Wired for Success

Reforming Whitehall to support science and technology

Allan Nixon, Anna Dickinson,

Anastasia Bektimirova

ONWARD

About Onward

Onward's mission is to develop bold and practical ideas to boost economic opportunity, build national resilience, and strengthen communities across all parts of the United Kingdom.

We are not affiliated to any party but believe in mainstream conservatism. Our vision is to address the needs of the whole country: young and old, urban and rural, for all communities across the UK – particularly places that have too often felt neglected or ignored by Westminster.

We believe in an optimistic conservatism that is truly national – one that recognises the value of markets, supported by a streamlined state that is active not absent. We are unapologetic about standing up to vested interests, putting power closer to people, and supporting the hardworking and aspirational.

Thanks

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About the authors

Allan Nixon

Allan Nixon is Head of Science and Technology at Onward. He was also previously Director of Strategic Collaboration for Fujitsu's Centre for Cognitive and Advanced Technologies. Prior to that, he served in a variety of special adviser roles in the UK Government over 4 years – including to the Prime Minister, the Security Minister, and the Health Secretary throughout the Covid-19 pandemic. Before joining the Government, Allan worked in the UK Parliament. He received his MA in International Relations from the International University of Japan and his Honours degree in Law from the University of Dundee.

Anna Dickinson

Anna is a Senior Researcher in the Science and Technology team. Prior to Onward she was the Health and Life Sciences Policy Manager at Public Policy Projects. She also spent time working as a Spanish to English translator in Cochabamba, Bolivia. Anna holds an Honours degree in Spanish and Politics, and an LLM in Law from Queen's University Belfast.

In addition to her role at Onward, Anna is Head of Strategy to Baroness Nicola Blackwood, Chair of Genomics England, and Oxford University Innovation.

Anastasia Bektimirova

Anastasia is a Senior Researcher in the Science and Technology team. She previously worked for the International Telecommunication Union, focusing on the United Nations affairs, strategic partnerships, ICTs for Sustainable Development Goals and gender digital divide matters. Anastasia is completing her studies towards an MPhil degree in Politics at the University of Oxford and holds an MSc degree in Media and Communications from the London School of Economics and Political Science.

Edited by Adam Hawksbee

Adam Hawksbee is Deputy Director of Onward. He was previously Head of Policy to Andy Street, Mayor of the West Midlands.

Endorsements

The Rt Hon Lord Willetts, Chair of the UK Space Agency and former Science Minister

"This report makes clear that the Government can do more to keep pace in the global science and tech race. The actions it calls for should guide further Whitehall reform to deliver the Government's ambitions to be a Science Superpower."

Professor Sir Anthony Finkelstein, Former Chief Scientific Adviser for National Security

"This is an important report that takes stock of the recent substantial reforms to the UK's science and technology system. It identifies the achievements but also clearly signals where these reforms have, to date, fallen short. It sets a – rightly – ambitious forward agenda that can act as a jumping off point for the next phase of reform by HMG and beyond."

Lord O'Shaughnessy, Former Minister for Innovation

"The Government should be commended for the reforms to science and tech that it brought in earlier this year — but it must go further. Onward's report sets out the vital next steps needed if the UK is to seize the science superpower mantle."

Matt Warman MP, Former Digital Minister

"This report is an important contribution to the science superpower mission. Many of the actions it calls for deserve to exert significant influence on the Government in its next stage of reforming Whitehall."

Dame Caroline Dinenage MP, Former Digital Minister

"The DSIT reforms brought in by the Government earlier this year were an important marker in reforming Whitehall for the tech revolution. But they must only be the start. Onward's report provides an important roadmap to complete these reforms and ensure Whitehall is ready to seize Britain's science superpower potential."

The Rt Hon Matt Hancock MP, Former Digital Secretary

"The global tech race is speeding ahead, and to be prosperous in the twenty-first century the UK can't let itself fall behind. This report makes some thought-provoking recommendations for how the Government can back its commitments on science with reforms to Whitehall to strip away the bureaucracy holding Britain back from seizing its tech potential."

Lord Vaizey, Former Digital Minister

“The findings in Onward's report underline the need to reform Whitehall further to seize the opportunities of the tech revolution. With the pace of innovation accelerating and a global race unfolding, it's vital that Government does not rest on its laurels in its mission to become a science and tech superpower.”

Lord Bethell, Former Minister for Life Sciences

“This is an eye-opening report underlining what more is needed to deliver on the government’s science agenda. Government should look hard at the recommendations this report calls for.”

Baroness Blackwood, Chair of Genomics England and former Minister for Innovation

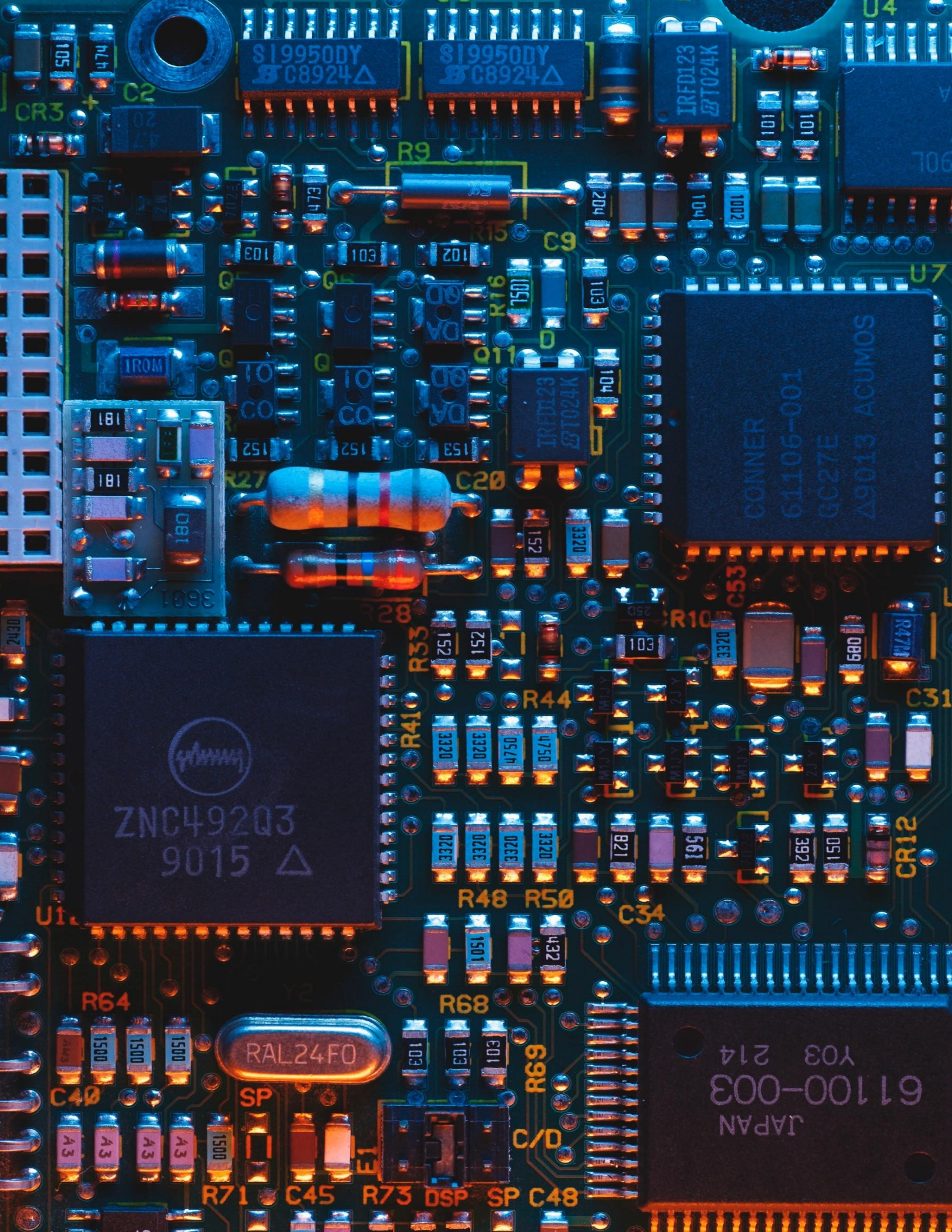
“The UK’s innovation ecosystem is dynamic and boasts of a richness, breadth and depth that is truly unique. But we must not rest on our laurels. A track-record of excellence does not guarantee a future of equal impact and value. I welcome the recommendations in this report, and echo the call for Government to go further, faster, to unleash our science and technology potential.”

Lord Johnson, Former Science Minister

"In his great report on higher education, Lionel Robbins presciently warned against moving universities to the Education Department because he feared that such an interventionist department would not understand or value the autonomy of universities. This Onward report rightly recognises that it was a mistake by the May Government to have placed universities under the rod of the Department for Education, where they are treated like failing secondary schools. There will be significant advantages in returning them to the sponsorship of a growth department, preferably the new Science, Innovation and Technology Department.”

Margot James, Executive Chair of Warwick Manufacturing Group and Former Digital Minister

“The creation of the Department of Science and Technology (DSIT) in February of this year was warmly welcomed by Britain’s scientific and research community. In its paper “Wired for Success” the think tank Onward have provided a blueprint for the sweeping changes needed for DSIT to deliver on its mission to make the UK a science superpower. A holistic strategy for innovation and investment is set out which would enable the UK to build on its advantages in frontier technologies like quantum computing and battery science. We need to be more ambitious, joined up and nimbler in the funding and execution of scientific innovation than we are; and the Onward recommendations provide the head start Britain needs in an increasingly competitive world.”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Executive Summary

In the first half of 2023 the UK Government transformed its approach to science. For the first time Britain's science superpower ambitions were matched with a focused Whitehall department and a dedicated Secretary of State. Ministers were quick to publish a comprehensive Science and Technology Framework along with a series of action plans on topics from semiconductors to quantum. The Prime Minister announced the UK will hold the first global summit on AI Safety and established a Foundation Models Taskforce led by technology entrepreneur Ian Hogarth, supported with £100 million of investment and reporting directly into No.10.

These are serious reforms. But to become a genuine science superpower, the Government needs to go further. This paper sets out a roadmap to complete the rewiring of Whitehall so the Government can realise the potential of science and technology to boost the nation's productivity, transform public services, and compete internationally in a world increasingly driven by pursuit of technology dominance. Four principles should guide the next phase of reform:

1. Centrality. Government must put science and technology at the core of its agenda, providing sufficient investment, ensuring ministerial attention and driving urgency.

2. Choices. Government must recognise and embrace trade-offs in *how* it wants to support science and *which areas* it wants to prioritise.

3. Coordination. Government must be united in its activity, with complete alignment between Whitehall departments, regulators and science bodies like UKRI.

4. Consistency. Government must stick to its plans over time, focussing on long-term goals and building consensus so that reforms withstand political change.

In each of these areas, the Government has signs of success and space for improvement.

On centrality, the creation of the Department for Science, Innovation, and Technology (DSIT) is a signal in itself. The Prime Minister has a personal focus on technology policy and has committed to chair monthly National Science and Technology Council (NSTC) meetings to drive cross-Whitehall delivery. But the NSTC has only met sporadically in recent months and lacks firepower to drive cross-Whitehall delivery.

There are other signs that the Government is not yet giving science sufficient priority. UK investment in science trails our competitors, despite rises in the R&D budget. More is needed to improve the Government's long-term technology horizon-scanning capabilities. Despite putting a premium on pace, Whitehall bureaucracy still slows down progress: the procurement of exascale compute power is set to go through the Treasury's lengthy business case process like any other tender, adding years to a process that should take months, if not weeks. Proposals for new lab space remain stuck in planning processes.

On choices, the formation of DSIT has been paired with a clear articulation of priority technologies alongside action plans and funding commitments. The National Quantum Strategy is exemplary, with clear goals, explicit deadlines for deliverables, and clarity on the technology's strategic advantage.

Yet big gaps remain. An action plan for engineering biology is yet to be published. The 2021 National AI Strategy is outdated. Funding for semiconductors is far lower than for comparable nations. And there is a lack of clarity more broadly on how the Government assesses foundational technologies and makes decisions on what sovereign capabilities are needed. More concerning still, the Government has not been clear on how it expects to bring together levers and funding from outside DSIT to support its science ambitions. Without an explicit, coordinated approach to driving innovation via industrial strategy too many science and technology policies risk falling short.

On coordination, progress has been made. There is now a Science Secretary who has the relevant funding and policy levers in a single department. Greater cross-government accountability is aided by named Cabinet leads for each of the DSIT framework's strands of activity. But ensuring other Whitehall departments act with urgency remains a challenge.

The Government has also done little to improve its relationship with regulators and the science community. The digital and technology regulation landscape is fragmented, with an apparent disparity between the objectives of the Government and regulators. The Government last provided Ofcom with a "Statement of Strategic Priorities" in 2019, when Theresa May was in No.10. DSIT's relationship with UKRI and research councils needs urgent reform to ensure projects and places secure the right funding in a reasonable time.

On consistency, it remains to be seen whether the Government can avoid the chopping and changing of strategies and plans that have typified recent decades. To stand the test of time, these reforms must be embedded firmly into departmental and governmental structures.

The Government must keep up the pace of reform – taking a series of practical steps in the coming months to ensure that Whitehall can deliver on the science and technology agenda.

Placing science at the centre of the Government's agenda first requires investment: ministers should update their R&D target to 3.5% of GDP, with an emphasis on boosting private sector R&D spend. A new Technology Futures Unit, modelled on Singapore's Centre for Strategic Futures, should be established to sharpen strategic decisions. DSIT should be unleashed from Treasury bureaucracy, exempting them from the full Green Book business case process and removing the limits on their delegated spending authority. Labs and other science infrastructure should be designated as Nationally Significant Infrastructure Projects to accelerate development.

Ensuring the Government makes clear choices requires a revamped Innovation Strategy, with clear commitments to which technologies will and won't secure support. A set of funded Innovation Missions, aligned to priority technologies, would galvanise private investment in the long-term.

Coordination of the science agenda would be improved by transferring responsibility for universities from the Department for Education to DSIT. The Science Secretary should gain sole responsibility for approving departmental R&D spends instead of the Chancellor. A Permanent Secretary-level official should be appointed to take charge of the NSTC, giving them real power across Whitehall. The Digital Regulation Cooperation Forum should be placed on a statutory footing with an extended membership to make regulation more responsive and predictable. And a new review should be launched into UKRI and research councils with an aim of significantly reducing funding approval timelines.

The Government has shown that it is willing to make big bets in aid of its science superpower ambitions – it cannot now rest on its laurels. There is a chance for the British state to be uniquely prepared for the technological revolution we are beginning to experience. Ministers must seize it.

Table of recommendations

Challenges	Recommendations
Centrality	
The Government's R&D budget ambitions put the UK in the middle of the pack	1. The Government should set a new headline R&D target of 3.5% of GDP by 2035, with a focus on boosting private sector R&D spend
The Government's ability to anticipate developments across the global technology landscape is poor	2. The Government should create a Technology Futures and Intelligence Unit modelled on Singapore's Centre for Strategic Futures
DSIT projects are held back by lengthy Treasury spending controls	3. DSIT should be exempted from lengthy and bureaucratic spending controls to ensure the department can move with the intended "agility and pace." Specific steps include: • Exempting DSIT Major Projects and novel spending from HMT sign off • Introducing single business case approvals for DSIT agencies • Shifting responsibility for evaluating DSIT spend to experts
Planning bureaucracy is holding back the development of lab space	4. The Government should create a new category under the Nationally Significant Infrastructure Projects (NSIP) regime for key science infrastructure, including lab space
Choices	
The Government lacks an explicit, coordinated approach to driving innovation across a range of policy domains	5. The Government should update the 2021 Innovation Strategy and fully fund a set of Innovation Missions in the Autumn Statement
Coordination	
Ownership of universities by the Department for Education means DSIT does not oversee a key component of the innovation cycle	6. The Prime Minister should move universities out of the Department for Education and into DSIT

The National Science and Technology Council (NSTC) is not being used to its full potential in driving cross-Whitehall coordination and delivery	7. A Permanent Secretary-level official should be appointed to take charge of the NSTC
No formal mechanisms are in place to coordinate R&D spending by other government departments	8. The DSIT Secretary should be given delegated powers to approve R&D spending plans by other government departments instead of Treasury ministers
Digital and technology regulation is highly fractured across a number of bodies and lacks coordination and clarity	9. The Government should reform the Digital Regulation Cooperation Forum and issue updated policy objectives to regulators
There is a large variance in the speed of funding approvals across the UK's research councils	10. The Government should instigate an urgent review with UKRI to improve timelines for funding approvals by research councils

The story so far

Creating DSIT and articulating a science strategy

The "DSIT reforms" encompass a number of structural and strategic shifts that occurred in the first half of 2023. They include the creation of the Department for Science, Innovation and Technology (DSIT) as well as several new strategies published since DSIT's creation. All are aimed at delivering "a single mission: to make the UK a science and technology superpower."[1]

The Science and Technology Framework is DSIT's "strategic anchor."[2] It sets the "strategic vision" and informs the action plans each department across Whitehall has been developing to meet long-term science and technology goals.[3] The Framework defines the Government's vision for what it hopes to have achieved by 2030 under ten strands:

1. Identifying Critical Technologies
2. Signalling UK Strengths and Ambitions
3. Investment in Research and Development
4. Talent and Skills
5. Financing Innovative Science and Technology Companies
6. Procurement
7. International Opportunities
8. Access to Physical and Digital Infrastructure
9. Regulation and Standards
10. Innovative Public

This section first outlines the structural changes across Whitehall in science and technology that have occurred. Then, taking each strand of the Framework in turn, it briefly describes key developments and areas of Government activity.

Structural reforms

Department for Science, Innovation, and Technology (DSIT)

DSIT was formed on February 6, 2023, by merging the digital and technology policy elements of the Department for Digital, Culture, Media and Sport (DCMS) with the science, research and innovation elements of the Business Department (BEIS) to create one department. Alongside this was the formation of the Department for Business and Trade, the Department for Energy and Net Zero and a "streamlined and refocused" DCMS.[4] Downing Street's stated purpose for these changes was to engender "greater focus, dedicated leadership, and better-targeted resources [to] help us deliver our promises in the here and now."[5] For DSIT specifically, the Prime Minister pointed to the "increasingly central role played by science and technology in the global economy and in citizens' everyday lives."[6]

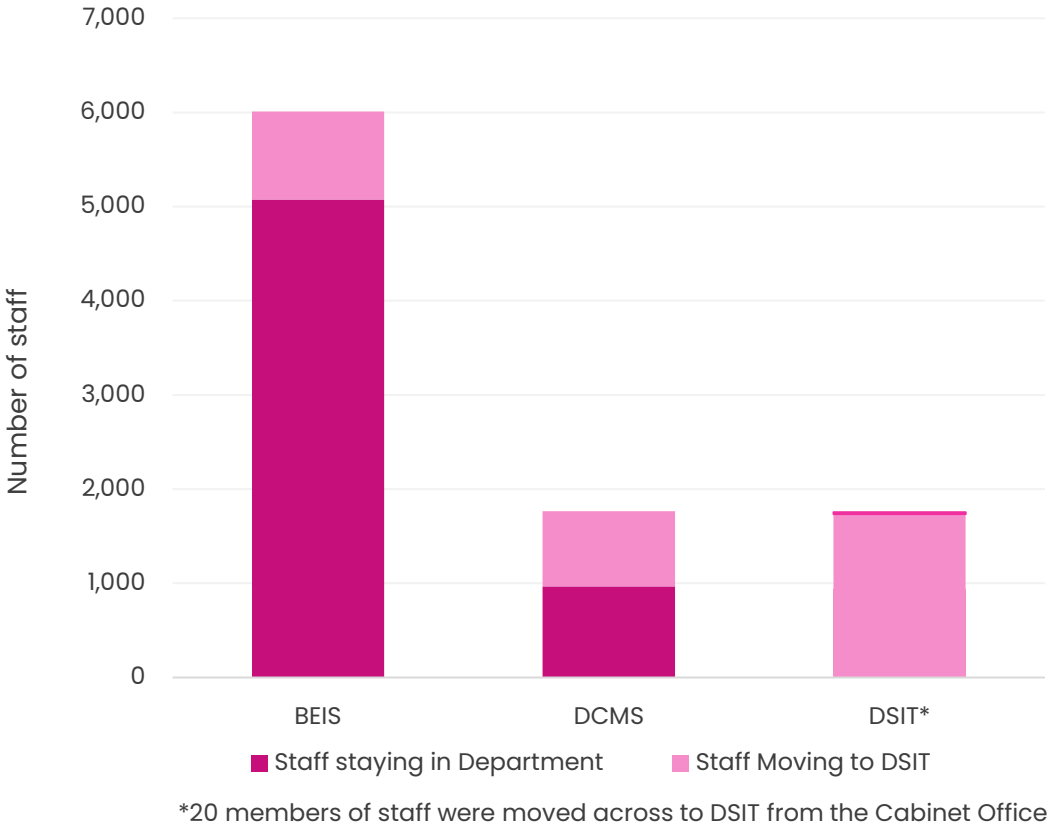
DSIT absorbed the Government Office for Science (GO-Science) and the Office for Science and Technology Strategy (OSTS), both previously part of the Cabinet Office. Despite moving from the centre of Government to a specific department,

the OSTS remains "dedicated to driving progress on this Science and Technology Framework across Government,"[7] and is now described within the Department as the "Strategy and Implementation team."

Officials across DCMS and BEIS whose portfolios fell into the new DSIT purview have been transferring across into the new department, incorporating around 935 staff from BEIS and 800 staff from DCMS.[8] On April 19, DSIT announced its non-executive directors to steer the new department's "startup board" during DSIT's first year, before a permanent board is recruited.[9]

Figure 1: Movement of Government Department Core Staff to Create DSIT

Source: GOV.UK (2023), Onward analysis



*20 members of staff were moved across to DSIT from the Cabinet Office

How DSIT will operate

The Science and Technology Framework outlined the intention for DSIT to have a cross-Whitehall function, declaring that the department would "bring together core science and technology functions across Government."[10]

How it operates as a department is intended to be different. Science Minister George Freeman has said DSIT will bring "agility and pace" to the science mission.[11] DSIT is purportedly to be "not just a new brass plate in Whitehall" but "a New Model Department for driving the Science, Research, Technology [and] Innovation agenda across Government."[12]

Table 1: The Prime Minister's priority outcomes for DSIT

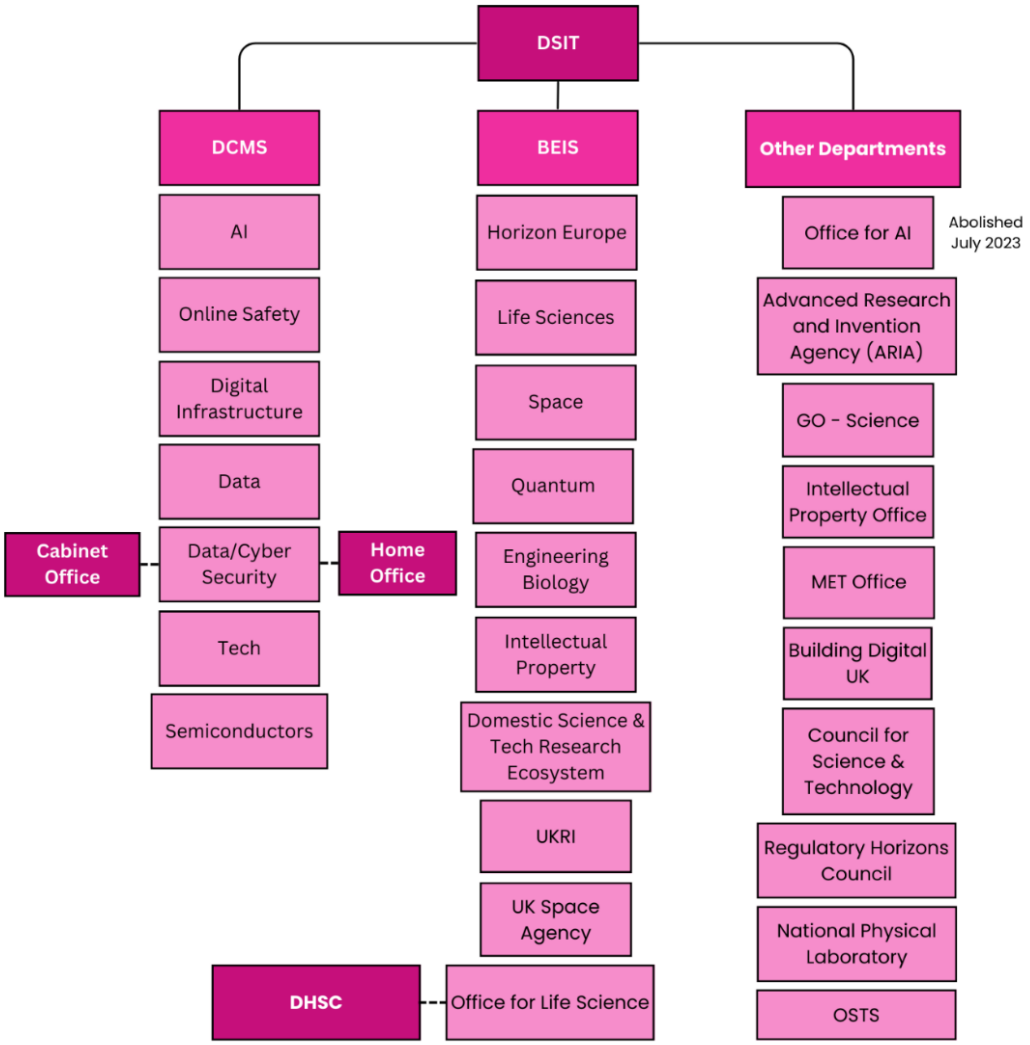
Source: UK Gov (2023), 'Making Government Deliver for the British People'

1	Optimise public R&D investment to support areas of relative UK strength and increase the level of private R&D to make our economy the most innovative in the world.
2	Promote a diverse research and innovation system that connects discovery to new companies, growth and jobs – including by delivering world-class physical and digital infrastructure (such as gigabit broadband), making the UK the best place to start and grow a technology business and developing and attracting top talent.
3	Put our public services – including the NHS and schools – at the forefront of innovation, championing new ways of working and the development of in-house STEM capability to improve outcomes for people.
4	Strengthen international collaboration on science and technology in line with the Integrated Review, and ensure our researchers are able to continue to work with leading scientists in Europe and around the world.
5	Deliver key legislative and regulatory reforms to drive competition and promote innovation, including the Data Protection and Digital Information Bill, the Digital Markets, Competition and Consumer Bill and our pro-innovation approach to regulating AI.
6	Pass the remaining stages of the reformed Online Safety Bill to keep British people, especially children, safe online.

Policy and portfolios across departments

One of the driving forces behind the creation of DSIT was to house science, innovation and technology under one department. Almost the full range of science and technology policy now falls into DSIT, except for universities which remain under the Department for Education.

Figure 2: Policy areas, Public Bodies, Councils brought under DSIT
Source: Gov.UK (2023), Onward research



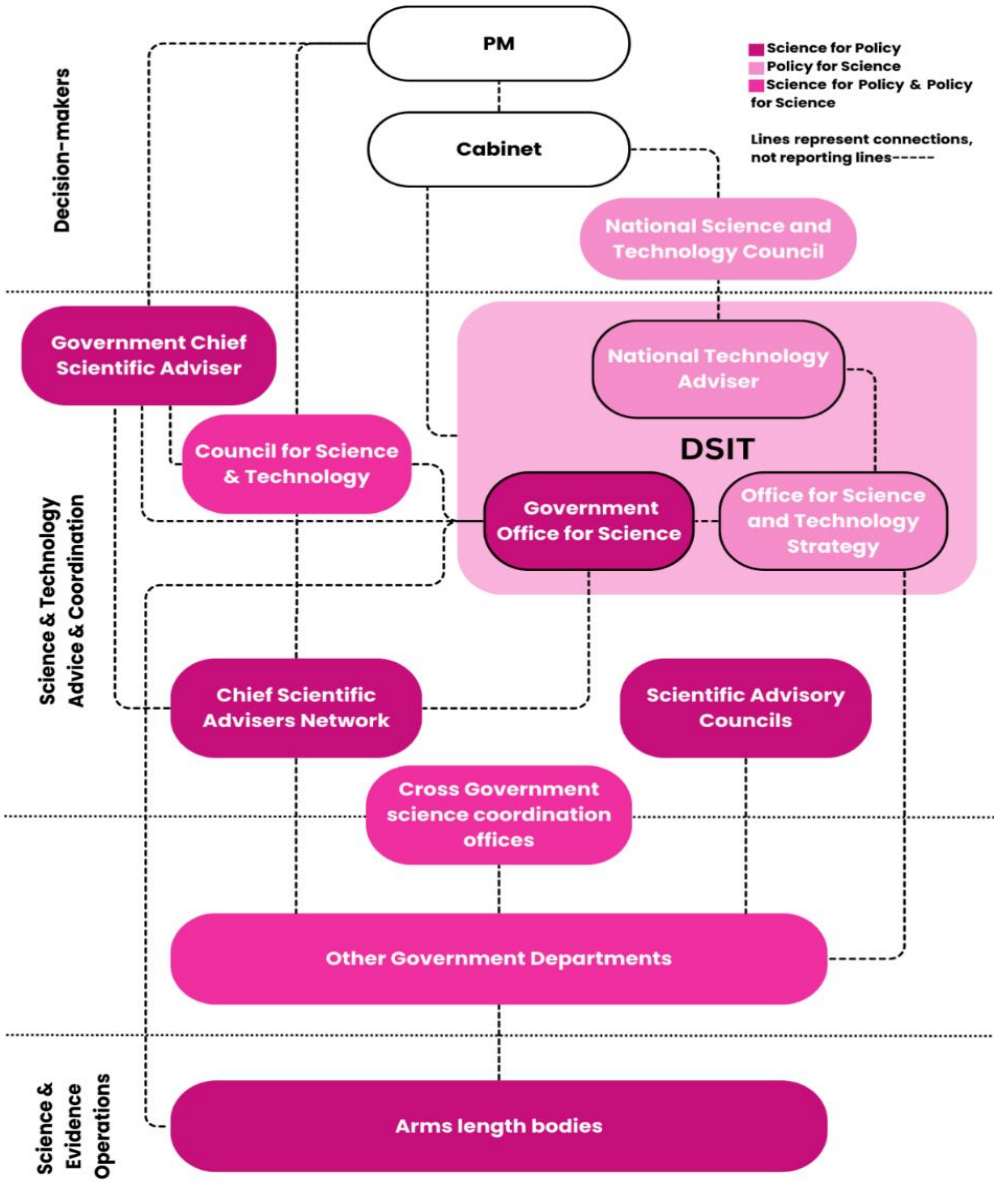
The National Science and Technology Council (NSTC)

The Framework reconfirmed the status of the NSTC as a Prime Minister-chaired Cabinet sub-committee "dedicated to matters relating to strategic advantage through science and technology." As a Cabinet sub-committee, the NSTC operates similarly to the National Security Council, with cross-Government decision-making authority and membership formed of senior ministers. In addition, the Framework set out that "[t]he NSTC is meeting monthly to consider matters across the Science and Technology Framework" – an ostensible upgrade on its frequency.[13] The DSIT Secretary and Chancellor of the Duchy of Lancaster are both named as deputy chairs.[14]

In her statement to Parliament, DSIT Secretary Michelle Donelan stated that "each of the ten framework strands has a lead Department tasked with putting in place a clear action plan, to which they will be accountable during the year. Delivery against those plans will be overseen by the National Science and Technology Council, which will hold Departments to account and drive pace."[15] The Framework also confirms that the DSIT Secretary will have a permanent seat on the National Security Council, underlining the Government's recognition of the national security and geostrategic importance of science and tech.

Figure 3: Organogram of Government bodies related to science and technology

Source: GOV.UK website and House of Lords Science and Technology Committee report (2023), Onward research



Implementing the Science and Technology Framework

The ten strands of the Science and Technology Framework are noted briefly below with the key activity (such as strategies and funding announcements) that have followed in each area.

1. Identifying the technologies most critical to the UK's objectives

The Framework sets an ambition to drive "strategic advantage" in five technologies:[16]

1. Artificial intelligence
2. Quantum technologies
3. Engineering biology
4. Future telecommunications
5. Semiconductors

While the Framework does not specify what building strategic advantage means, the Integrated Review Refresh elaborated: "the UK's relative ability to achieve our objectives compared to our competitors", giving the term a clear international character.

The rationale behind selecting the five priority technologies is not spelled out in the Framework. Instead, the Framework points to eight general criteria, calling it a "robust and repeatable approach to identify the technologies" without elaborating on the process further.[17] It also commits the NSTC to reviewing annually which critical technologies should be the Government's focus.

The Framework states that the Government must "be prepared to intervene to shape markets" in which these technologies sit. These interventions will be shaped by the Integrated Review's Own-Collaborate-Access framework, which "guide[s] strategic decisions on building and using capability in priority areas" of science and technology.[18] Each technology is to have its own cross-Government action plan – four of which have been published to date:

1. The AI White Paper (March 2023) focused predominantly on regulation. While new funding was largely absent it noted that the Government has "invested over £2.5 billion in AI since 2014."[19] The Integrated Review Refresh a few weeks later announced a taskforce on Foundation Models,[20] shortly followed by a commitment to an "initial" £100 million investment.[21] It did not focus on how the Government intends to build strategic advantage in AI, instead pointing to the 2021 National AI Strategy as the guiding document for the Government's overarching approach.[22]
2. The National Quantum Strategy (March 2023) is backed by £2.5 billion over ten years, marking a significant increase on previous commitments made in the 2017 Industrial Strategy of just £20 million.[23] The National Quantum Strategy has clear commitments for the £2.5 billion, including £70 million

for specific "missions", £100 million on focussed research hubs, and £20 million for acceleration programmes.[24] The Strategy's clearly articulated goals include maintaining a top three position in the quality of quantum science publications over the next ten years, possessing a 15% share of global private equity investment into quantum technology companies and a 15% share of the global quantum technologies market.

3. The Wireless Infrastructure Strategy (April 2023) makes the case for how not only will the UK be a world leader in 5G, but also in 6G, with £100 million to "pioneer future telecoms and 6G research."[25] The Strategy sets a headline target for the UK to have nationwide coverage of standalone 5G to all populated areas by 2030, and claims to set "a clear, coherent direction for 6G reflect[ing] our commitment to building [strategic] advantage and to maintaining the UK's position as a global leader in science research and innovation."[26]

4. The National Semiconductor Strategy (May 2023) was published many months later than expected.[27] It came with headline funding of "up to £200 million… over the years 2023-25 and up to £1 billion in the next decade"[28] and received mixed reviews by industry.[29] In an implicit reference to the comparatively lower figure of funding than other technologically advanced states, the DSIT Secretary made clear in her foreword that the UK's plan "is rightly differentiated from the approaches of other countries" and the UK is "instead focusing on what is best for the UK." Suggesting a more targeted approach, the document defines "particular areas of strategic advantage" the UK intends to focus on: design and intellectual property, compound semiconductors, and R&D.

5. An action plan on engineering biology is still due to be published. The Government did, however, publish a call for evidence in July running until September seeking views on "the key areas where it can best support engineering biology."[30]

2. Signalling UK strengths and ambitions

This strand covers communications, aimed at providing clarity and building credibility with industry and academia at home while also increasing confidence abroad in the UK's commitment to its science superpower ambitions. The Government belatedly delivered its commitment to launch the GREAT Technology campaign to promote UK technology to Silicon Valley,[31] with the Deputy Prime Minister Oliver Dowden declaring "our doors are open."[32]

3. Investment in R&D

The Government published Sir Paul Nurse's review of the research, development and innovation (RDI) landscape alongside publication of the Framework. The review sought "to identify improvements to the organisational research landscape

that are required to deliver the Government's ambition to be a science superpower."[33] Nurse emphasised that "stability and clarity in the Government's strategy for RDI…[is] essential for securing both long-term sustainable economic growth and increased inward investment to the UK." The review described ten attributes for a successful RDI landscape, with recommendations for strengthening the UK's delivery of each.[34]

4. Talent and Skills

Across academia, education, industry and the public sector, the Framework maps how science and technology skill gaps will be addressed. Actions include recruitment of academics and school teachers, programmes to train and upskill workers of all ages, and improving visa routes for high skilled workers. The Expert Exchange has also been established – a secondee programme to bring expertise from academia and industry into the heart of Whitehall.[35] The Science Secretary declared in March that DSIT was creating a Global Talent Network "to bring the best AI minds in the world to come and work in the UK."[36]

5. Financing innovative science and technology companies

The Framework commits to ensuring there is sufficient supply of capital to help scale innovative UK companies. This includes not only committing to cross-departmental collaboration to implement needed reforms and unlock private capital, but also backing the critical technologies with Government investment.[37] The Spring Budget included a commitment to reform R&D tax credits and new investment in AI, including through the newly announced Manchester Prize.[38]

In July the Chancellor set out details of the Mansion House Compact, which seeks to deliver on the Government's ambition to unlock private investment. The announcement included a pledge that several defined contribution pension funds would allocate at least 5% of their default funds to unlisted equities by 2030.

6. Procurement

The Framework focuses on other Government departments "creat[ing] a demand for innovation that can catalyse their buying power into economic growth," committing to work with the Cabinet Office on a cross-Government action plan that will be particularly focused on driving innovation in critical technologies.[39] This has yet to be published.

7. International Opportunities

The DSIT Secretary told Parliament on publication of the Framework that the crux of the Government's approach to science and technology internationally is to "shape the global science and technology landscape through strategic international engagement, diplomacy and partnerships."[40]

Published shortly after the Framework, the Government's International Technology Strategy mirrored this intent, with a commitment to focusing on the same five priority technologies as the Framework (plus an added sixth, data, that will underpin the others). The Strategy describes how the UK can deploy its hard and soft power to proactively influence the global science landscape to deliver growth and prosperity.[41] The International Technology Strategy underlines how it seeks to "build on" the science and technology vision outlined in the Integrated Review Refresh, published a few weeks earlier, by "strengthen[ing] our commercial success to cement our place as a S&T superpower."

DSIT has also sought to provide a backup solution to the ongoing issue of association with the EU's Horizon Europe. The publication of the Government's "Plan B" – termed "Pioneer" – is a detailed, £14.6 billion programme for what the UK will do if association talks with the EU fail.[42] The Windsor Framework – resolving the disagreement between the UK and the EU over the Northern Ireland Protocol – was agreed in February. However, with talks between the two sides still ongoing,[43] the Government extended its Horizon Europe Guarantee scheme by three months for a second time, to the end of September 2023.[44]

Three other agreements have been reached since the publication of the International Technology Strategy, delivering on the Government's stated priority of international technology partnerships. Although the pact with India does not indicate explicit, funded projects together, it commits to "enabling quicker, deeper collaboration on science" and "removing red tape standing in the way of major collaborations, while unleashing a raft of new joint research schemes."[45] Other agreements have been reached with Japan, announced during the G7 technology ministers summit in May,[46] and most recently with Canada.[47]

8. Access to physical and digital infrastructure

This pillar commits to ensuring Britain has the infrastructure needed to "attract talent and investment, establish anchors for innovation clusters and enable companies to scale." The Framework outlines the plan of action through mechanisms like public-private collaboration on "living labs" for applied R&D. There is also a clear intention for this to be UK-wide, and not focused in the so-called Golden Triangle of Oxford, London and Cambridge.[48]

Alongside the Framework, the Government published its Future of Compute Review written by Cambridge Professor Zoubin Ghahramani.[49] This was swiftly followed by a commitment in the Budget to spend £900 million to build an Exascale computing facility (a supercomputer with world-leading computing power of 1×10^{18} floating-point operations per second) as well as a programme to provide dedicated compute capacity for AI research.[50]

9. Regulation and Standards

Michelle Donelan stated that "[r]egulate to innovate is the culture I am bringing to my new department."[51] The Government states that it is seeking a third way between the US's laissez-faire approach and the EU's more restrictive one,[52] with a "pro-innovation" model that "attracts investment while representing UK values and safeguarding citizens."[53]

This approach is evident in the AI White Paper, which sets out five principles: safety, security and robustness; transparency and explainability; fairness; accountability and governance; and contestability and redress.[54] The Government rejected the idea of creating a standalone AI regulator, arguing this "could stifle innovation" and that it would take an "adaptable approach" to regulating AI.[55] Instead, the White Paper sets "best practice" guidance for existing regulators with a 12 month deadline for them to turn this into practical guidance, and suggests that Government may eventually enshrine these in primary legislation.[56]

The Government also published its response to the Vallance Review on technology regulation. The Chancellor noted that the purpose was "to establish the UK as the best regulated economy in the world in key growth sectors ensuring that industry and investors have the certainty, they need to drive innovation, investment and growth through anticipating new developments in emerging technologies." The Government accepted all of the recommendations, including the commitment to develop a multi-regulator "sandbox" for AI within six months.[57]

10. Innovative Public Sector

The final pillar of the Framework seeks to capitalise on the promises of innovation to deliver better public services. This includes the commitment to ensure "appropriate risk-taking", simplify and remove bureaucracy and have "agility to work with business and support strategically important sectors."[58] Initiatives have since been taken, such as a call for evidence released by the Education Department on how AI can be used to improve education,[59] and a new £21 million fund from the Health Department to roll out artificial intelligence across the NHS.[60]

Taking stock

Is Whitehall science superpower-ready?

There are four key tests to determine whether the Government has the right building blocks to become a science and technology superpower:

1. Centrality – is the Government prioritising science and technology?
2. Choices – is the Government accepting necessary trade-offs?
3. Coordination – is the Government working as one across departments and agencies?
4. Consistency – is the Government sticking to a strategy over time?

1. Centrality

The scale of the Government's science superpower ambition requires placing science and technology at the core of its agenda. To achieve this, the Government must put in sufficient investment, ensure ministerial attention and drive urgency. Progress also requires an appreciation of the intense geopolitical environment in which the UK is seeking to achieve these aims. Capabilities in cutting-edge science and technology are driving state competition, and some are engaged in "geoeconomics" – a systematic attempt to build economic dependencies by hollowing out competitors' domestic capabilities in key technologies.[61]

Measuring centrality means considering:

1.1 Is science getting attention from the PM and No.10?
1.2 Is science properly funded?
1.3 Is there long-term thinking on science?
1.4 Is science treated with urgency?

1.1 Is science getting attention from the PM and No.10?

The Integrated Review established the ambition to become a science and technology superpower by 2030.[62] It put "sustaining strategic advantage through science and technology" as the first pillar of its "Strategic Framework" to guide the Government as a whole as it navigates the national security and international challenges throughout the rest of the decade.[63] Science and technology is not placed as prominently in the Refresh. "Generating Strategic Advantage" is the fourth pillar of the Refresh's revamped Strategic Framework, with science and technology a core – but not the only – focus of this pillar.

In practice, the DSIT reforms themselves are indicative of the Government's increased focus on science and technology, most notably the creation of a new Government department dedicated to science, innovation and technology with a "top seat at the Cabinet table."[64] "Machinery of Government" changes do not occur without significant effort and intent from the Prime Minister's office. Yet the context is also noteworthy. Structural reforms rarely bring political gain. The political turmoil preceding Rishi Sunak's entry into Downing Street and the looming general election following 13 years of the Conservatives in power,

underline the limited political capital the Government enjoys. Making a significant "Machinery of Government" alteration in such circumstances, therefore, is evidence of the importance with which 10 Downing Street views the science and technology agenda.

Since then, there have been a number of instances of the Prime Minister focusing on the global issue of managing AI:[65]

- Sunak put AI front and centre of his visit to the G7 Leaders' Summit in May 2023.
- Sunak met with senior technology leaders to discuss AI regulation later that month.[66]
- Sunak made a trip to the US where he discussed his proposal with President Biden for the UK to host a global AI Safety summit in late 2023.
- There have been reports of senior members in the Prime Minister's team putting significant effort into AI.[67]

However, there are also signs that Prime Ministerial time has not kept pace with ambitions set in the Science and Technology Framework. The Framework stated that the National Science and Technology Council (NSTC) "is meeting monthly." Discussions with department officials suggest this has not been adhered to so far, with the NSTC only meeting sporadically since this commitment was stated in February 2023.

1.2 Is science properly funded?

The UK's R&D budget is increasing to record levels. The Government has committed to the budget reaching £20 billion across the UK by 2024-25 – a 30% increase in cash terms over the Spending Review period – with an ambition to reach £22 billion by 2026-27. The headline ambition in relation to GDP is economy-wide R&D investment of 2.4% of GDP by 2027.[68]

However, a statistical revision announced in late 2022 by the ONS means that the UK may already be hitting its 2.4% target.[69] The Government has claimed that applying this new methodology, the economy-wide R&D spending for 2020 would have been "between 2.6% and 2.7% of GDP for 2019 and between 2.9% and 3.0% for 2020."[70]

The 2.4% target was set in 2015, as it was the average among OECD members at the time.[71] But the OECD average is now between 2.9% and 3.0%,[72] while the UK's headline target remains 2.4%. The UK currently sits outside of the top ten of OECD nations, with nine spending more than 3% of GDP on R&D (see Figure 1 below).[73] In its response to a House of Lords Science and Technology Committee report earlier this year, the Government noted that "analysts are building on previous work…to review this target to ensure it is commensurate with the level of ambition that we have for the economy-wide investment in science."[74]

Figure 4: OECD Comparison of increase in Government R&D budget

Source: OECD Data (2022), Onward analysis

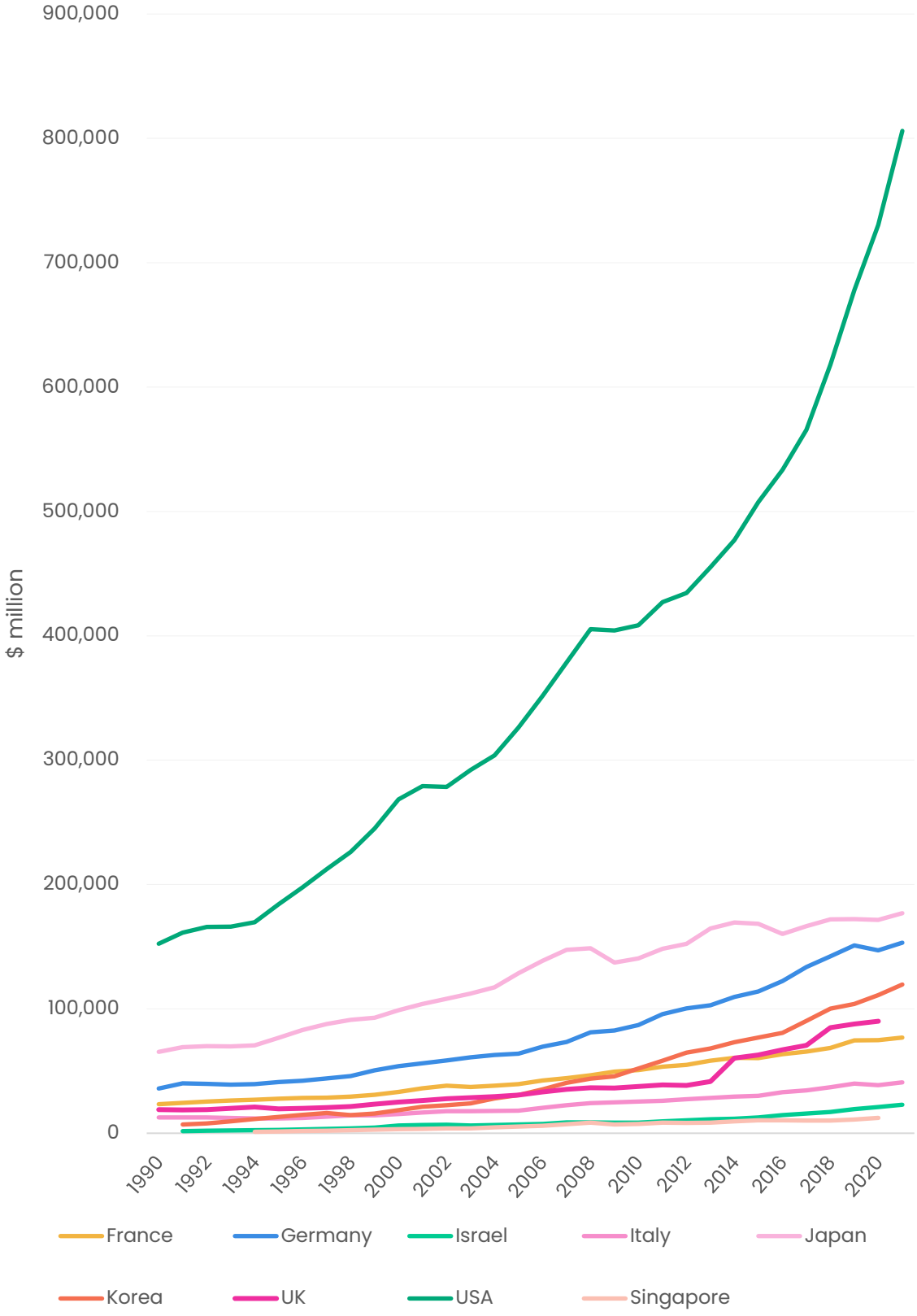


Figure 5: OECD Comparison of Gross Expenditure on R&D (GERD) as a Percentage of GDP

Source: OECD Data (2022), Onward analysis

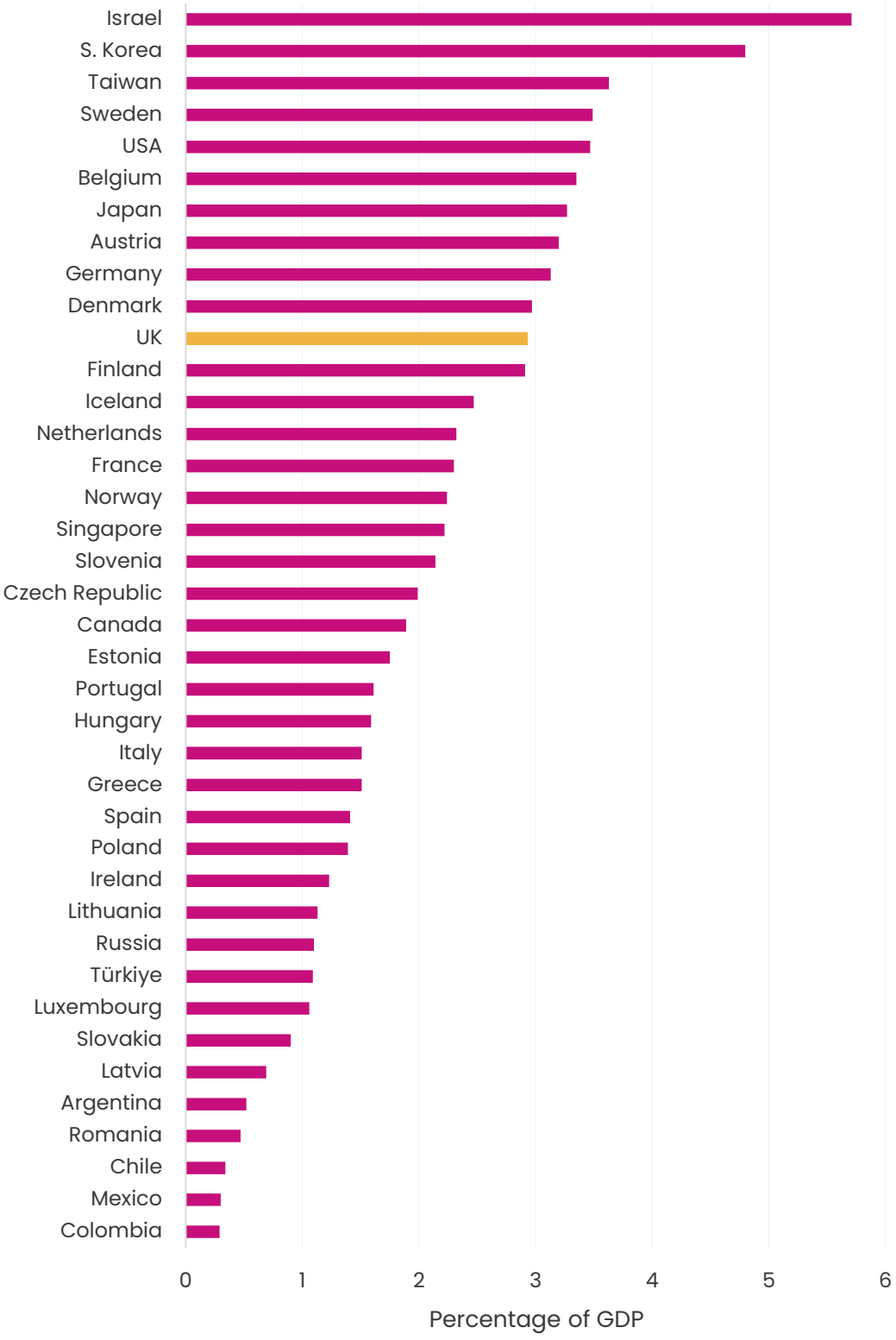
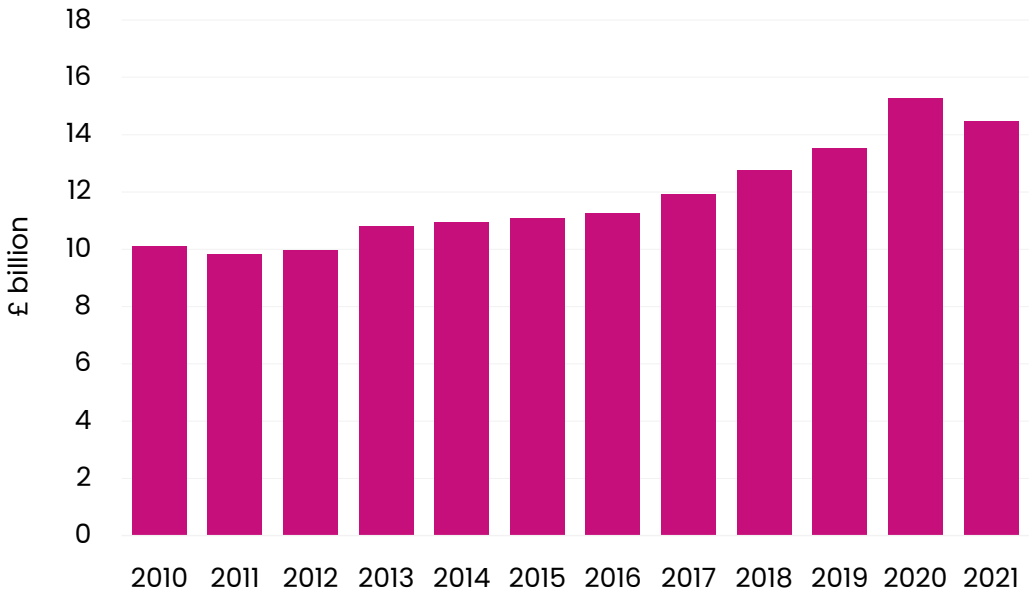


Figure 6: United Kingdom R&D Total Budget by Year

Source: ONS data (2023), Onward analysis



1.3 Is there long-term thinking on science?

The Science and Technology Framework commits the Government to coming forward with action plans to protect its strategic advantage in the priority technologies from being undermined by state actors.[75] This underlines the increasingly intertwined nature of science and technology with the UK's national security concerns.

The Government's inability to identify challenges ahead in the global technology landscape has been a weakness in the past. This is perhaps most evident with the UK Government's U-turn on Huawei in 2019.[76] The National Cyber Security Centre's opinion that China's dominant telecoms company Huawei was not a security risk was no doubt true in the short term.[77] Yet longer-term, Huawei's ostensible attempts to achieve near-monopoly power over 5G would have only increased in coming iterations of the technology.

The UK's agreement to allow Huawei to provide the core technology in Britain's 5G communications would have risked the UK's telecommunications market eventually becoming monopolised by a company legally bound to obey commands by the Chinese state where it claims security concerns.[78] The Government eventually reversed its decision and is now enforcing the removal of Huawei from UK 5G networks by the end of 2027,[79] which was triggered largely as a result of a Conservative backbench revolt.[80]

The Government has attempted to address this lack of strategic foresight. The Integrated Review in 2021 committed to "establish new [science and technology] horizon-scanning, assessment and policy capabilities" to identify future opportunities and challenges.[81] In 2022, Sir Patrick Vallance, then Government Chief Scientific Adviser, wrote that the Technology and Insights Team within the Government Office for Science (GO-Science) provides the Government with "independent objective assessments of the UK's science power, and the potential of emerging technologies, to identify strategic opportunities and risks."[82] And the Integrated Review Refresh in March this year committed to "bas[ing] more staff overseas to enhance our cooperation with partners… to understand and respond to the challenges posed by the rapidly changing technological and geopolitical environment."[83] It also committed to "developing our horizon-scanning capabilities and investing in more open partnerships with the technology sector."[84]

Early signs of progress on building ties with industry are apparent. At London Tech Week the Prime Minister announced that frontier labs had granted the UK Government "early access" to "help build better evaluations and help us better understand the opportunities and risks of these systems."[85] With commercial labs increasingly at the forefront of cutting-edge technology development,[86] more initiatives like this for other key technologies being developed by industry will be vital. The Technology and Insights team should play a central role in identifying where there is most need for stronger industry links.

There are early signs, too, that the Government has improved its technology intelligence functions. A specific subsection of the Technology and Insights team is focused on international technology intelligence, working with the Joint Intelligence Organisation (JIO) in the Cabinet Office which also provides intelligence assessments which involve evaluating emerging technologies.[87] But the JIO's remit is necessarily broad, encompassing the full geopolitical and domestic national security threat picture, and it is not able to focus closely on long-term technological trends and their implications. Resourcing and focus on technology intelligence across the Government is therefore spread relatively thin – a concerning situation considering the vital importance of the UK's long-term interests.

Practical application of the Government's technological assessments is also unclear. The Own-Collaborate-Access (OCA) framework could be an instructive framing guide which can inform decision-making over Government's investment and security measures for specific technologies. However, when prompted by the House of Lords Science and Technology Committee on the OCA framework, the Government conceded that it is merely a "concept" to help the Government make choices rather than practically applicable.[88] The ongoing uncertainty as to how the Government is applying this is therefore a weakness it should address.

1.4 Is science treated with urgency?

DSIT was set up to do things differently. Science Minister George Freeman's portrayal of a more lean and agile department than the usual Whitehall monoliths is the right direction of travel.

There are welcome signs of progress. The Foundation Model Taskforce is being led by an industry expert, Ian Hogarth, backed by £100 million, and is to be "modelled on the successes of the Vaccine Taskforce, operating with the same agility and delegated authority so the Chair and Taskforce are empowered to take forward work and make decisions at pace."[89] Further, an "Expert Exchange" was announced in April this year, a secondment programme "to bring cutting-edge expertise [into DSIT] from UK academia and industry to drive momentum on some of the most important research and technologies of the future."[90]

Action to improve public procurement is also promised in the Science and Technology Framework. In the summer of 2022, the Lords Science and Technology Committee noted that the need to drive value for money which is built into the UK public procurement system is often not well-suited to innovation. It noted the Government's intent but concluded that "there are few details on how public procurement rules will change." In a move to address this, the Framework commits to developing a "cross-Government action plan" to drive innovation through procurement.[91] However, as yet no plans to address this have been forthcoming.

There is a pressing need to relieve the procurement bureaucracy from important purchases. The procurement of exascale computing power noted above is a key example. The Future of Compute Review published by the Government earlier this year sets out that compute power is a crucial component of the UK's science and technology ambitions.[92] Yet the recently announced £900 million project to build an exascale computer looks set to go through the standard procurement process,[93] meaning it will be years until the UK has the required compute power.

Business case reform is also vital. Former Science Minister David Willetts has argued that the business case system is one of the main impediments to the Government moving quickly on delivering its science and technology priorities.[94] He outlines how the business case process set by the Treasury's Green Book consists of five separate streams of work to assess separately the economic, financial, commercial, management, and strategic elements, each with their own official "key-holder" who often asks for more information and more assurance. The whole process, according to Willetts, can take well over a year: one senior official he spoke to assesses the time from the original idea to execution to be over two and a half years, with 13 specific approvals.

The ARIA model is an attempt to overcome this cumbersome model, with a single business case to delegate its entire funding envelope. Instead of the business case

process dividing strategic decisions into a variety of smaller programmes for individual assessment, a single business case for the programme is used. This would also reflect how venture capital operates – making a range of investments across a portfolio recognising that only some will succeed – allowing the Government and its agencies to have a greater appetite for risk.

Demand for lab space is also increasing at a rate far outstripping supply. Between Oxford and Cambridge alone the lab space deficit is nearing 2 million square feet (see Figure 7). And demand is only increasing, with almost half of R&D companies looking to extend their facilities by 2026 (see Figure 8). Other innovation hubs around the world are expanding rapidly in an attempt to meet their increasing demand challenges, with Greater Boston set to add 14.4 million square feet of new lab space by the end of 2024.[95]

Insufficient lab space will constrain one of Britain's biggest growth opportunities. The Oxford-Cambridge Arc's knowledge-based economy alone is set to grow to £235 billion by 2030 and will support two million jobs.[96] Failure to address the lab space deficit will result in the UK economy missing out on an estimated £50 billion of GVA by 2030.[97]

Figure 7: Laboratory requirements and supply in Oxford and Cambridge
Source: Bidwells data (2021), Onward analysis

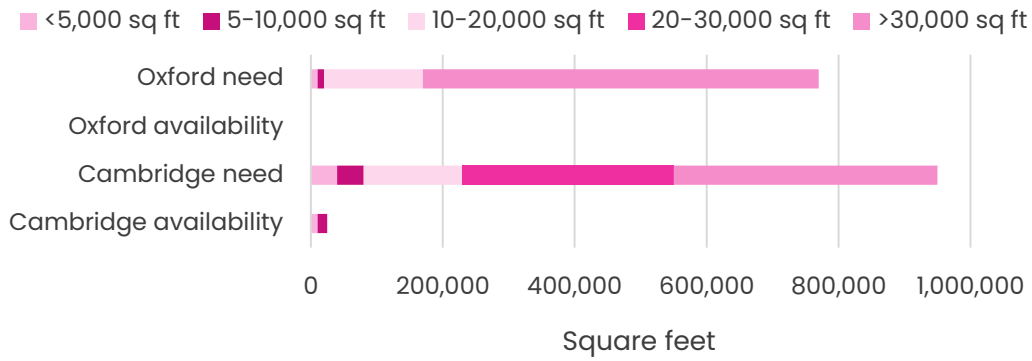
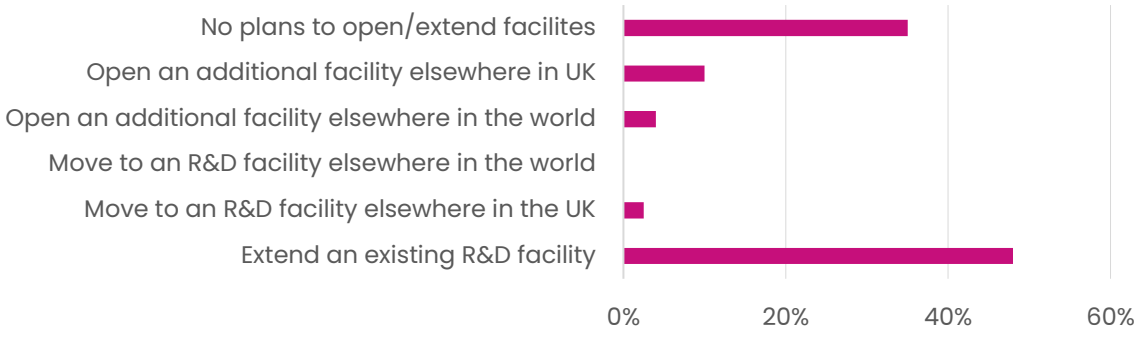


Figure 8: Five year plans of large R&D companies with a UK base
Source: YouGov/Bidwells R&D Business Survey data (2021), Onward analysis



The Science and Technology Framework sets out ambitions to "increase infrastructure capacity."[98] And the Government more recently announced that it will look to update the National Policy Planning Framework (NPPF) to require local plans to "pay particular regard to R&D needs" including lab space.[99] But this is a relatively minor adjustment, and currently only part of a consultation.

On many fronts the Government continues to approach key science and technology goals with a "business as usual" mindset. If the Government wants to build strategic advantage over its competitors, it must remove these barriers to progress.

2. Choices

The Government must make choices, both in the role it intends to play and what it prioritises. It must demonstrate a clear strategy on how it plans to bring together levers and funding from outside DSIT to support its science ambitions. Without an explicit, coordinated approach to driving innovation via industrial strategy too many science and technology policies risk falling short.

Other nations have realised this. China has been pursuing its "Made in China 2025" plan for a number of years now.[100] The US has its $52.7 billion CHIPS and Science Act.[101] And Germany has its €40 billion (£34.4 billion) "Industry 4.0" plan.[102] As each of these strategies demonstrate, to build an absorptive capacity – the ability to commercialise cutting-edge technologies across the economy – the full power of the state is needed, across planning, energy supply, skills, attracting talent from abroad, and harnessing advanced manufacturing capabilities to scale.

The second aspect of this test is prioritisation. Put simply, to have a strategy is to choose. The UK is a middle power nation in a tight fiscal context, with limited natural resources and comparatively small population. This means that the Government must make trade-offs. Policy priorities call for choices, where the delivery of other Government pledges inevitably clashes with the science superpower agenda – such as the potentially competing goals of managing net migration with attracting science and technology talent.

Measuring choice means considering:

2.1 Is there clear communication of the Government's science strategy?
2.2 Are clear choices being made and trade-offs accepted?
2.3 Are resources being targeted behind these specific choices?

2.1 Is there clear communication of the Government's science strategy?

The UK's industrial strategy today is opaque. As MakeUK CEO Stephen Phipson recently argued, "Every other major economy, from Germany to China to the US, has a long-term national manufacturing plan [underlining] the importance of an

industrial base to the success of its wider economy. The UK is the only country to not have one."[103]

But an industrial strategy of sorts exists. In January this year, Chancellor Jeremy Hunt outlined the Government's "five growth industries."[104] Science and technology play a prominent role, with AI and advanced robotics as two of the five pillars. However, when combined with the five technologies identified in the Science and Technology Framework, criticism has arisen for it being "a slightly odd mixture of specific technologies and whole industry sectors."[105]

Beyond simply being explicit, a successful industrial strategy requires clear choices, too. As the BEIS Select Committee noted in its criticism of Theresa May's Industrial Strategy Green Paper in 2017, it failed to discuss "the implicit tensions and conflicting demands that exist in policy making." In other words, it was ill-prepared to make the important choices between Government policies which do not always align. Any future industrial strategy must have a clear-eyed assessment of what it is choosing, and what it is therefore not.

Industry bodies in the science and technology community have called for an "innovation-led" industrial strategy. Being focused on innovation would ensure resources were targeted at commercialising cutting-edge advancements in the Government's stated priority technologies for specific purposes. As AIRTO, the industry body for the research community, argues, "it is only through prioritising innovation that the UK is going to face down the big challenges facing our global society, such as the climate emergency and maintenance of a productive economy." It makes the case for an innovation-led industrial strategy, arguing that "[a]dopting an innovation-led Industrial Strategy is not simply about creating the conditions to encourage invention to thrive; it is also about stimulating process innovation in identified mission-critical areas and ensuring that knowledge originating in the UK is harnessed by the market for the benefit of UK plc."[106]

The Government has already recognised the importance of innovation-led missions. As part of its planning for Pioneer, the backup plan in the event that the UK does not associate with Horizon, UKRI has been canvassing the science community for ideas on "innovation moonshots."[107]

2.2 Are clear choices being made and trade-offs accepted?

There has been significant progress in the communication of the Government's science and technology goals. The five foundational technologies have been clearly established, with action plans for each providing further detail. These plans serve to clarify cross-Government action while linking clearly to other documents, like the International Technology Strategy.

Yet how the Government settled on these five technologies is unclear. The Framework points to a "robust and repeatable approach" against eight criteria – but no further explanation is given. To have confidence in the Government's

assessments, more detail on this process is needed, with clear explication of the perceived trajectory and possibilities of these technologies.

The Framework states that "building strategic advantage" in each of the five priority technologies is the underpinning ambition, yet how it intends to achieve this is not always apparent. The National Quantum Strategy provides clear goals, explicit deliverables with set deadlines, and a clear definition of "strategic advantage" which places goals within an international context. But neither the AI White Paper nor the National AI Strategy set out how the Government intends to build "strategic advantage" in artificial intelligence.

The Own-Collaborate-Access framework is not used to provide clarity on how the Government views each of the technologies in national security terms. Again, there is no clarity on which of the three categories AI fits in the AI White Paper or the National AI Strategy. On quantum computing, the National Quantum Strategy too is not explicit on whether the UK intends to own or collaborate on quantum capabilities – as per the framework – stating only that "it is not in the UK's interests to rely purely on others for access to these critical technologies."[108]

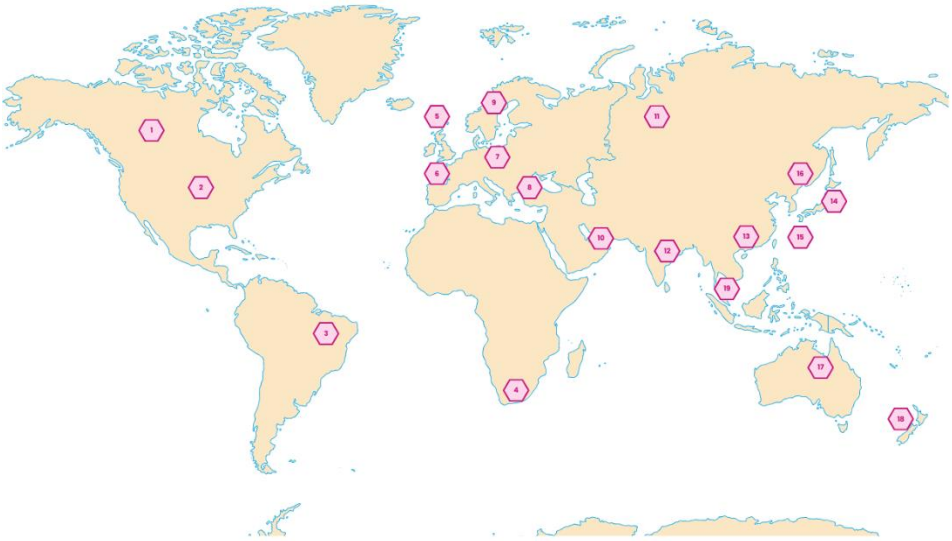
More clarity is available for semiconductors, with the Government stating that it seeks to "access" semiconductors generally. Through international agreements, it seeks to "collaborate" in semiconductor endeavours such as "facilitat[ing] the mutual exchange of our skilled researchers, academics, students and engineers."[109] In narrow specific circumstances it seeks to "own" them, by doubling down on "particular areas of strategic advantage" in three areas - design and intellectual property, compound semiconductors, and R&D.[110]

2.3 Are resources being targeted behind these specific choices?

Action plans across the five technologies have been paired with significant investment. The UK's National Quantum Strategy commits to investing £2.5 billion in quantum technologies over the next 10 years – making the UK the fourth largest funder of quantum technologies in the world.[111]

Figure 9: International Comparison of Government Funding in Quantum Technologies

Source: Forbes data (2023), Onward analysis



1. Canada $1,6 billion
2. USA $3,7 billion
3. Brazil $11 million
4. S. Africa $3,2 million
5. UK $3,2 billion
6. France $2,3 billion
7. Germany $6,4 billion
8. Israel $435 million
9. Austria $127 million
   Switzerland $120 million
   Spain $67 million
   Hungary $11 million
   Netherlands $904 million
   Sweden $160 million
   Finland $84 million
   Denmark $34 million
   Ireland $13,5 million
10. Qatar $10 million
11. Russia $790 million
12. India $1,1 billion
13. Japan $1,8 billion
14. China $25 billion
15. Taiwan $282 million
16. S. Korea $52 million
17. Australia $98,5 million
18. N. Zealand $36,7 million
19. Singapore $121,6 million
    Thailand $6 million

While the AI White Paper does not cover funding, the £900 million to be invested into a ground-breaking exascale supercomputer and a dedicated "AI Research Resource" is substantial. This comes alongside the "initial" £100 million for the Foundation Model Taskforce.

However, the Government underperforms in other areas. Its funding behind the semiconductor strategy – £200 million by 2025, £1 billion by 2030 – pales in comparison to that of the US and the EU's, at £42.5 billion[112] and £37.9 billion[113] respectively. Weighting these sums to economy size, this would equate to £6.15 billion for the EU and £4.97 billion for the US. The UK's semiconductors funding is therefore in the magnitude of between a fifth and sixth that of equivalent international comparators. This £1 billion is also only a hundredth of the budget of leading chip manufacturer TSMC's planned capital expenditure over the three years since 2021.[114] Even if the UK is seeking to build "world leading strengths" in narrow areas of the semiconductor pipeline, as the Government's strategy states,[115] it is difficult to see how the UK can become world-leading when its funding is several orders of magnitude smaller than its peers.

3. Coordination

Becoming a science superpower relies on the state acting as a coordinated collective rather than a disjointed and disparate group of entities pulling in

opposing directions. There must be clear lines of ownership, accountability and responsibility across Government. And significant political power must be deployed to drive this coordination, given Whitehall's history of department tribalism and interdepartmental disputes.[116]

Beyond Whitehall, it means the many facets of the state pursuing the same overarching objectives — or at the very least not pursuing policies that are actively at odds. This is especially important when it comes to arms-length bodies like regulators and key science bodies who the Government has less direct power over.

Measuring coordination means considering:

3.1 Is there clear ministerial and departmental ownership of science and technology policy and funding?
3.2 Is there senior political ownership and coordination efforts from centre of government?
3.3 Is there alignment with activities of broader facets of government?

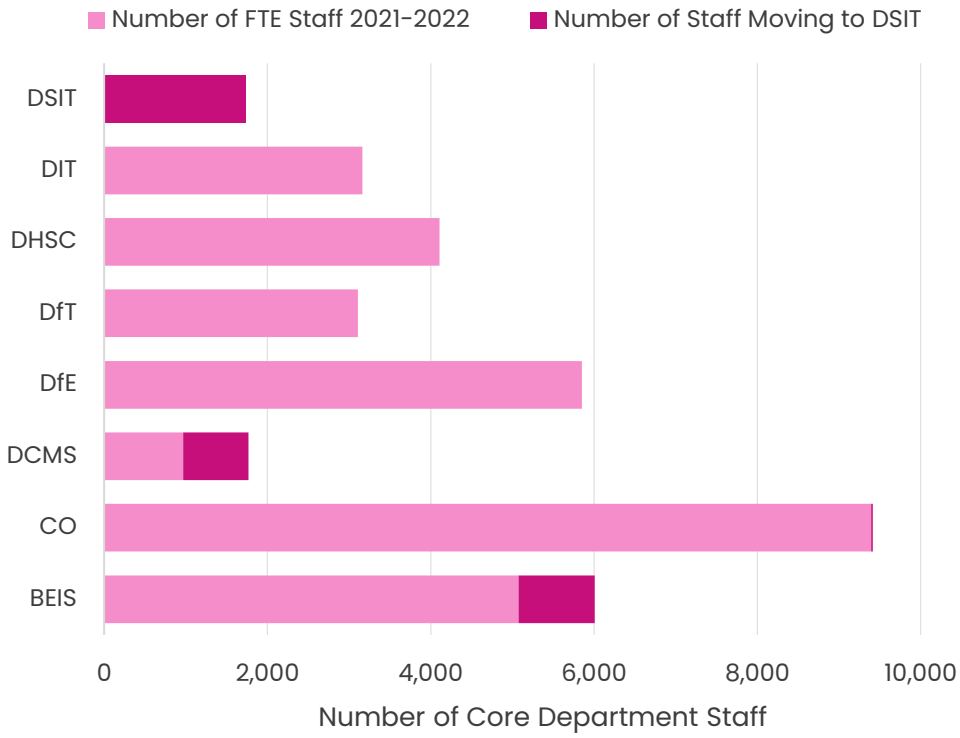
3.1 Is there clear ministerial and departmental ownership of science and technology policy and funding?

The creation of DSIT means there is clear ownership of the science agenda within Government. Dominic Hallas, director of technology startup industry body the Startup Coalition, stated DSIT "should be free to create approaches that unashamedly back innovative technology and science to transform our economy and make the case for them in government."[117] It is also important that the Department is agile and adaptable given the rapidly changing disciplines it is responsible for – what Minister Freeman calls a "startup mentality."

But this agility could come at a cost, with a more streamlined department at risk of having less influence across Whitehall, particularly given its relatively low headcount. Smaller teams might limit the ability of DSIT to deliver across a particularly wide range of departmental responsibilities, and slow lengthy spending approval processes that need to go through Treasury and often be agreed by other (bigger) departments. Drive and focus from ministers and senior DSIT officials will be key.

Figure 10: Comparison of Government Department Core Staff Numbers

Source: GOV.UK Data (2023), Onward analysis

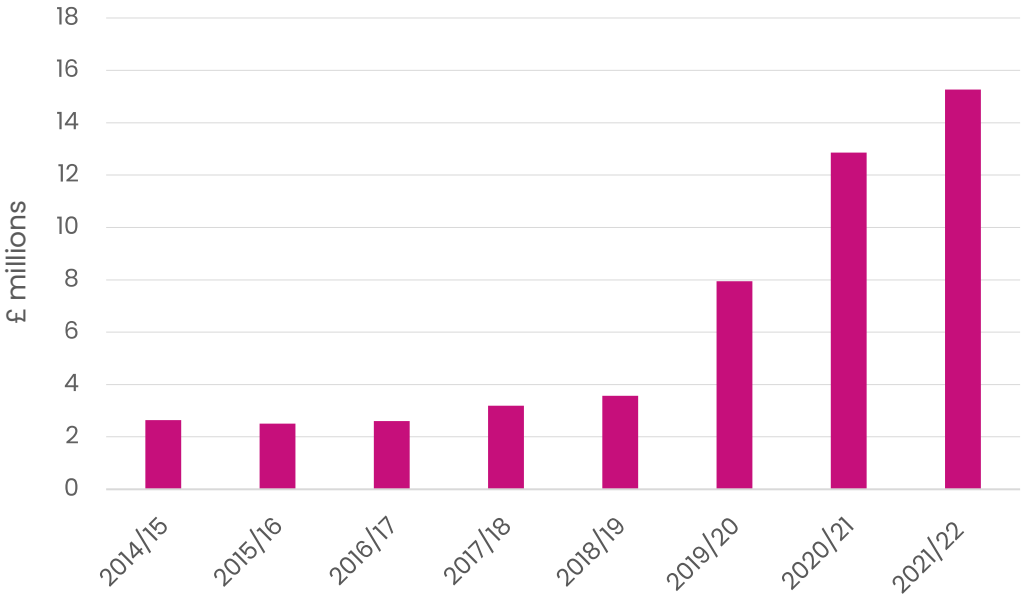


Universities remaining in the Department for Education (DfE) is also problematic. Universities play a central role in driving UK innovation, hosting vital research and training the researchers and technicians who drive the innovation process. Former Science Minister David Willetts has described the split between DSIT and DfE as "very dysfunctional" and has been supported in this criticism by the Chief Executive of the British Academy Hetan Shah.[118] [119]

Universities are also crucial to the commercialisation of research into the economy. Analysis from the Social Innovation Monitor suggests that out of 274 UK incubators and accelerators, 80 were associated with universities.[120] In 2021-2022, there were 21,162 active university-rooted spinouts, startups and social enterprises registered in the UK, employing over 100,000 people, according to recent HESA estimates.[121] This dynamism translates into economic growth with the estimated turnover of these firms exceeding £15 million in 2021-2022.[122] Compared to 2018-2019, this amounted to an increase in turnover of 75% for startups and 89% for spinouts.

Figure 11: Estimated turnover of all active university startups, spinouts, and firms

Source: HESA data (2023), Onward analysis



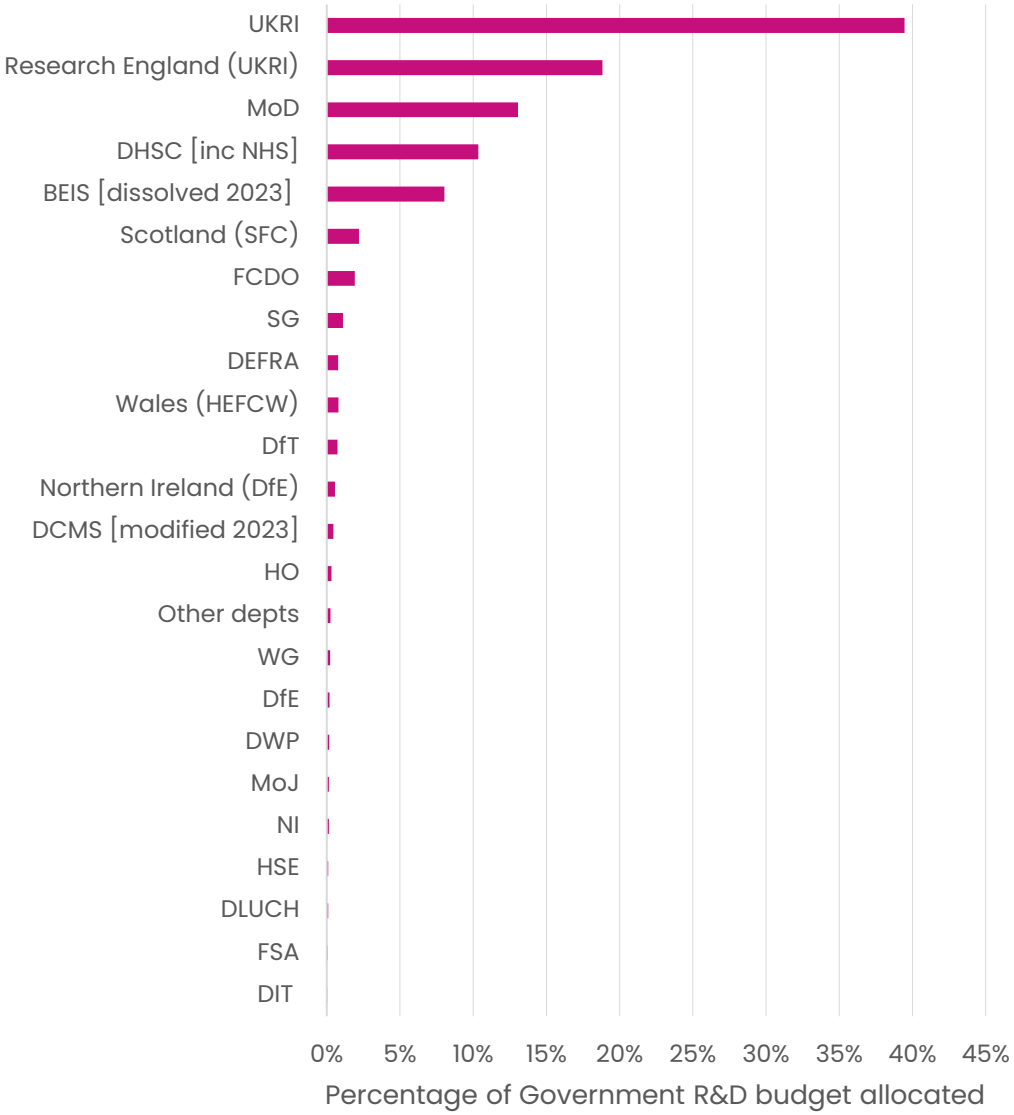
Funding is critical to fully realise the innovation potential of universities. There is an estimated gap of £4.3 billion between the funding universities receive for research and what they actually spend on it.[123] This has been aggravated by the drop in European research funding following the UK's exit from the EU: the Universities of Oxford and Cambridge combined saw a drop from £130 million annually to around £1 million.[124] Fees from international students are used to plug this gap and cover research needs. Having the innovative capacity of the UK's universities heavily reliant on income from international students is unhealthy – the UK's science ambitions should not rely on student intake.

Finally, a combined departmental budget for science and technology is a vital innovation. But there is little clarity on Whitehall R&D budgets. The Government has noted that "[t]he majority of BEIS R&D funding has been allocated to Department of Science Innovation and Technology, except for policy areas where responsibility sits with another Secretary of State."[125]

The BEIS R&D budget for 2024/25 was roughly 70 per cent of the Government's R&D budget as a whole,[126] meaning the remaining 30% per cent therefore is administered via other government departments. In January, Science Minister George Freeman described an informal, cross-government forum that had been set up recently to help departmental R&D spend.[127] But beyond this, no formal mechanisms are in place to ensure cross-government join-up.

Figure 12: Percentage of Government R&D Budget Awarded per Department or Body

Source: ONS Data (2023), Onward analysis



The removal of science and research from the Department for Business and Trade (DBT) may also create challenges. As argued above, science and technology is of central importance to the UK's economy, and delivery of the UK's science and technology policies depend on a coordinated industrial strategy. In a modern, successful economy, all sectors should be technology sectors. There must therefore be strong collaboration across DSIT and the DBT if the Government is to deliver on its science superpower ambitions.

3.2 Is there senior political ownership and coordination efforts from centre of government?

Creating a new cabinet position of Secretary of State for Science, Innovation and Technology provides a voice for science at the Government's top decision-making forum. It is welcome that the Framework delineates DSIT's cross-Government role. Naming departments who are responsible for each strand and tasking them with developing an action plan to which they will be held to account will drive accountability and coordination. The NSTC will play a key role in monitoring progress by ministers and their departments.

This cross-government coordination role was the underlying conception behind the creation of the NSTC, which has been widely regarded as crucial. On hearing of the move to disband the NSTC by Prime Minister Liz Truss in September 2022, the House of Lords Science and Technology Committee wrote to urge her to reconsider, noting that "[a] coherent and consistent strategy for science and technology coordinated across government departments is vital for economic growth and to tackle the many challenges we face."[128] The Nurse Review too noted that "[t]he NSTC has the potential to improve alignment and reduce barriers on those issues over and above existing roles and responsibilities of Departments, including facilitating agreement and co-ordination across Government, for matters that are not currently examined or decided elsewhere."[129]

However, as noted above, it seems that the NSTC has not been utilised sufficiently for this purpose in recent months. Discussions with officials suggest that very few NSTC meetings have been held since DSIT's creation, falling far short of the monthly commitment made at the beginning of the year.

There is also an outstanding question over the Office for Science and Technology Strategy (OSTS), now the Strategy and Implementation Team. Moving this team out of the Cabinet Office and into DSIT could denude its ability to provide a central department-corralling function – when it speaks, it may now be perceived by other departments as speaking for DSIT, not as a central arbitrator. However, this team still ostensibly provides some "centre of government" functions such as supporting the NSTC's work across the Government.[130]

There is the potential, therefore, that the DSIT Strategy and Implementation team could bring the best of both worlds. With the DSIT Secretary now one of the deputy chairs of the NSTC, this could provide her with a body to corral the rest of Whitehall by setting a clear agenda and following up on progress. Yet the success of this largely depends on there being sufficient power placed behind the NSTC.

3.3 Is there alignment with activities of broader facets of government?

Government extends beyond the corridors of Whitehall. Regulators and the science community are vital players over whom ministers have limited influence or control.

Regulators play a key role in science and technology. TechUK estimates that "around 96% of technology sector output and 81% of exports is in services, where regulation is vital for the research, development and then deployment of digital services."[131] Digital regulation can offer clarity and confidence to investors, businesses and the public. Science Minister George Freeman has argued that the Government's strategy is explicitly not to compete in the subsidies race but instead establish the right regulatory ecosystem.[132]

The Government rightly accepted Sir Patrick Vallance's recommendations in his review on technology regulation. Important initiatives like regulatory sandboxes will help to drive innovative approaches to regulating emerging technologies. Yet many of the recommendations are sector-specific, and the Vallance Review does not dig into the deeper issue of whether the Government's relationships with the various regulators involved in digital and technology are right.

Communicating policy objectives formally to regulators is an important way the Government can guide their activity. Often there is a legal requirement for the regulator to have due regard to formal strategic steers. However, the use of this function by the Government has not been sufficient in recent years. The Government last furnished Ofcom with a "Statement of Strategic Priorities" in 2019, when Theresa May was Prime Minister.[133] The Competition and Markets Authority's (CMA) strategic vision was also last updated in 2019.[134]

This is beginning to change. The Wireless Infrastructure Strategy noted that Ofcom is due to have its strategic priorities updated soon.[135] A consultation to update the CMA's closed in June this year.[136] Ensuring the Government uses these revisions to ensure the right balance is found between regulating to protect consumers and markets while driving its "regulate to innovate" agenda is vital.

The Chancellor has also recently questioned the CMA's commitment to its "pro-innovation" role. Just days after the Deputy Prime Minister Oliver Dowden declared "our door is open" on the launch of the Government's campaign to attract US technology firms, the CMA blocked a merger between Microsoft and Activision, leading the Activision CEO to say this signalled Britain is "closed for business."[137] The EU competition regulator made matters more complicated by going against this decision and approving the merger, leading.[138] The Chancellor warned the CMA to be mindful of its "wider responsibilities for economic growth."[139]

In Sir Patrick Vallance's review of technology regulation, he noted fragmentation as a key issue, pointing to the "significant burden" it puts on companies to either have to engage with multiple regulators or are unclear on which regulators they need to approach.[140] In 2019, the House of Lords Communications and Digital Committee identified at least thirteen statutory and non-statutory bodies with remits for online regulation in some form.[141] In the same report, the Committee concluded that "the digital world does not merely require more regulation but a different approach to regulation."[142] This led to the creation of the Digital

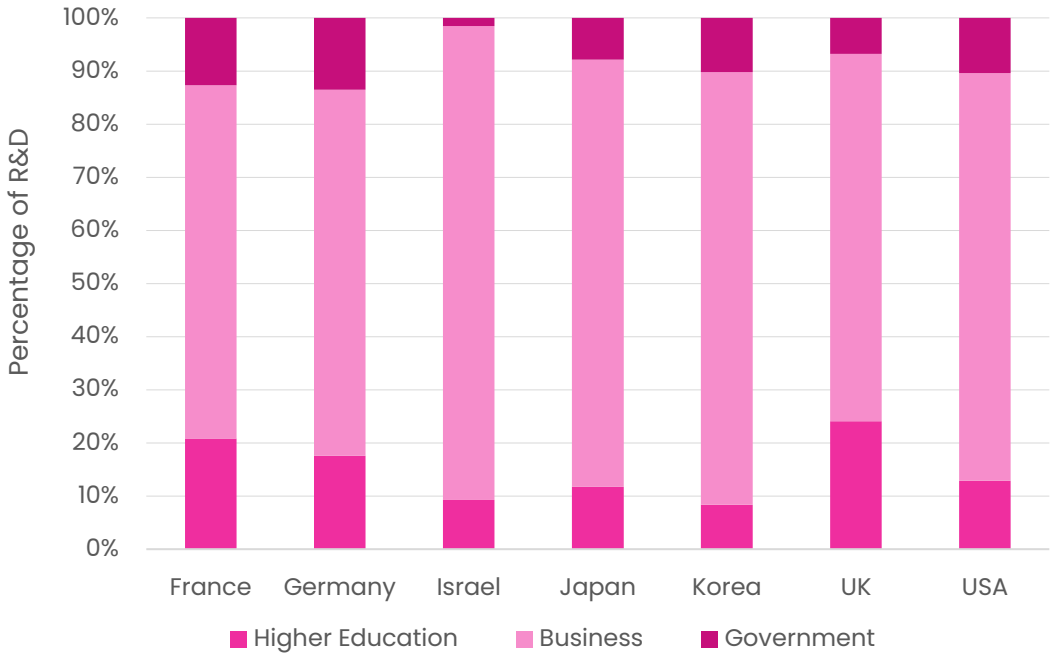
Regulation Cooperation Forum (DRCF) in July 2020, which the Government has recently described as an "important step in creating a more coordinated regulatory landscape."[143]

But the DRCF is limited in its ability to coordinate. It is a voluntary, non-statutory body, with no power to direct its members, and is not accountable to Parliament. Its membership consists of only the Information Commissioner's Office, Office for Communications, CMA and the Financial Conduct Authority. It is therefore limited in its ability to coordinate the actions of its four members.

Coordination between the Government and the wider science community is key too. As Sir Paul Nurse made clear in his independent review of the science landscape earlier this year, "[T]he UK's RDI landscape is the product of decisions taken over many years and reflects changing, sometimes short-term, public policy priorities and initiatives, and varied approaches to public funding of research."[144]

Figure 13: International Comparison of the percentage of domestic expenditure on R&D performed by sector

Source: OECD Data (2022), Onward analysis



A report in 2022 found that UKRI – an arms-length body of DSIT, responsible for managing the dispersal of the majority of the Government's R&D budget (see Figure 12) – has a number of issues. The report argued that it had "partially met the objectives set out in the framework document but that gaps remain," pointing to key issues like a lack of clarity over the fundamental relationship of UKRI with the organisations sitting below it.[145] It also argued that there should be clearer lines of

responsibility between UKRI and its sponsoring department (then BEIS, now DSIT) on strategy and delivery, as well as the criteria used to assess performance.[146]

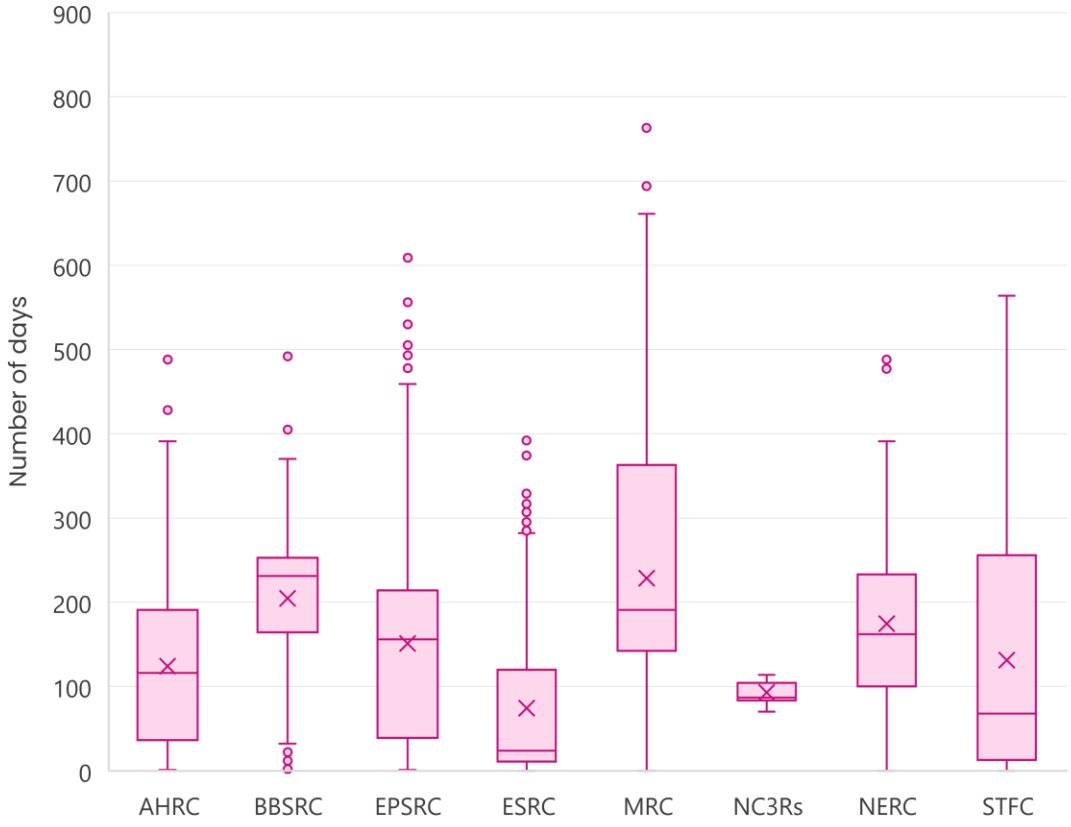
In his response to the Grant report, then Business Secretary Kwasi Kwarteng underlined the importance of "accelerating UKRI's programme to harmonise and integrate the operations of its constituent councils, maximising the benefits of being a single organisation."[147] Yet significant attempts to achieve this remain to be seen.

More is needed to cut through bureaucracy to ensure funding gets to key projects quickly. Harvard economist Wei Yang Tham's research suggests delays in funding allocation can significantly impact how research organisations allocate their investment. Labs that anticipate funding delays or interruptions were found to spend an average of 26% less, but as low as 94% less, per month compared to uninterrupted labs.

UKRI data shows that there is considerable variance in research funding decisions between the different research councils that make up UKRI (See Figure 14). The Economic and Social Research Council (ESRC) has the quickest decision times, taking 76 days on average. The Science and Technology Facilities Council (STFC) takes an average of 132 days. The longest is the Medical Research Council (MRC) with an average of 230 days.[148] Scientific fields that have practical, environmental and healthcare applications tend to have longer waiting times.

Figure 14: Time taken between application to research council to a decision being taken (April 2021-March 2022)

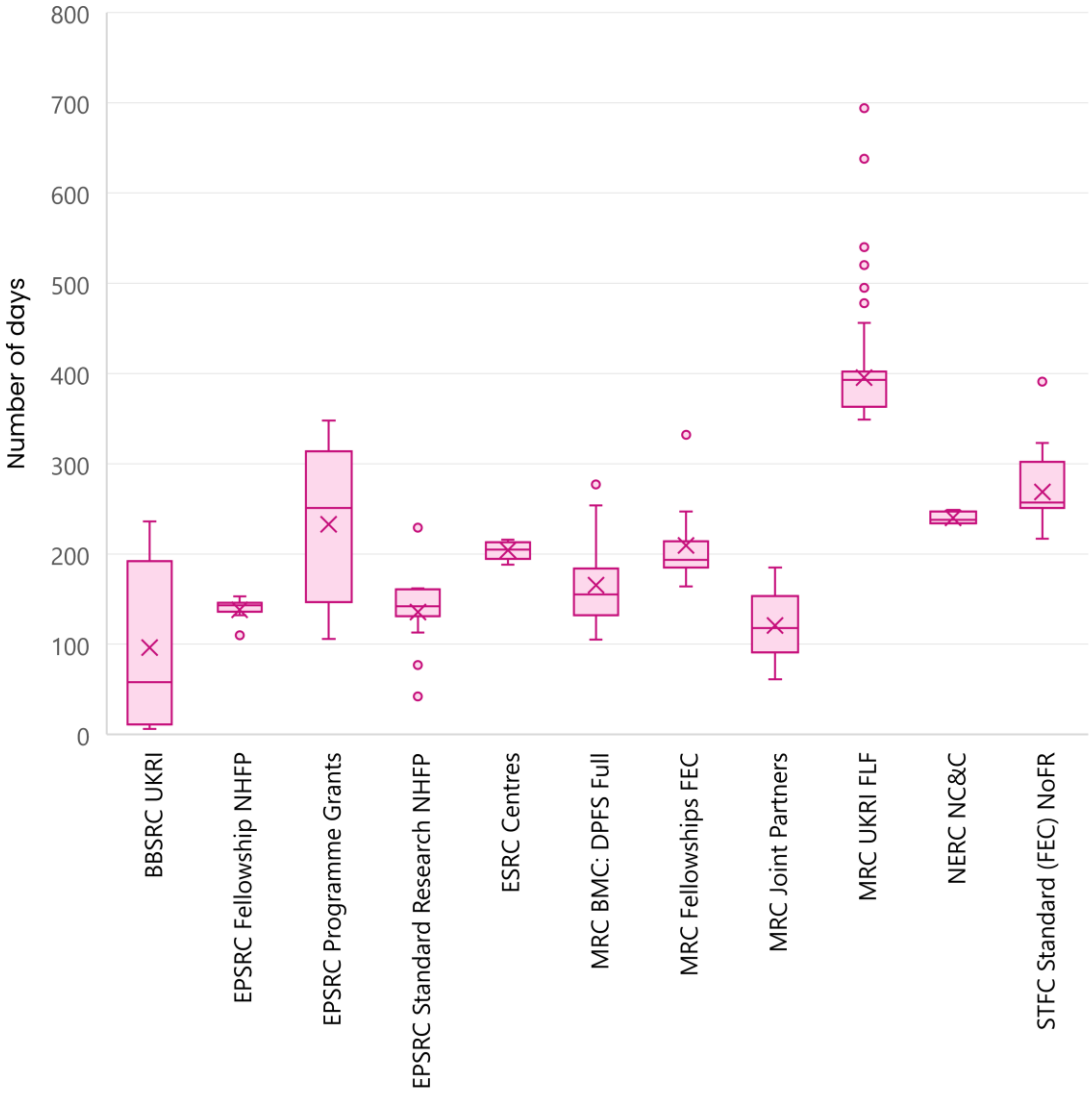
Source: UKRI data (2023), Onward analysis



Further variation exists within the schemes of each council (see Figure 15). The schemes with the shortest decision timeline were the BBSRC UKRI schemes that took an average of 55 days to provide a decision, which is partly attributable to many of these being part of the COVID-19 Rapid Response call. The scheme that took the longest to provide a decision was the UKRI Future Leaders Fellowships which took an average of 395 days.

Figure 15: Time taken between application to scheme to a decision being taken (grants over £1 million, April 2021-March 2022)

Source: UKRI data (2023), Onward analysis



4. Consistency

The realisation of long-term goals is only possible by constant pursuit of them. This is achieved by continuity in personnel, plans, policies, and the bodies that deliver them. Consistency leads to predictability and dependability, which industry, academia, and investors need. Stephen Phipson, the CEO of MakeUK, recently argued, "[I]nconsistency in public policy breeds uncertainty in private industry. That prevents businesses from planning effectively so instead of incentivising investment, it incentivises intransigence."[149]

Given the nature of the UK's political system, achieving consistency requires consensus. To protect against political upheaval, efforts must be taken to embed reforms for the long-term by attempting to build broad consensus over their merit.

Measuring consistency means considering:

4.1 Is there continuity in key personnel?
4.2 Is there limited churn in plans and policies?
4.3 Is there predictability and continuity in key science bodies?

4.1 Is there continuity in key personnel?

Since 2006 there have been 15 changes in the Minister responsible for science and research (Table 1). At present, the average tenure is around 1.2 years. During the same time period, the portfolio in which science, research and technology falls has also changed seven times. The department which oversees it has been modified five times, and has not had its own standalone Whitehall department since the Ministry of Technology was merged with the Board of Trade in 1970 (see Table 2).

Crucial to success will be ensuring that the position of Science Secretary itself lasts and that the junior minister positions within DSIT are protected from repeated churn as far as possible.

Table 2: Changes in Minister responsible for Science, Technology and Innovation (2006-2023)

Source: GOV.UK data, Onward analysis

Name	Title	Term
M. Wicks	Minister of State for Science and Innovation	2006-2007
I. Pearson	Minister of State for Science and Innovation	2007-2008
Lord Drayson	Minister of State for Science and Innovation	2008-2010
D. Willetts	Minister of State for Universities, Science and Cities	2010-2014
G. Clark	Minister of State for Universities, Science and Cities	2014-2015
J. Johnson	Minister of State for Universities, Science, Research and Innovation	2015-2018
S. Gyimah	Minister of State for Universities, Science, Research and Innovation	2018-2018
C. Skidmore	Minister of State for Universities, Science, Research and Innovation	2018-2019
J. Johnson	Minister of State for Universities, Science, Research and Innovation	2019-2019
C. Skidmore	Minister of State for Universities, Science, Research and Innovation	2019-2020
A. Solloway	Parliamentary Under-Secretary of State for Science, Research and Innovation	2020-2021
G. Freeman	Parliamentary Under-Secretary of State for Science, Research and Innovation	2021-2022
N. Ghani	Minister of State for Science and Investment Security	2022-2022
G. Freeman	Minister of State for Science, Research and Innovation	Incumbent
M. Donelan	Secretary of State for Science, Innovation and Technology (position created in 2023)	Incumbent

Table 3: Changes in Government Departments Responsible for Science, Technology & Innovation (1964-2023)

Source: GOV.UK data, Onward analysis

Created	Name	Closed or Merged
1964	Ministry of Technology (MinTech)	Dissolved 1970 (merged with the Board of Trade to form the Department of Trade and Industry)
1964	Department of Education and Science	Dissolved 1992
1970	Department of Trade and Industry	Dissolved 2007
2001	Department for Education and Skills	Dissolved 2007
2007	Department for Business Enterprise and Regulatory Reform	Dissolved 2009
2007	Department for Innovation, Universities and Skills	Dissolved 2009
2009	Department for Business, Innovation and Skills	Dissolved 2016
2016	Department for International Trade	Merged in 2023
2016	Department for Business, Energy and Industrial Strategy	Dissolved 2023 (divided into 3 departments)
2023	Department for Business and Trade	
2023	Department for Energy Security and Net Zero	
2023	Department for Science, Innovation and Technology	

4.2 Is there limited churn in plans and policies?

On industrial policy, there is a pressing need for longer-term consistency if the UK is to keep pace with competitors abroad. While the UK was busy announcing (but not implementing) four entirely different growth strategies between 2015 and 2021, China has implemented one five year plan. A report by Professor Diane Coyle in 2021 concluded that "the UK's industrial policy since the 1970s has been characterised by frequent policy reversals and announcements, driven by political cycles."[150]

Yet in the narrower realm of science and technology policy and strategy, there are signs that efforts are being made to build a more long-lasting approach. Since the formation of DSIT and the publication of the Science and Technology Framework and other subsequent publications by DSIT, Whitehall departments have been well coordinated.

The International Technology Strategy's focus on building strategic advantage through the five priority technologies is a clear case in point. In addition, a joint DSIT and Foreign Office publication underlines a degree of cross-Government coordination too. The Integrated Review Refresh is also aligned in its ambitions to "generate strategic advantage through S&T."[151] Therefore, continuity already present prior to the publication of the Integrated Review in 2021 has been embedded further.

In other instances, there are inconsistencies which serve to create uncertainty. The Government's Innovation Strategy 2021 noted that it would focus on "seven technology families."[152] It also committed to funding "Innovation Missions" that would be set by the NSTC to drive progress in key innovation goals that the Government committed to funding.[153] These Missions are yet to receive specific government funding. It is unclear whether the Science and Technology Framework's five technologies mean that the technologies in the Innovation Strategy that are not included in the Framework's five (e.g. robotics, genomics, and advanced manufacturing) are to be considered implicitly deprioritised.

There also remains the ongoing uncertainty over Horizon Europe. Questions about the future of international cooperation have been one of the most prominent concerns of the UK science community for a number of years. While the Government has covered lost funding in the interim, it has been unable to solve this dilemma for two years.

As The Economist put it, "money can be replaced, the opportunities for collaboration… cannot."[154]

4.3 Is there predictability and continuity in key science bodies?

The analysis above shows that there is much to welcome with the creation of DSIT – it should now be given the chance to deliver and embed. With a general election on the horizon, ensuring that the new Science Department takes root in Whitehall is vital. The Leader of the Opposition, Keir Starmer, is reportedly undecided as to whether his administration would keep DSIT in its current formulation.[155] Work is

needed, therefore, to build consensus on the merits of the Government's approach.

There are signs that the Government has been making attempts to build political consensus. In giving evidence to the Lords, Andrew McCosh, then Director General at the Office for Science and Technology Strategy, considered the Government's objectives to be "fundamentally bipartisan propositions… They are a national endeavour to do well. The Government has been encouraging us to engage the Devolved Administrations on this approach and to engage with opposition parties."[156]

More is needed. Many of the issues described in this report are not new, with prominent figures in the science and technology communities championing many of these causes for years. Yet now there is increasing political salience of science and technology in Westminster, allowing more of these ideas – and new, more radical ones, too – to come to the fore.

Recommendations

The DSIT reforms are a strong start on the road to becoming a science superpower. On an array of fronts the Government has sought to address the underlying weaknesses which have held it back from achieving its ambitions. But despite much improvement, more is needed.

Recommendation 1: The Government should set a new headline R&D target of 3.5% of GDP by 2035, with a focus on boosting private sector R&D spend.

When it comes to R&D funding, the UK must go further. The revision in the ONS's figures suggests the UK is not lagging as far behind international competitors as previously thought. But it still sits outside the top ten of OECD countries on R&D spend. To be a science superpower, the UK should aspire to be in the top five of OECD countries. Hitting this means having economy-wide R&D expenditure upward of 3.5% of GDP. Based on OECD forecasts the UK economy is estimated to grow to £2.8 trillion by 2035.[157] To reach 3.5% by 2035 would require an average of 3% annual growth, amounting to roughly £100 billion being spent on R&D in the UK.[158] The UK should aspire to achieve this primarily by increasing the share of private sector R&D spend in the UK.

Figure 10: Forecast of future UK Gross Expenditure on R&D following current increase trends

Source: ONS data (2023), Onward analysis

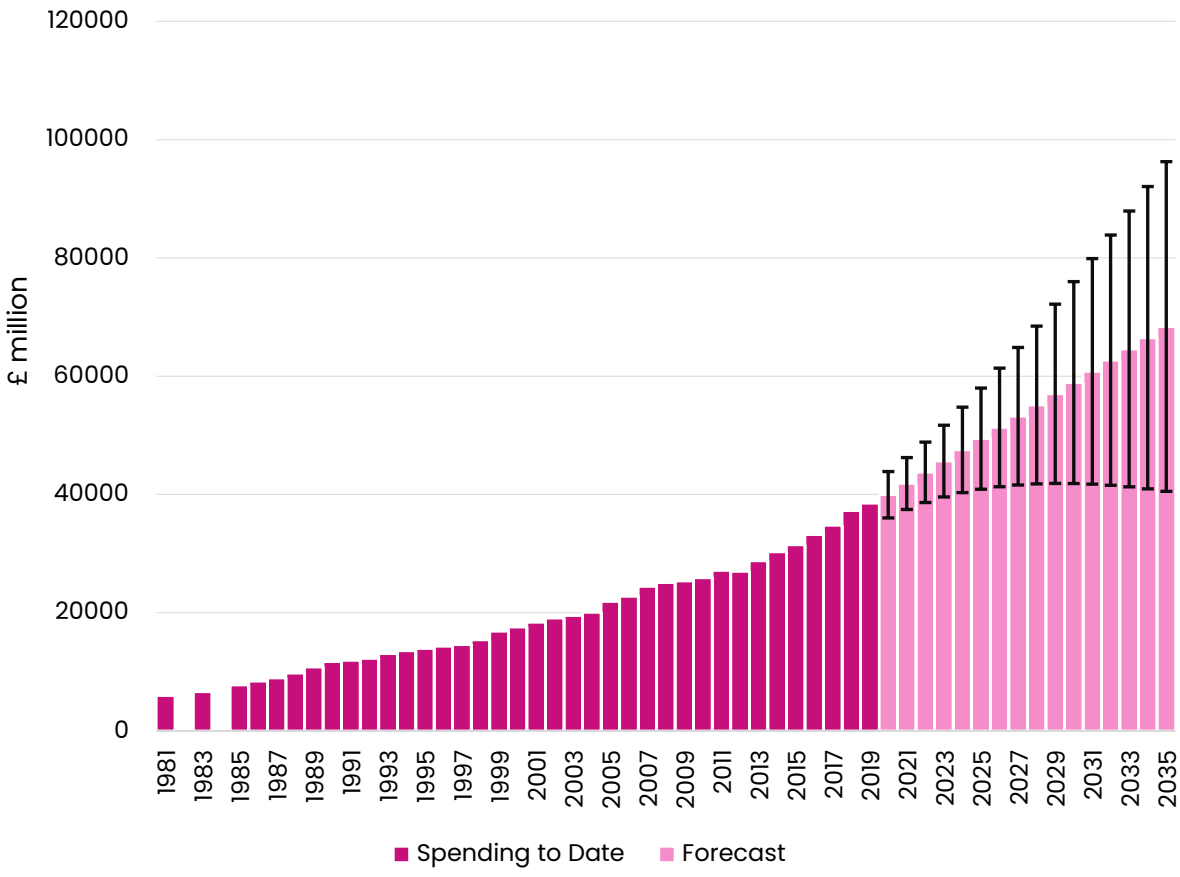
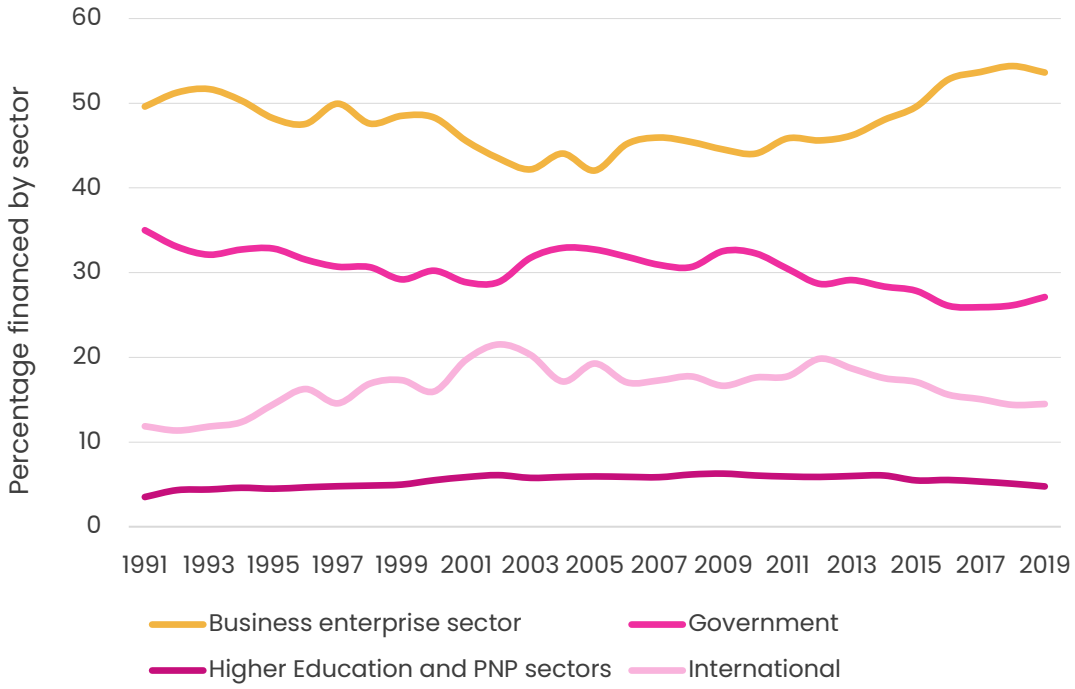


Figure 11: UK Gross Domestic Expenditure on R&D financed by sector

Source: OECD data (2022), Onward analysis



Recommendation 2: The Government should create a Technology Futures and Intelligence Unit modelled on Singapore's Centre for Strategic Futures.

The Government is right to want to improve its long-term science and technology foresight capabilities. These functions and the national security apparatus must be closely aligned, to bridge the intelligence and foresight gap.

A dedicated futures and intelligence unit would ensure ministers are receiving focused and informed intelligence assessments and advice on technological developments internationally to help inform their strategies and plans. The unit could take inspiration from Singapore's "Centre for Strategic Futures"[159] (CSF) – a team in the Singapore Prime Minister's office focused on "navigating emerging strategic challenges and harness potential opportunities."[160] Like the CSF, this Unit should be given the mandate to operate "like a think tank within government, with the freedom to focus on issues of strategic importance even if they were not perceived to be immediately urgent."[161]

This unit should be a joint Cabinet Office and DSIT body, working closely with both GO-Science and the Joint Intelligence Organisation within the Cabinet Office. It should replace the Technology and Insights Team that sits in GO-Science.

The Unit's purpose should be to:

- Provide near-term assessments of the state of progress across the five critical technologies, domestically and abroad
- Provide longer-term assessments of trajectories of other technologies that ministers should be considering
- Consider the implications of emerging technologies for economic, social and national security concerns
- Assess how these capabilities could be, and are, being used by strategic competitors abroad. It would also provide insight as to how other governments are navigating this constantly evolving landscape
- Work closely with DSIT to build strong relations with key private sector organisations conducting cutting-edge R&D to ensure the Government is aware of private sector activity – especially in frontier labs run by the world's leading technology companies
- Embed in the UK's national security community like the current Technology and Insights Team in DSIT, working closely with the Joint Intelligence Organisation to ensure that its assessments are also being factored into broader intelligence and national security considerations within the Government

In time, the unit could also develop a "internal challenge" function to test the strength of existing policies, similar to the Defence Secretary's "Secretary of State's Office of Net Assessment and Challenge" (SONAC). This would allow it to test strategic assumptions and conventional thinking around what is needed to generate strategic advantage. It should support efforts to assess how strategic technologies should be treated in relation to perceived UK sovereign capability needs.

Recommendation 3: DSIT should be exempted from lengthy and bureaucratic spending controls to ensure the department can move with the intended "agility and pace."

The Treasury plays a crucial role in Whitehall. Under Margaret Thatcher in the 1980s, His Majesty's Treasury (HMT) consolidated its role across government and limited the ability of ministers to inflict ever-increasing spending pressures on taxpayers. The department oversees a consistent approach to value for money across Whitehall and brings a coherence to economic policy.

But the Treasury is coming under increasing criticism. A 2014 Nesta paper called for "The End of the Treasury" arguing that the conflation of economic strategy and spending control left the country insufficiently focussed on economic growth.[162] One of the authors of the Nesta paper, Stian Westlake, more recently wrote that

"government by accountant" breeds "myopia in the British state, as public investment is routinely diverted to meet short-term pressures."[163] A 2018 survey of civil servants who had contact with the Treasury's spending teams found that just 42% agreed that HMT considered the long-term impact of funding decisions.[164]

Former Bank of England Chief Economist Andy Haldane has argued that the current Treasury fiscal rules "risk underinvesting today in tomorrow's economic and environmental health."[165] The recent decision to delay the delivery of HS2 in order to reprofile capital spend is just one example of HMT cutting across departmental plans in order to adhere to a narrowly defined form of fiscal management.[166]

The Treasury approach is particularly damaging for a department like DSIT which is meant to be innovative, future facing, and operate with "agility and pace" according to Ministers.[167] Significant departmental projects, like the procurement of a £900 million exascale computer, risk being caught in a "penny rich, pound poor" approach in which the instinct of the Treasury to limit spending presses against a desire to boost economic growth.

Decisions made by spending teams in siloes, without regard for how big investments in technology might generate strategic advantage internationally, risk limiting our science superpower ambitions. The Treasury also lacks expertise to evaluate science and technology projects: according to Institute for Government analysis, in 2020 there were no science and engineering specialists in HMT, compared to just under 1,000 in BEIS.[168]

Radical changes to the Treasury, like splitting its functions or overhauling fiscal rules, are not the only route to enabling DSIT to act in a nimbler and more strategic way. Instead, the Science Department should have a unique role carved out in Whitehall. This would involve:

- **Exempting DSIT Major Projects and novel spending from HMT sign off.** At present there are seven DSIT initiatives defined as "major projects", ranging from carbon storage research to digital infrastructure delivery.[169] As the department embeds, more of its activities are likely to be defined as Major Projects, or characterised as "novel" spending – both triggering HMT spending controls.[170] DSIT Major Projects should continue to be supported by the Infrastructure and Projects Authority, but final sign off should sit with the DSIT Secretary not HMT.[171] This would allow the department to move more swiftly while still operating within value for money frameworks.

- **Introducing single business case approvals for DSIT agencies.** Bodies that fall under DSIT, like the UK Space Agency and UKRI, have substantial budgets and engage in a wide range of R&D intensive activity. If individual projects and initiatives from these bodies are required to go

through HMT Green Book processes, they will likely be delayed and could have their ambition reduced. They should therefore have their spending approved via a single, integrated business case that operates at a strategic level. This was the approach taken with the Advanced Research and Invention Agency (ARIA) to ensure that it was free from micromanagement by Treasury officials with little science and technology expertise.[172]

- **Shifting responsibility for evaluating DSIT spend to experts.** Subject-specific knowledge will be required to evaluate the value for money of investments undertaken by DSIT and associated bodies. Groups of experts, including secondees into DSIT or scientists in the new Technology Futures and Intelligence Unit are better placed to make judgements than HMT generalists. Evaluation of future investments should be undertaken by these experts, to support the greater spending freedoms for DSIT outlined above.

Recommendation 4: The Government should create a new category under the Nationally Significant Infrastructure Projects (NSIP) regime for key science infrastructure, including lab space.

There is a pressing need for more lab space if the UK is to become a science superpower. Demand for lab space is far outstripping supply, with Oxford and Cambridge alone short by 2 million square feet (see Figure 8). And demand is only increasing. Britain's progress pales in comparison to places such as Greater Boston, which is set to add 14.4 million square feet of new lab space by the end of 2024.

Radical changes to the planning process to improve lab space supply are needed. But while the Government has identified that more must be done, to date it has only come forward with modest proposals.

Adding science to the NSIP regime would help address this. The NSIP regime was created in 2008 to fast-track nationally significant large-scale infrastructure projects that would otherwise be locked in years, or even decades, of planning impediments. The NSIP process reduces the amount of consent regimes required to meet development consent via a "bespoke consenting route."[173] This in effect simplifies and speeds up the approval process of nationally significant projects.

The NSIP regime has had success: analysis conducted by the Government shows that it had cut the average time taken for large-scale projects to receive planning approval to 2.6 years, when projects like Heathrow's runway had previously taken eight.[174] While the average time for an NSIP project has since increased to four years, the Government recently published an action plan to bring this time back down and speed up approvals.[175]

Despite applying to other nationally important endeavours such as energy security and achieving net zero, science is not included in the NSIP regime. Science and technology should be added as a specific category, allowing key infrastructure to be fast-tracked via the NSIP regime to speed up the UK's severe lab space supply needs. Allowing for many of the large-scale proposals within Cambridge and Oxford's nearly 2 million square feet of science infrastructure demand to be fast-tracked would help to tackle this problem over the long term.

Recommendation 5: The Government should update the 2021 Innovation Strategy and fully fund a set of Innovation Missions in the Autumn Statement.

Clear explication of the Government's priority technologies, each supported with a tailored action plan, has provided some much-needed clarity and direction to science policy. However, how the Government seeks to build its stated aim of "strategic advantage" remains unclear on the whole.

If the UK is to become a science and technology superpower, it must move beyond narrow science policies towards a more strategic approach to industrial policy, aimed at building the UK's absorptive capacity to constantly bring new technologies into the economy. Yet the Government lacks an explicit, coordinated approach to driving innovation via industrial strategy.

An industrial strategy centred on "innovation missions" would allow the Government to overcome the current perceived "odd mixture" of focusing on foundational technologies and whole sectors. The Government's 2021 Innovation Strategy rightly pointed out that there needs to be a focus both on missions as well as foundational technologies. It argued that "[m]issions are about a clear and measurable outcome…for which we need to draw on multiple technologies and research disciplines, work with different industries and supply chains and tackle innovation, manufacturing, and logistical challenges."[176]

To address this lack of clarity and to build the UK's absorptive capacity, the Government should update the 2021 Innovation Strategy and set out a clear set of Innovation Missions which should be fully funded at the Autumn Statement. As envisaged by the Innovation Strategy, these missions would sit alongside its focus on driving strategic advantage in frontier technologies. They would seek to leverage UK capabilities in frontier technologies and focus on tackling tangible problems and mobilise the energies, insights and resources of government, industry, civil society, and academia behind a shared endeavour to tackle them.

Recommendation 6: The Prime Minister should move universities out of DfE and into DSIT.

The creation of DSIT has, for the first time, placed funding and policy levers under an empowered Secretary of State. But universities remaining in the Department

for Education is problematic, given their central importance to the UK's innovation ecosystem. Universities drive essential research, they train – and attract from abroad – the researchers and technicians who drive the innovation process, and they are crucial to the commercialisation of this research into the economy through thousands of spinouts and startups. Moving universities into DSIT would unlock a more joined-up innovation ecosystem, enable more coordinated resource allocation and align academic research efforts with national policies like the Government's five priority technologies.

The benefits of transferring universities to DSIT would include:

- Eliminating the split in responsibility for funding of research and the rest of university functions, allowing more effective coordination of resources
- Supporting university-based incubators and accelerators by aligning their efforts with DSIT's responsibility for commercialisation
- Ensuring that the university courses reflect the Government's long-term science and technology objectives and cultivates skills that align with industry demands
- Coordinating international student intake with labour shortages in high-skilled occupations crucial to strategic science objectives
- Harnessing the contribution of the arts, humanities and social sciences to the UK's innovation ecosystem, and reflecting their role in the R&D evidence base
- Focussing DfE efforts on the expansion of non-university technical education and apprenticeships.

Recommendation 7: A Permanent Secretary-level official should be appointed to lead the NSTC.

The NSTC has the potential to drive the Government's strategic science and technology objectives across Whitehall, overcoming the coordination challenges that have plagued ministers in the past. But this potential is currently unrealised - the NSTC meets too infrequently, and has limited resources to set agendas and follow up on actions.

The NSTC needs more senior leadership and organisational heft to establish its role. The Prime Minister should appoint a senior official as Director of the NSTC, at Permanent Secretary-level and sitting jointly in DSIT and the Cabinet Office. The NSTC Director would be empowered by the Prime Minister to drive cross-Whitehall science, technology & innovation priorities: setting a clear programme of work for the NSTC, identifying clear deliverables and deadlines, and holding departments and senior officials to account. DSIT's Strategy and Implementation team should be empowered to support the NSTC Director, in the same way that the Economic and Domestic Affairs Secretariat provides support to the Cabinet.

There are examples across Whitehall of similar approaches having a positive impact. The creation of the National Security Advisor post in 2010 was essential to ensuring the success of the new National Security Council. The appointment of Andy Haldane as Director of the Levelling Up Taskforce, serving at the level of a permanent secretary and working across the Cabinet Office and MHCLG, accelerated progress on the Levelling Up White Paper.

The Government could take advantage of the absent National Technology Advisor role, repurposing the position to lead the NSTC as well as the important external engagement with industry that the role is currently being set up to perform. The role has been vacant since it was held by Sir Patrick Vallance, jointly with his role as Chief Scientific Advisor.

Recommendation 8: The DSIT Secretary should be given delegated powers to approve R&D spending plans by other government departments instead of Treasury ministers.

While around two thirds of the Government's R&D spend is now administered via DSIT, the remaining third is administered through other government departments. Here, the Government lacks formal mechanisms to ensure this spend is targeted at driving strategic priorities.

Currently, R&D spending by other departments must be approved by the Treasury. A cross-Whitehall forum has been created in an attempt to ensure this spend is directed towards strategic priorities. But this forum does not have formal decision-making powers. In practice, the decision to approve remains with the Chief Secretary to the Treasury who is not best placed to make assessments over the extent to which proposed R&D spend will fulfil the Government's strategic science objectives.

A new system would see approval transfer from Treasury ministers to DSIT. Oversight and input by Treasury officials would still be necessary — perhaps via a bespoke joint DSIT-Treasury forum which would process and provide advice to the DSIT Secretary as part of the approval process. But giving the DSIT Secretary the ultimate power to approve or reject R&D spend across the Government would vastly improve the likelihood that the whole of the Government's R&D spending is closely aligned with strategic priorities. Across Whitehall, this could ensure the MOD's Defence Science and Technology Laboratory R&D spending on quantum technologies and AI, or biomedical activities by the Health Department's Genomics England Ltd., are spent in line with the Government's strategic objectives.

Formalising the cross-Whitehall forum for coordinating R&D spend by other departments will also help to ensure that spending is focused on priorities early on in the process.

Recommendation 9: The Government should reform the Digital Regulation Cooperation Forum and issue updated policy objectives to regulators.

Regulation is key in the Government's quest for science superpower status, particularly given its focus on agility and coaxing businesses less by financial incentives compared to international competitors. Yet the Government has not got this balance right to date – digital regulation in particular is highly fragmented, making it hard for businesses to navigate.

Ultimately, the Digital Regulation Cooperation Forum (DRCF) needs to do more to build coherence of digital regulation. It is currently a weak and poorly staffed coordinating function sitting underneath participating regulators. Reforming the DRCF should include:

- Expanding it to include more regulatory bodies beyond its current membership of four. This could include the Children's Commissioner, the Advertising Standards Authority, and the Gambling Commission
- Placing it on a statutory footing with an explicit mandate for driving clarity and certainty across the digital regulation system, with powers to provide direction to regulators in cross-cutting regulatory issues
- Making it accountable to Parliament, allowing closer scrutiny and ensuring it is performing as intended

Alone, this will not tackle the more fundamental challenge of ensuring regulator's focus on the Government's "pro-innovation" agenda. The Government should consider whether the levers it has over regulators are sufficient, and whether there is enough transparency and scrutiny allowed for individual decisions – by the Government, Parliament, and industry.

At the very least, the Government should be far more active in giving clear policy objectives to regulators to ensure its pro-innovation agenda is better followed. As noted above, the Government last furnished Ofcom with a "Statement of Strategic Priorities" in 2019, when Theresa May was Prime Minister.[177] The CMA's strategic vision was also last updated in 2019.[178]

Recommendation 10: The Government should instigate an urgent review with UKRI to improve timelines for funding approvals by research councils.

The average time taken for funding approval by the research councils varies widely, from 76 days (Economic and Social Research Council) to as much as 230 days (Medical Research Council). This holds up the delivery of vital research projects, many of which are in incredibly fast-moving disciplines, such as AI, where the UK cannot afford to let cumbersome bureaucracy hold back progress.

There are a number of ways that could be considered to tackle the length and disparity of these funding approvals:

- Greater use of two-stage application processes – a recommendation by the Tickell review which often involves limiting the first stage to a brief project summary to allow initial, faster triages to cut down the number that are submitted as full proposals.[179]
- Standardised application forms – also recommended by Tickell
- Mechanisms that favour high-risk, high-reward projects such as randomised funding allocation, which can speed up processes as there is no need for committees to reach consensus.
- Inducement prizes, seed grants, and equity stakes, all of which are being considered by ARIA.[180]

An urgent review should be conducted to look into the feasibility of new targets for research councils and mechanisms to achieve them. The review should report back no later than by the end of the year, with clear recommendations for the Government to take forward.

Conclusion

The DSIT reforms expended significant amounts of effort and political capital by the Sunak administration for very little near-term political benefit. At a time of national trepidation caused by severe economic disruption, early 2023 was an ostensibly odd moment for technocratic tinkering of the Machinery of Government. This report argues that they were fundamentally the right thing to do.

As Prime Minister Rishi Sunak put it, "[m]ake the wrong decisions now and we will fall behind as other countries see an explosion in productivity, jobs and improved quality of life. Get it right and the United Kingdom can lead the 21st century, just as we did in the 19th and 20th."[181]

The DSIT reforms go a long way to "get it right" – but more is needed. The UK cannot hope to become a science and technology superpower without further reforms, particularly those which aim to tackle the barriers to progress still endemic across Whitehall.

The Government has shown that it is willing to make big bets in aid of its science superpower ambitions – it cannot now rest on its laurels. There is a chance for the British state to be uniquely prepared for the technological revolution we are beginning to experience. Ministers must seize it.

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