emma Cavan, Imperial College London	STS0055
*	Dr John Holdren, Harvard University (QQ 57–63)	
	Imperial College London	STS0058

*	Innovate UK (QQ 40–46)	
	Innovation Advisory Council for Wales (IACW)	STS0018
	Institute of Development Studies (IDS)	STS0020
	Institute of Physics (IOP)	STS0046
	Institution of Engineering and Technology (IET)	STS0017
	Japanese Pharmaceutical Group (JPG)	STS0007
	Jazz Pharmaceuticals	STS0066
	KBio	STS0034
	Lancaster University	STS0040
	LifeArc	STS0008
	Lockheed Martin UK	STS0060
	Manchester Institute of Innovation Research	STS0069
	Medical Schools Council	STS0053
	Met Office	STS0082
**	Ministry of Defence (QQ 106–112)	STS0087
*	Dr Beth Mortimer, Royal Society University Research Fellow (QQ 122–131)	
	N8 Research Partnership (N8) and Yorkshire Universities (YU)	STS0039
	National Centre for Universities and Business (NCUB)	STS0079
	National Farmers' Union (NFU)	STS0009
	National Measurement Laboratory (NML) at LGC	STS0064
	National Nuclear Laboratory (NNL)	STS0033
	National Oceanography Centre (NOC)	STS0025
*	Natural Environment Research Council (NERC) (QQ 90–98)	
	NCC Group	STS0011
	NOAH	STS0052
	Norwich Research Park, University of East Anglia, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, Quadram Institute	STS0059
	Dr Kathryn Oliver and Professor Annette Boaz, London School of Hygiene and Tropical Medicine	STS0019
*	Office for Science and Technology Strategy (QQ 47–56)	
*	Professor Chris Pearce, University of Glasgow (QQ 23–31)	

	People for the Ethical Treatment of Animals (PETA) Foundation	STS0023
	The Physiological Society	STS0072
	QUPID	STS0067
	Reaction Engines	STS0015
*	Professor Graeme Reid, University College London (QQ 9–15)	
*	Rolls-Royce plc (QQ 32–39)	
	Royal Academy of Engineering	STS0049
	Royal Aeronautical Society	STS0041
	Royal Society of Chemistry (RSC)	STS0014
	The Royal Society of Edinburgh	STS0075
	The Royal Society	STS0078
	The Russell Group	STS0012
	SCI (Society of Chemical Industry)	STS0073
	Dr Mark Scibor-Rylski	STS0002
	Science Council	STS0070
	Dr Alexander Serb, University of Southampton	STS0032
*	Dr Marga Gual Soler (QQ 57–63)	
	Dr Richard Stephens, Keele University	STS0029
	techUK	STS0047
	UCL (University College London)	STS0022
	UK Collaborative on Development Research (UKCDR)	STS0062
	UK Reproducibility Network (UKRN)	STS0042
*	UK Research and Innovation (UKRI) (QQ 113–121)	
*	UK Space Agency (QQ 16–22)	
	UKCloud	STS0043
	UKspace and ADS Group	STS0006
	Universities UK (UUK)	STS0057
	University of Edinburgh	STS0035
	University of Hull	STS0063
	University of Sheffield	STS0056
	University of St Andrews	STS0038
*	Sir Patrick Vallance, Government Chief Scientific Adviser, Head of the Government Science and Engineering Profession and National Technology Adviser (QQ 64–80)	

**	Professor Fiona Watt, Medical Research Council (QQ 90–98)	STS0084
*	Wellcome Trust (QQ 1–8)	
*	Rt Hon Lord Willetts, former Minister of State for Universities and Science, May 2010 to July 2014, Department for Business, Innovation and Skills (QQ 1–8)	
*	Professor James Wilsdon, University of Sheffield (QQ 1–8)	

Private seminar

Seminar held at the House of Lords on 25 January 2022

Members of the Committee present were Baroness Brown of Cambridge (Chair), Baroness Blackwood of North Oxford, Viscount Hanworth, Lord Holmes of Richmond, Lord Krebs, Baroness Manningham-Buller, Lord Mitchell, Lord Rees of Ludlow, Baroness Rock, Lord Sarfraz, Baroness Sheehan, Baroness Walmsley and Baroness Warwick of Undercliffe.

Remarks were heard from:

- Sir Adrian Smith, President of the Royal Society;
- Hetan Shah, CEO, the British Academy;
- Dr Helen Ewles, Head of Research and Innovation Policy, Royal Academy of Engineering; and
- Professor Mike Malim, Vice President, Non-Clinical, Academy of Medical Sciences.

APPENDIX 3: CALL FOR EVIDENCE

The House of Lords Science and Technology Committee is conducting an inquiry into the UK's research and innovation system and whether it can deliver the Government's ambition for the UK to be a "science superpower". The committee invites written contributions by Friday 25 March 2022.

Background

The Government plans to make the UK a "science superpower". It has committed to increasing investment in research and development to 2.4% of GDP by 2027, with a long-term target of 3%. This is in line with comparable OECD countries. The Government has said it will support this target by increasing public research and development funding from £9bn in 2017 to £22bn by 2026/7.[283] In addition, a cabinet committee chaired by the Prime Minister, the National Science and Technology Council (NSTC), and the Office of Science and Technology Strategy have been established to promote an overall strategy for scientific and technological development in Government policy.

The NSTC has identified four priority areas for UK science and technology: "the sustainable environment, health and life sciences, national security, defence and space, and a digital and data-driven economy".[284]

There are ongoing reviews of various aspects of the science and technology system. These include a review of the functioning of UK Research and Innovation (UKRI), the second Sir Paul Nurse review of the UK research, development and innovation landscape, and a review of research bureaucracy. Many of these reviews are due to publish in the coming months; they should help answer the question as to whether the UK's research, development and innovation institutions need reform to achieve the Government's aims for UK science. The Committee will examine the findings of these reviews, and the broader issue of scientific skills and careers in the future.

Purpose of the inquiry

It is not clear what it would mean for the UK to be a "science superpower", nor how an overall strategy for science and technology will be coordinated across Government and interact with the research and innovation delivery system. The UK has many respected academic institutions, but this is only part of what is needed for a high-skills, high-tech economy. It remains unclear which sectors the Government will focus on and invest in. It is not apparent how the vision of the UK as a science superpower will be integrated with other areas of national policy, or economic and industrial strategy. Nor is it clear how the Haldane principle, the idea "that decisions on individual research proposals are best taken following an evaluation of the quality and likely impact of the proposals (such as a peer review process)", will be protected.[285]

The Committee seeks to understand what the Government's ambition for the UK to be a science superpower means in practice; what a viable strategy for the UK's science and technology sectors would look like; how to ensure a strategy endures and is not overturned when governments change; what contribution state,

283 Autumn Budget and Spending Review 2021: A Stronger Economy for the British People (publishing.service.gov.uk) page 4

284 HM Government, 'Office for Science and Technology Strategy': https://www.gov.uk/government/groups/office-for-science-and-technology-strategy

285 Higher Education and Research Act 2017, clause 103 (3)

private and international funding should make; whether science objectives could be better supported across Government policy; what the UK can learn from other countries; and how balancing 'top-down' messages about Government priorities with 'bottom-up' curiosity driven research will work in this new landscape with a stronger focus on a national science and innovation strategy.

The Committee is seeking evidence on the following questions (there is no requirement to answer all questions in your submission):

Questions

1. What would it mean for the UK to be a "science superpower?

   - What would a "science superpower" look like?
   - Does the Government have a coherent strategy and sufficient existing policies to make the UK a "science superpower?"
   - What measures should determine whether the UK has become a "science superpower"?
   - Are the four scientific and technological priorities identified by the National Science and Technology Council the right ones for the UK?
   - What could be done to ensure that the Government's science and technology strategy is long-term and pursued across administrations? What have been the consequences of a frequently changing science policy?

2. Are the right structures in place in Government to implement a science and technology strategy?

   - How should Government coordinate science policy across different departments, with different strategic priorities such as levelling up? What role could the National Science and Technology Council play?
   - How should the National Science and Technology Council and the Office for Science and Technology Strategy interact with existing bodies like the UKRI Council and the Council for Science and Technology?
   - Are the right levers and mechanisms in place for the delivery of a science and technology strategy?
   - Who should be accountable for the delivery of a science and technology strategy?
   - What ministerial representation should science and technology have?

3. Does the introduction of a science and technology strategy challenge the Haldane principle and UKRI's commitment to fund outstanding research?

   - Should the Government take further steps to preserve and enhance the Haldane principle?
   - How should the Government balance support for bottom up, curiosity-driven research with support for research focused on its strategic priorities?

4. Is the UK realising the potential of its research investment?

   - Do bureaucratic processes hinder research and development in the UK? Are there examples of where these could be removed without compromising oversight?

- Could the bureaucracy reducing principles of the Advanced Research and Invention Agency be extended to other public sector research establishments?
- How can the Government better incentivise and support interdisciplinary research and innovation?
- Does the Government's strategic direction and the current allocation of research funding align with the UK's scientific and economic strengths?

5. How should state funding for research and development be allocated between different organisations, who should make that decision and by what criteria?

- Should Government departments commission and fund more research and development directly?
- What role should public sector research establishments play?
- What role should universities play?
- How should state funding be used to leverage private sector funding?

6. What more should be done to encourage private-sector investment in research and development in the UK?

- What policies could incentivise private sector research spending in the UK? Are there international examples the UK could learn from?
- What more could be done to incentivise collaborations between academics and industry? Are there barriers preventing this collaboration that could be removed?
- What can be learnt from local innovation ecosystems, such as the Cambridge Science Park?
- What stage of the pipeline, from innovation to industry, is presenting the most significant problems for commercialising discoveries in the UK?
- What contribution should public procurement make to achieving the aims of the science and technology strategy?

7. How well does the UK collaborate on research with international partners and what can it learn from other countries?

- In which areas of science and technology is collaboration, or negotiating access to existing projects, more appropriate than competition or seeking comparative advantage?