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UK science, technology & innovation policy after Brexit: priorities, ambitions & uncertainties

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Introduction: STI in a decade of ABC



UK Prime Minister Boris Johnson visits a biotechnology laboratory in Edinburgh on January 28, 2021. (Pool photo by Wattie Cheung/Getty Images)

Across UK politics and society, the past decade has been one of the most turbulent and eventful of modern times. Three developments stand out as particularly significant, two of which were global in origin, and one of which the UK imposed upon itself:



Austerity: In the aftermath of the global financial crisis of 2007-08, which rocked economies worldwide, the UK was left with what the Institute for Fiscal Studies terms “the largest budget deficit in its peacetime history”.² A Conservative government under Prime Minister David Cameron was elected in May 2010 on a promise to consolidate the public finances and reduce structural public borrowing as a proportion of national income. This led to significant cuts to public spending over the 2010-2015 Parliament.

Brexit: In his bid for re-election in 2015, PM Cameron committed to hold a referendum on UK membership of the European Union (EU).³ He won that election but lost the referendum that followed on 23 June 2016, when a 52%-48% margin voted for Brexit. This unexpected outcome led PM Cameron to resign, sent shockwaves through the EU, and began the complex process of UK withdrawal that was to convulse the next four years of UK politics, under two more Conservative PMs: Theresa May (2016-2019); and Boris Johnson (2019—).⁴



² https://www.ifs.org.uk/tools_and_resources/fiscal_facts/fiscal-response-crisis

³ <https://www.bbc.com/news/uk-politics-49753420>

⁴ <https://www.bbc.co.uk/news/uk-politics-eu-referendum-36616018>



COVID-19: When the pandemic began in early 2020, the UK appeared well positioned, with a strong national health service, sophisticated biomedical science, and finely-tuned expert advisory structures. Things turned out very differently. As of 1 March 2021, with 122,989 COVID-19-related deaths, the UK has suffered the fifth highest mortality rate in the world (185 deaths per 100,000 people).⁵ Economic damage has also been severe, with a 9.9% drop in GDP over 2020—the largest among the G7 advanced economies.⁶ The UK's success in procuring and distributing large quantities of vaccines—as of 1 March 2021, over 20 million people have received a first dose⁷—has for now diverted attention from these earlier failures, but a more significant reckoning is likely to come in the form of an independent public inquiry.⁸

So what role have science, technology and innovation (STI) played in this 'ABC' decade, of austerity, Brexit and COVID-19? There is a significant STI strand to each of these episodes:

- Under the 2010-2015 **austerity** measures, government R&D investment was one of only a few areas of UK public spending to be protected, with a flat cash settlement. What seemed at first like a positive outcome soon felt less so, as year-on-year flat budgets meant a real-terms decline (albeit cushioned by the capacity to cross-subsidise university research from increased student fees). By the middle of the decade, calls were growing across the political spectrum for an increase in public R&D spending, and from 2016 onwards, investment slowly started to rise, accompanied by wholesale reforms to the governance and institutional landscape for research policy and funding.⁹
- In the lead-up to the 2016 **Brexit** referendum, the UK's university and research sectors were vocal in their support for continued EU membership.¹⁰ Afterwards, they continued to make a strong case for the UK to maintain its association to Horizon Europe (the EU's new framework programme) and to the European Research Council. So there was relief when association was included in the eleventh-hour EU-UK trade agreement that was struck on 24 December 2020, although the details of how to fund this still needed to be worked out.¹¹ However, according to the Royal Society, the UK's share of EU funding has already

⁵ Daily data from Johns Hopkins Coronavirus Resource Centre: <https://coronavirus.jhu.edu/data/mortality>

⁶ <https://blog.ons.gov.uk/2021/02/01/minding-the-gap-why-has-uk-gdp-fallen-so-sharply-in-the-pandemic/>

⁷ <https://coronavirus.data.gov.uk/details/vaccinations>

⁸ <https://www.bbc.co.uk/news/uk-politics-53419544>

⁹ <https://www.theguardian.com/science/political-science/2015/oct/27/the-spending-review-is-just-the-start-of-a-battle-for-uk-research>

¹⁰ A 2016 poll in *Nature* placed levels of support for 'Remain' in the UK's scientific community at around 80%, so at odds with wider public opinion: <https://www.nature.com/news/scientists-say-no-to-uk-exit-from-europe-in-nature-poll-1.19636>

¹¹ <https://www.nature.com/articles/d41586-021-00009-y>

fallen by around a third since 2015, and there are concerns too that the UK may become a less attractive destination for international researchers. Few expect a return to historically high levels of UK-EU research collaboration any time soon.

- In the UK, as elsewhere, the research community has been at the forefront of the response to **COVID-19**. Scientific advisers, under the leadership of Sir Patrick Vallance (Chief Scientific Adviser) and Professor Chris Whitty (Chief Medical Officer)—pictured here alongside the Prime Minister—have been centrally involved, achieving unusual levels of public visibility. Such roles are only the tip of an iceberg of input, involving thousands of epidemiologists, biomedical and public health researchers, clinicians, behavioural scientists and other experts, from across the National Health Service, Public Health England and UK universities.



So for the UK's research system, this has been a decade of constant—and at times, destabilising—change. But also of growth and opportunity. Viewed from the perspective of April 2021, while many aspects of the UK's management of the pandemic have proved intensely challenging, its R&D community is widely regarded as having performed well, and is benefiting from higher levels of political (and to some extent, public¹²) support as a result. *The Economist* captures the mood in a recent article, noting that:

*“Alongside vast clinical trials, the country has been home to most of the world’s genetic sequencing, the development of a successful jab and its fast roll-out. Elite institutions, streamlined regulation and big datasets are a potent combination—as, it turns out, are close links between business, academia and government.”*¹³

With some light now appearing at the end of the pandemic tunnel, and the initial stages of the Brexit process complete, what are the prospects for UK STI over the next five to ten years? Ranging across R&D investment, structural reform of the funding system, international collaboration, and thematic priorities, this report provides a snapshot of recent developments, persistent uncertainties and future pathways, as the government seeks to secure the status of post-Brexit Britain as “a science superpower.”¹⁴

¹² Ipsos MORI (2020) *How has COVID-19 affected trust in scientists?* Ipsos MORI/UKRI, September 2020.

<https://www.ukri.org/wp-content/uploads/2020/09/UKRI-271020-COVID-19-Trust-Tracker.pdf>

¹³ The Economist (2021) *How British science came to the rescue*. The Economist, 27 February 2021.

<https://www.economist.com/britain/2021/02/27/how-british-science-came-to-the-rescue>

¹⁴ PM's Office (2019) *PM sets out vision to cement UK as a science superpower*, 8 August 2019.

<https://www.gov.uk/government/news/pm-sets-out-vision-to-cement-uk-as-a-science-superpower>

1. Investment and the R&D Roadmap

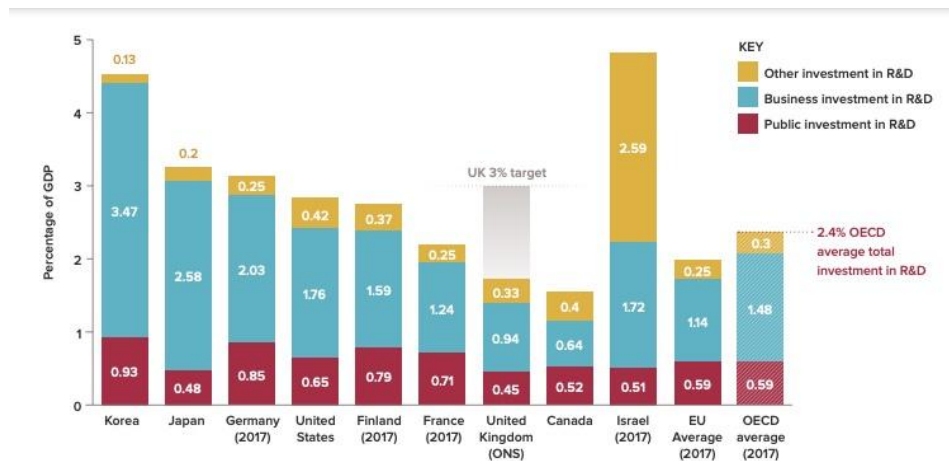


Figure 1: UK R&D investment as a % of GDP, compared to other OECD countries (2018 data) (Source: UK National Academies¹⁵)

1.1 Public and private investment: current levels & future targets

In 2018—the latest year for which complete data is available¹⁶—total UK expenditure on R&D was **£371 billion**. Of this total, **government R&D expenditure was £12.6 billion**.¹⁷ The overall volume of R&D investment has risen steadily, from £18.5 billion in 1981 (in 2018 prices)—a real terms increase of 101% over forty years. But over the same period, **R&D expenditure as a proportion of GDP has fallen**, from **2.0% of GDP in 1981** to **1.7% of GDP in 2018**.

As Figure 2 shows, for twenty years, the UK's gross domestic expenditure on R&D (or GERD) ratio to GDP¹⁸ has remained broadly static, despite commitments by successive governments to boost the R&D intensity of the economy. In 2004, the Labour government under PM Tony Blair published a ten-year investment framework, which pledged to invest 2.5% of GDP in R&D by 2014.¹⁹ R&D spending did then start to rise, but the global financial crisis and a change of government saw the GERD ratio slip back again.

¹⁵ From an October 2020 briefing on *Investing in UK R&D* produced by the UK National Academies.

<https://www.raeng.org.uk/policy/policy-themes/research-and-innovation-policy/investing-in-engineering-research-and-innovation/investing-in-uk-r-d>.

¹⁶ GERD data for 2019 was published on 15 April 2021—see

<https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/uk-governmentexpenditureonscienceengineeringandtechnology/2019>—a complete R&D dataset for 2019 will be published by ONS later than usual, in July 2021.

¹⁷ Rising to £13.4bn in 2019, according to the latest ONS data

<https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/uk-governmentexpenditureonscienceengineeringandtechnology/2019>

¹⁸ Gross domestic expenditure on R&D (GERD)

¹⁹ HM Treasury (2004) Science & innovation investment framework 2004-2014. Available here:

https://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/spending_sr04_science.htm

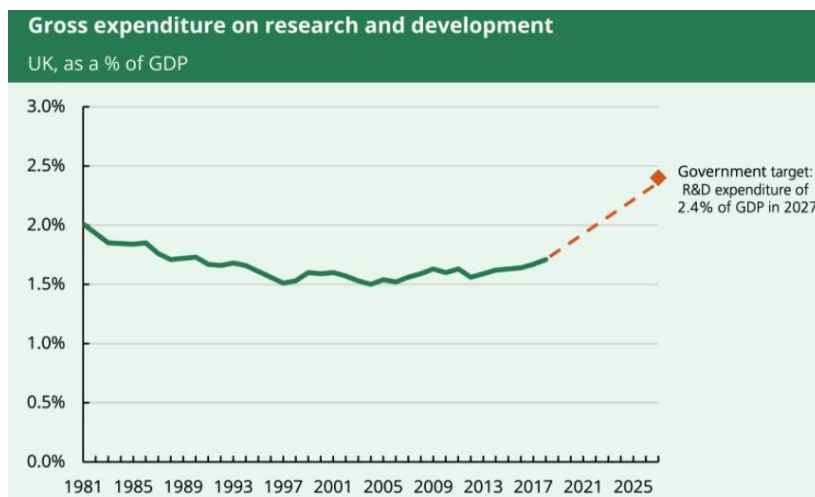


Figure 2: UK GERD, 1981 to 2018, with projected targets to 2027. (Source: ONS data & House of Commons Library²⁰)

By the time of the UK's 2015 general election, there was growing consensus across the political spectrum that R&D investment needed to rise significantly—not least because the GERD gap between the the UK and other OECD countries (averaging 2.4%) and EU member states (2%) was starting to widen (as shown in Figure 1 above).



Figure 3: In September 2019, a few weeks after Boris Johnson became PM, his aides were briefing the BBC that science was his government's “top priority” after Brexit.²¹

In November 2017, under PM Theresa May, the UK government formally endorsed a GERD target of **2.4% by 2027**, with a **longer term goal of 3%**, and announced an initial £2.3 billion tranche of extra investment towards this, focused on R&D aspects of a new industrial strategy.²² These targets were inherited by Boris Johnson when he became PM in July 2019, but he and his advisers soon began to think in more ambitious terms. In the run-up to the December 2019 general election, the government's envisaged contribution was made explicit, with a Conservative manifesto pledge to **raise government spending on R&D to £18bn a year by 2025**.²³

This target was raised yet further in the March 2020 budget to **£22 billion a year by 2025**, prompting the UK's Campaign for Science and Engineering to describe the government as having “supercharged public investment in science, delivering investment faster and further than it had

²⁰ This figure from: House of Commons Library (2020) *R&D Spending*. HoC Library Briefing Paper, Number SN04223, 17 June 2020. <https://commonslibrary.parliament.uk/research-briefings/sn04223/>

²¹ <https://www.bbc.co.uk/news/science-environment-49885230>

²² <https://www.ft.com/content/93e0ff04-cd30-11e7-b781-794ce08b24dc>

²³ <https://www.sciencecampaign.org.uk/news-media/case-comment/case-analysis-of-2019-conservative-manifesto.html>

promised.”²⁴ Of course, setting targets is an easier task than delivering them.²⁵ Brexit and the costs of COVID-19 make this an unusually turbulent period for the public finances. GDP-based targets are particularly slippery after a year in which the UK’s GDP fell by 9.9%, its largest drop in 300 years.²⁶ These fluctuations have led ministers to speak more about the total they aim to invest (£22bn a year). But recent increases, which saw the Department for Business, Energy and Industrial Strategy (BEIS) R&D budget rise by £1.6bn for 2020-21, and by a further £250m in 2021-22, suggest that HM Treasury continues to take these targets seriously.²⁷

Even with a rising budget, the government is a supporting player in the R&D story. Of the £37.1 billion spent on UK R&D in 2018, public investment accounts for 30% of the total. Business R&D is 68%, or just over £25 billion.²⁸ Figure 4 illustrates the sectoral mix. This includes relatively high levels—by international comparison—of investment from firms headquartered outside the UK, with steady growth in this foreign direct investment (FDI) over the last twenty years.

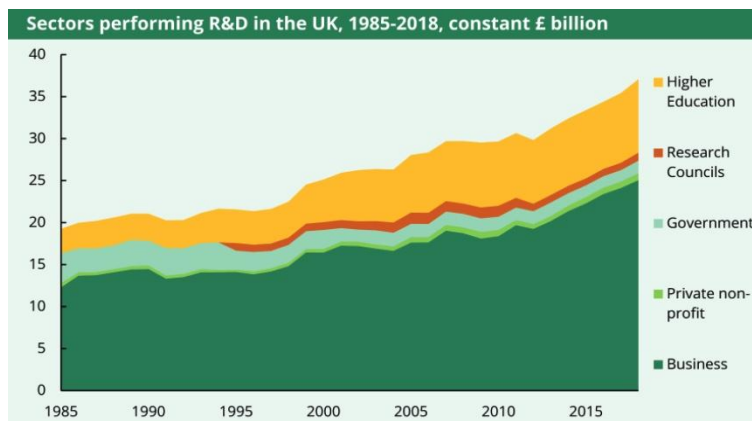


Figure 4: UK R&D spending by sector, 1985-2018 (Source: ONS & House of Commons Library)²⁹

Economists estimate that for every £1 spent by government on R&D, private sector R&D output rises by 20p per year in perpetuity,³⁰ so additional public investment should generate business multiplier effects. However, times are far from normal,

and BEIS has acknowledged that it expects to see a “significant decrease” in business R&D spending over the short term.³¹ Tackling this issue, and ensuring that public and private investment are mutually reinforcing, is one of the goals of the **UK R&D Roadmap**.

²⁴ <https://www.sciencemaq.org/news/2020/03/uk-cues-big-funding-increases-rd>;

<https://www.sciencecampaign.org.uk/news-media/press-releases/budget-2020-supercharged-science.html>

²⁵ Carvalho, A. (2018) Wishful thinking about R&D policy targets: what governments promise and what they actually deliver. *Science and Public Policy*, Volume 45, Issue 3, June 2018, pp.373–391.

²⁶ <https://www.ft.com/content/96e19afd-88b3-4e8d-bc3e-a72bd1f60d3c>

²⁷ <https://www.sciencecampaign.org.uk/news-media/case-comment/beis-research-budgets-set-uk-on-the-path-to-2-4-.html>; <https://www.gov.uk/government/news/250-million-additional-funding-to-boost-collaboration-and-protect-ongoing-research>

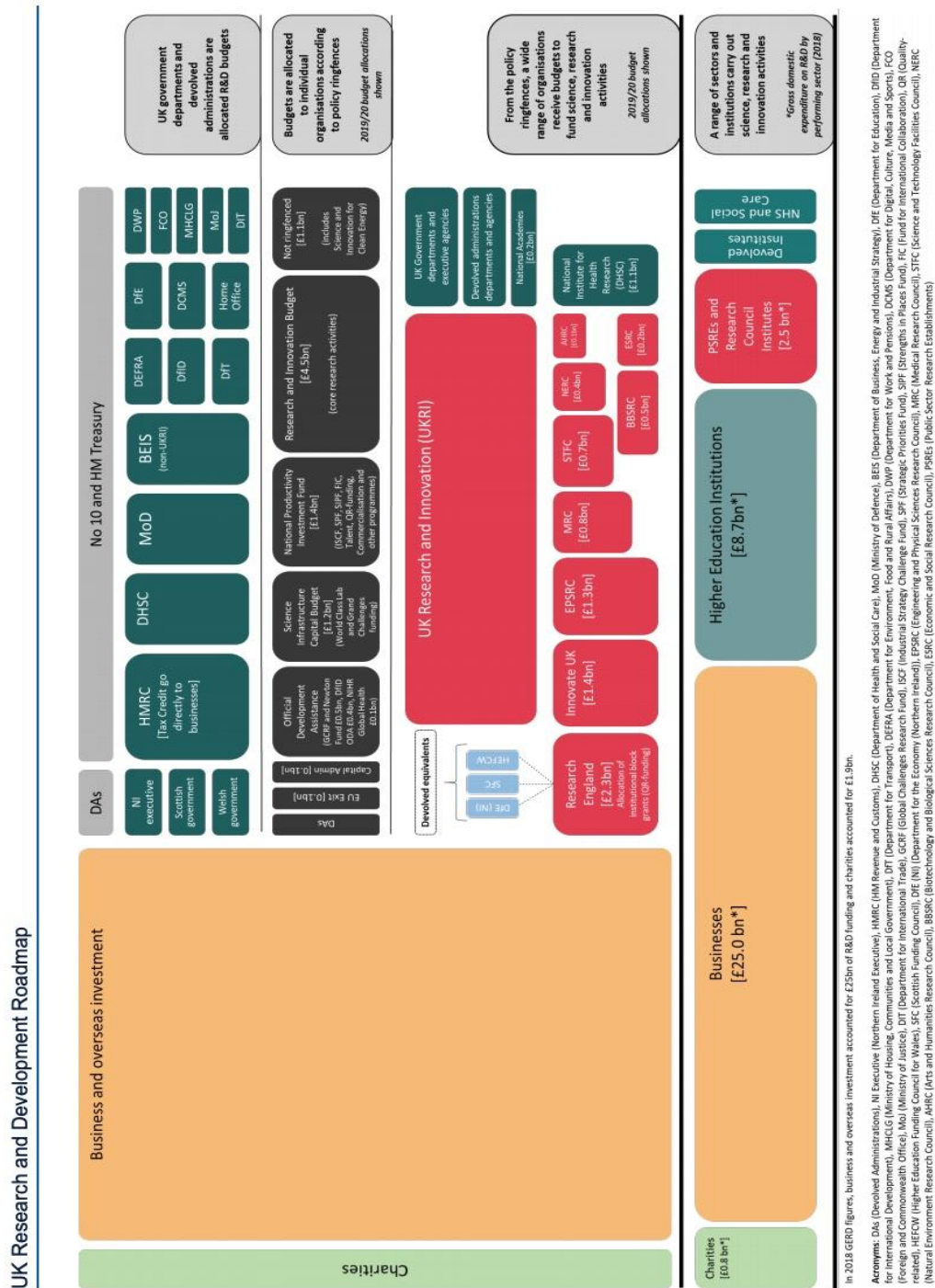
²⁸ <https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/timeseries/gibl/gerd>

²⁹ House of Commons Library (2020) *R&D Spending*. HoC Library Briefing Paper, Number SN04223, 17 June 2020. <https://commonslibrary.parliament.uk/research-briefings/sn04223/>

³⁰ Haskel J, Hughes A, Bascavusoglu-Moreau E (2014) *The Economic Significance of the UK Science Base*. A report for the Campaign for Science and Engineering (CaSE)

³¹ <https://committees.parliament.uk/writtenevidence/11596/pdf/>

³² Figure taken from HM Government (2020) *UK Research and Development Roadmap*. 1 July 2020
<https://www.gov.uk/government/publications/uk-research-and-development-roadmap>



1.2 The UK R&D Roadmap

On 1 July 2020, soon after announcing its £22 billion a year R&D investment target, the government published an initial draft of its **UK R&D Roadmap**.³³ Framed in the context of the UK's recovery from COVID-19, the Roadmap combines an analysis of current R&D strengths and weaknesses, with a prospective focus on emerging priorities. As its introduction explains:

*“The pandemic has also brought long-standing issues in our R&D system into sharp relief. We will seize the moment to harness the ingenuity, creativity and agility shown by the R&D system over the last few months...We will take a whole systems approach to ensure that we make the bold changes needed to ensure our system is fit for purpose...”*³⁴

The Roadmap is not a fully-developed R&D strategy; rather, it is a step towards one, with the aim of developing a “comprehensive plan”. The July 2020 document asks how the UK can:

- Provide the most effective forms of funding and management for researchers and research organisations, incentivising work of the highest quality;
- Most effectively support applied research that can help tackle the most complex and pressing challenges of government, industry and wider society;
- Take “bigger bets” – on a small number of ambitious programmes and institutes in genuinely transformational areas of science and research;
- Be more prepared to take risks to achieve potentially greater gains from research, and adopt long-term approaches to investing in research;
- Engage with people and in places across the country, to strengthen and improve our research and innovation system and inform our priorities and choices;
- Embed horizon-scanning to identify early and prepare to exploit our emerging strengths effectively, including discoveries that are ready for development, exploiting these for the prosperity and security of the UK;
- Improve our funding and decision-making approaches, embracing light-touch, ultra-fast and flexible processes with minimal red tape;
- Enable international collaboration of UK R&D and strengthen current collaboration mechanisms.³⁵

Although the draft Roadmap contains more questions than answers, it is valuable in **signposting priorities** for R&D policy and investment over the next few years. Five stand out:

³³ HM Government (2020) UK Research and Development Roadmap. 1 July 2020
<https://www.gov.uk/government/publications/uk-research-and-development-roadmap>

³⁴ Ibid, p.8

³⁵ Ibid, p.12

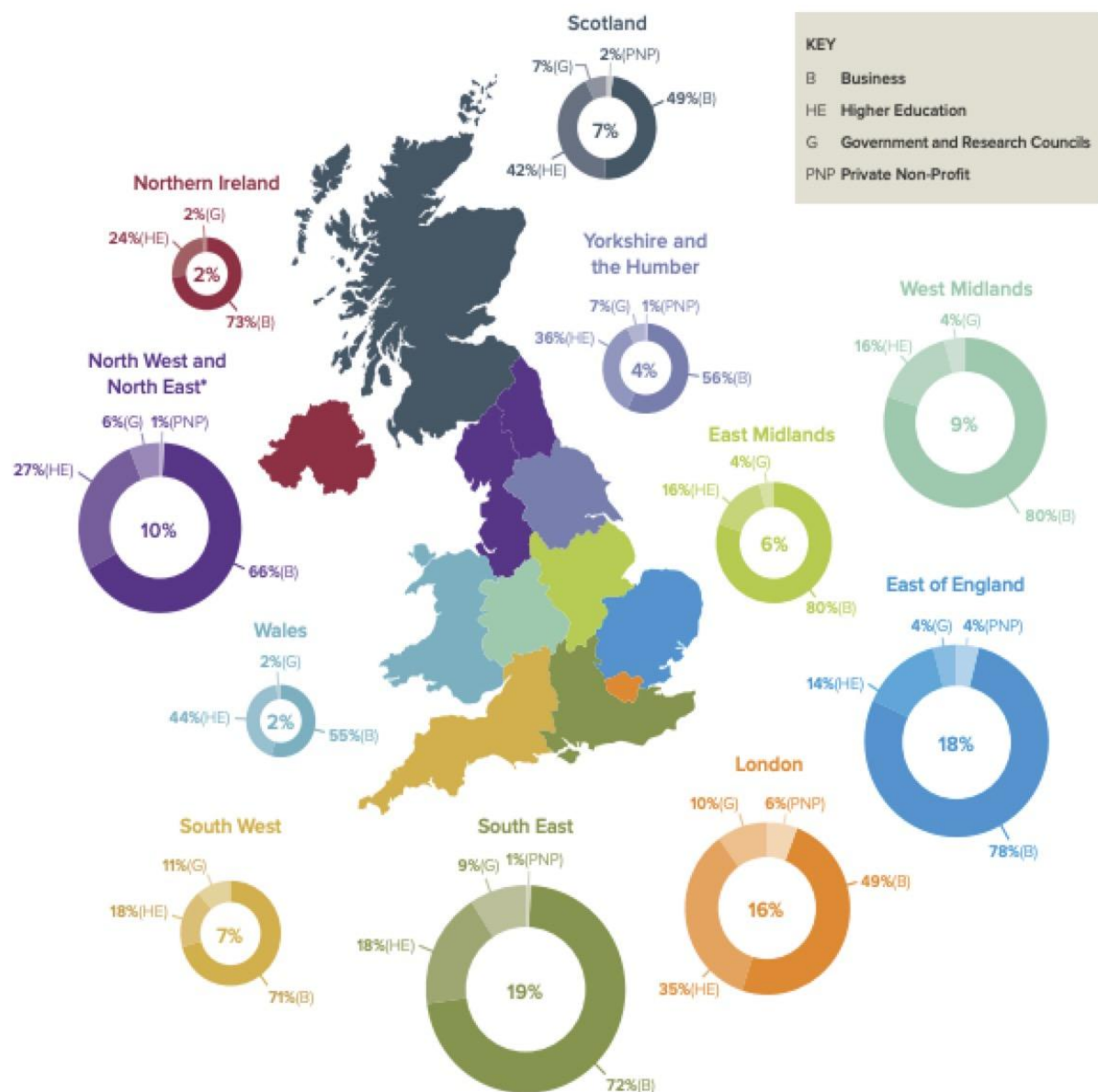
- 1) **accelerating the translation of R&D investments into tangible economic and social outcomes.** Crucial to this will be deploying extra public investment in fields, sectors and geographies that create positive multiplier effects through additional business investment. If we apply the rough 2:1 private-public R&D investment ratio that operates across the UK system, then an increase of around £9bn a year in public investment (from £12.6bn to £22bn per year) would need to be accompanied by an increase of roughly £18bn from the private sector (from £25bn to £43bn). This is an ambitious—some would say, impossible—target to aim for at any time, but particularly in the wake of ongoing economic turbulence from Brexit and the pandemic.³⁶
- 2) **levelling up R&D across the UK.** As Figure 6 shows, R&D activity and funding is unevenly concentrated across the UK, with London (16%), the South-East (19%) and East of England (18%) between them accounting for 53% of R&D expenditure (but only 36.6% of total population).³⁷ The Roadmap commits to the development of an R&D Place Strategy to “drive place-based outcomes...levelling up the UK” and to finding ways “to optimise the benefits to places in our R&D decision-making processes.” (pp.35-6)
- 3) **a commitment to new “moonshot” goals.** Drawing on work by the PM’s Council for Science and Technology, moonshots are described as “*ambitious, measurable goals which could have a significant impact on an important societal issue*” (pp. 16-17). Beyond a working definition, there is limited clarity in the Roadmap on precise areas that could become moonshots. The one concrete step towards this is a restatement of an earlier commitment to create a “unique and independent funding body for advanced research”, modelled on the US’ Advanced Research Projects Agency (ARPA), with an initial budget of £800m, and likely to be crucial to moonshot efforts (see 2.4 below).
- 4) **tackling perceived problems in research cultures.** The Roadmap underlines the government’s concern that careers in R&D are becoming less attractive, due to uncompetitive salaries, barriers to career progression, and a lack of opportunities for talented people from diverse backgrounds. To address these issues, an R&D People and Culture strategy is being developed, for publication in the first half of 2021.³⁸ There will also be a drive to reduce bureaucracy at UKRI and across the wider R&D system (p.51).

³⁶ See pp. 24-31 of the R&D Roadmap. Plus commentary on this from Richard Jones here: <http://www.softmachines.org/wordpress/?p=2495>

³⁷ ONS (2020) UK gross domestic expenditure on research and development, 2018.

³⁸ <https://www.gov.uk/government/groups/rd-people-and-culture-strategy-steering-group>

Figure 6: Regional Distribution of R&D spending across the UK³⁹



³⁹ Data from ONS R&D statistics for 2018. Map from UK National Academies (2020) *Investing in UK R&D*. <https://www.raeng.org.uk/policy/themes/research-and-innovation-policy/investing-in-engineering-research-and-innovation/investing-in-uk-r-d>.

- 5) **a post-Brexit reset of the UK's approach to international collaboration and mobility.** The Roadmap commits to “*upgrading the UK’s offer for global collaborative research and innovation through the development of a new, agile offer*” (p.40). This will include strengthening links with established partners—including the US and Japan—and seeking association to Horizon Europe (since agreed—see 3.2). The Roadmap was accompanied by the announcement of an Office for Talent based in 10 Downing Street, which will “*make it significantly easier for top global science, research and innovation talent to come to the UK*” (p.22). Further emphasis is given to ODA-linked collaborations with developing country partners, in support of the UN’s Sustainable Development Goals (p.41).⁴⁰

The publication of the R&D Roadmap was followed by a period of formal consultation, which received almost 400 responses, with a summary of these published in January 2021.⁴¹ Initial expectations were for the fuller “comprehensive plan” to follow alongside the autumn 2020 spending review. But after COVID-19 turbulence saw the spending review downgraded to a one-year settlement, the timetable for a finalised R&D Roadmap has been left unclear. Some aspects of the Roadmap may also be superseded by a new government **Innovation Strategy**, due to be published at the end of June 2021.⁴²

1.3 Recent budget announcements

As noted above, steep growth in public and private levels of investment will be essential if the 2.4% GDP and £22bn a year targets are to be reached. Before the pandemic ripped a hole through government economic forecasts, R&D was expected to form a central strand of its three-year spending plans, originally expected in autumn 2020.

When this morphed into a **more modest one-year review** on 25 November 2020, it still contained encouraging news. Public R&D budgets were increased for the second year in a row, to reach £14.6bn in 2021-22 (of which BEIS would receive £11.1bn). This includes a commitment to increase core UKRI budgets by around £400m per year through to 2023-24, an extra £490m for Innovate UK in 2021-22, and a further £350m to UKRI to support “strategic government priorities, [and] build new science capability.”

⁴⁰ ODA-linked funding for R&D collaboration is one element of the Roadmap that is already being downgraded, following significant reductions in overall UK spending on overseas aid (see section 3.3).

⁴¹https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/954356/uk-rd-roadmap-summary-survey-responses.pdf

⁴²<https://www.researchprofessional.com/0/rr/news/uk/politics/parliament/2021/4/Kwarteng--Innovation-strategy-will-be-tke--22bn-R-D-spending-plan.html>



Figure 7: HM Treasury announces additional R&D investment in the November 2020 one-year spending review.

While there was some disappointment that longer-term spending plans to 2025 were delayed, UKRI's success in securing a three-year settlement for core elements of its budget was seen as a positive recognition that

the R&D system needs stability.⁴³ Other strands of the November 2020 spending plans were less welcome: notably a significant cut to the UK's international aid commitments from 0.7% to 0.5% of GDP, which is already having knock-on effects on aid-linked research funding (see section 3.3. below). And there was limited detail on the new Shared Prosperity Fund, which is intended to replace the approximately £2.1bn of structural and regional funding that the UK received each year from the EU, pre-Brexit (which included some support for R&D infrastructure).⁴⁴

The annual **Budget** followed on 3 March 2021, but on this occasion, bar an announcement of a review of tax reliefs for business R&D, the research system was less prominent. From a funding perspective, the main shift since November 2020 has been an agreement in principle for the UK's association to **Horizon Europe**—the €95.5 billion EU framework programme—as part of the EU-UK Trade and Cooperation Agreement, signed on 24 December 2020.⁴⁵ UK participation is expected to cost around £1bn in 2021-22, and roughly double that each year after until 2027. Many hoped to see this commitment in the Budget, but it was conspicuous by its absence, leading to speculation that these funds would be drawn from elsewhere in the R&D budget.⁴⁶

Anxiety intensified through March 2021 over the potential combined effects of these extra Horizon Europe costs, and the ODA-linked budget cuts, on the headline R&D budget. In a letter to the Prime Minister on 25 March 2021, Lord Patel, Chair of the House of Lords Science and Technology Committee, summarised the concerns of many that: *“Diverting an amount of this scale from BEIS's R&D budget—equivalent to almost 20% of the 2020/21 budget of UKRI—would*

⁴³ <https://www.sciencecampaign.org.uk/news-media/press-releases/case-responds-to-2020-spending-review.html>

⁴⁴ <https://commonslibrary.parliament.uk/research-briefings/cbp-8527/>;

<https://www.instituteforgovernment.org.uk/explainers/european-structural-funds-after-brexit>

⁴⁵ See Pt. 5 of summary here:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962125/TCA_SUMMARY_PDF_V1-.pdf

⁴⁶ <https://www.sciencecampaign.org.uk/news-media/press-releases/case-responds-to-the-2021-spring-budget.html>

be unprecedented, and would come at a time when the sector was instead expecting a significant uplift in funding.”⁴⁷

Fortunately such fears proved unfounded when, on 1 April 2021, the government announced that **year one of the UK’s association to Horizon Europe will be funded through a mix of £250m in extra investment from HM Treasury, and around £700m of unallocated funds from BEIS.**⁴⁸ This will take the **total public R&D spend for 2021/22 to £14.9bn**—so comfortably on track towards the target of £22bn by 2025. However, the uncertainty leading up to this announcement has dented confidence in the government’s commitment to the £22bn and 2.4% GDP targets, and attention is now shifting to the next Spending Review, expected in autumn 2021, when the next three years of the government’s R&D Roadmap will need to be properly laid out. In recent weeks, influential figures such as Sir Adrian Smith, President of the Royal Society, have called for a “much more concrete plan” for investment—including in the ongoing costs of Horizon Europe.⁴⁹

1.4 From ‘dual support’ to multiple streams for university research

Since the mid-1980s, UK public funding for research has commonly been described as a “dual support” system—combining an annual block research grant to universities, allocated on a “quality-related” (or “QR”) basis as the result of successive research assessment exercises, with project and programme funding distributed through the research councils.⁵⁰

In recent years, this picture has become more complicated, with multiple funding streams—and interdependencies between these, which have become more visible as a result of the financial pressures of the pandemic.

First, the creation of UKRI in 2018 (described more under 2.1 and 2.2 below) saw the **integration of the two pillars of dual support under one roof** (at least in England, where the new body Research England now has responsibility within UKRI for quality-related block funding). This has yielded some benefits, but has also blurred the edges between these different funding modes⁵¹, and has meant that the volume of QR funding has struggled to keep pace with growth in other parts of the system, which are more visibly aligned to government or societal priorities. The

⁴⁷ <https://committees.parliament.uk/publications/5295/documents/52891/default/>

⁴⁸ <https://www.gov.uk/government/news/250-million-additional-funding-to-boost-collaboration-and-protect-ongoing-research>

⁴⁹ <https://www.researchprofessional.com/0/rr/news/uk/politics/parliament/2021/4/R-D-target-of-2.4---got-lost--amid-Horizon-uncertainty-and-ODA-cuts.html>

⁵⁰ See e.g. <https://re.ukri.org/funding/>;

<https://russellgroup.ac.uk/media/5529/underpinning-our-world-class-research-base-the-importance-of-q-r-july-2017.pdf>

⁵¹ For example, some new streams of QR funding have been more tightly aligned to specific programmes, such as the Global Challenges Research Fund.

Russell Group of research-intensive universities suggests that the value of QR funding “has seen a real-terms fall in its value of 13%” since 2010—a point also supported by UKRI data.⁵²

Second, on the research council side of dual support, there has been **significant growth in strategic, challenge-directed programmes** (see 2.3 below), while conventional grant funding has remained largely static. There are significant differences in the way these challenge funds operate from traditional grants: they typically involve larger awards to consortia of university and non-academic partners, with significant reliance on match funding and other in-kind contributions.

Third, the introduction in 2012 of higher UK student tuition fees, accompanied by a steady increase in overseas student numbers, has enabled many universities to generate **surpluses from fee income, which in turn subsidise university research**, the real costs of which are estimated by the Higher Education Policy Institute to be underfunded by around £4.3 billion per year across the UK.⁵³ It can be hard to determine the precise scale of cross-subsidies within university financial accounts, but their crucial importance has been made more explicit in the past year, as an impact of COVID-19, which at one stage looked likely to lead to significant drops in international and domestic student numbers.⁵⁴ These predictions proved over-pessimistic, but the Department for Business (BEIS), responsible for research funding, now recognises that *“Approximately one third of all research activity in universities is currently funded through surpluses that universities accrue....from international students and commercial activities, amounting to around £4.7bn per year.”*⁵⁵

Fourth, debates over the costs and benefits of UK-EU research collaboration which took place in the run-up to the Brexit referendum, and have continued since, have made the **scale and distribution of EU funding more visible within the UK system**. This funding is not evenly spread: for example, the British Academy highlights that 13 out of the top 15 disciplines with the highest share of their funding from EU sources are in the arts, humanities and social sciences.⁵⁶

To summarise, while dual support persists as a way of describing the two biggest pillars of the funding system, there is now a greater appreciation across UK university-based research of the importance of **multiple, interdependent funding streams**:

- Quality-related (QR) funding, allocated on the basis of the REF;
- Grant funding awarded through UKRI, its constituent research councils, other public funders—such as the National Institute for Health Research—and the national academies;


⁵² <https://wonkhe.com/blogs/the-invisible-hand-that-supports-quality-research/>

⁵³ <https://www.hepi.ac.uk/2020/03/09/from-t-to-r-revisited-cross-subsidies-from-teaching-to-research-after-augar-and-the-2-4-rd-target/>

⁵⁴ <https://www.ft.com/content/34347b56-4867-49f8-b7b5-4a61515f4a63>

⁵⁵ <https://committees.parliament.uk/writtenevidence/11596/pdf/>

⁵⁶ <https://www.thebritishacademy.ac.uk/documents/311/brexit-means.pdf>

- 
- Challenge-directed funding, largely coordinated via UKRI, and usually involving external partners in business, government or civil society;
 - Internal cross-subsidies for research within universities, drawn from domestic and international student tuition fees, or other commercial activities;
 - European funding sources, now via the UK's association to Horizon Europe;
 - Business and industrial funding for university research;
 - Charitable funding (including Wellcome Trust, Cancer Research UK and Leverhulme Trust).

There is strength and flexibility that flows from this diversity of funding sources. But from a policy and institutional management perspective, it can also make the system hard to navigate and understand in its entirety.

2. Structural reforms to the research funding system

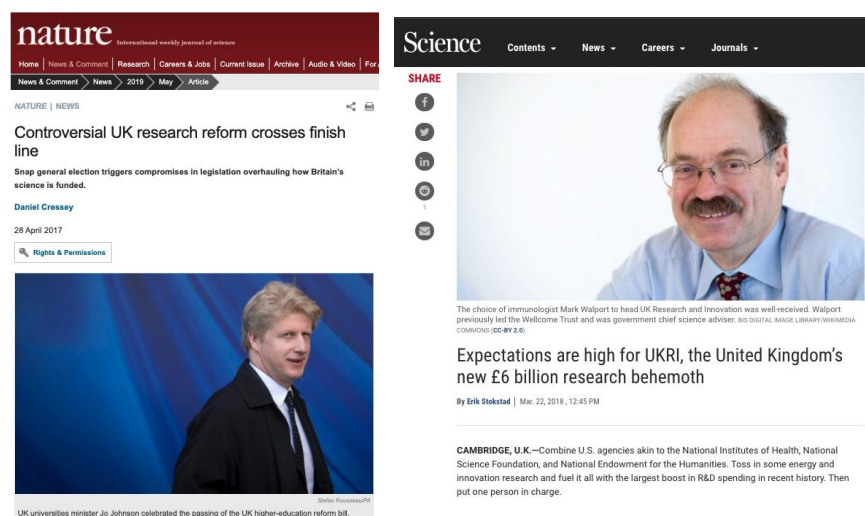


Figure 8: Coverage in *Nature* and *Science* of the successful passage of the Higher Education and Research Act (2017), spearheaded by (now Lord) Jo Johnson, former minister for universities and science, and the subsequent launch of UK Research and Innovation. under Sir Mark Walport as its first CEO.

2.1 The Nurse Review and 2017 Higher Education and Research Act

Before the uncertainties of Brexit, and later the pandemic, were added to the mix, the UK's public R&D system was already in the throes of its most significant structural reforms for 25 years. These began in 2014, when the then Coalition government under PM David Cameron published a UK science and innovation strategy.⁵⁷ This announced two further reviews: one led by Sir Paul Nurse on the effectiveness of the research councils⁵⁸; the other led by Dame Ann Dowling on how to strengthen business-university research collaborations.⁵⁹

Following the May 2015 general election, the government issued a Green Paper on higher education and research,⁶⁰ and the **Nurse Review** was published shortly afterwards, in November 2015. The government immediately announced that it would be taking forward the Nurse recommendations. After a further period of consultation, a White Paper version of these proposals (and other changes to the higher education system) was published in May 2016.

Nurse's headline proposal was for the creation of a new, integrated research and innovation funding agency—to be known as **UK Research and Innovation (UKRI)**—which would draw together the seven existing research councils, Innovate UK and the research elements of the former Higher Education Funding Council for England (HEFCE) under a single strategic umbrella. Within the White Paper, UKRI's objectives are summed up as follows:

⁵⁷ <https://www.gov.uk/government/publications/our-plan-for-growth-science-and-innovation>

⁵⁸ <https://www.gov.uk/government/collections/nurse-review-of-research-councils>

⁵⁹ <https://www.gov.uk/government/publications/business-university-research-collaborations-dowling-review-final-report>

⁶⁰ <https://commonslibrary.parliament.uk/research-briefings/cbp-7399/>

- a greater focus on cross-cutting issues that are outside the core remits of the current funding bodies, such as multi-and interdisciplinary research;
- a strengthened, unified voice for the UK's research and innovation system;
- improved collaboration between the research base, business and the commercialization of discoveries;
- better mechanisms for the sharing of expertise and best practice – for example, around management of major projects and large capital investment;
- more time for research leaders to focus on strategic leadership through the centralisation of back and middle office functions; and
- improved quality of evidence on the UK's research and innovation landscape through the pooling of multiple datasets.

These proposals were not universally welcomed, and prompted intense debate through 2016 and into early 2017.⁶¹ The government responded to many of the points raised through amendments to its proposals, and on 27 April 2017, the Higher Education and Research Act was passed.⁶² The launch of UKRI—by then operating in “shadow” form⁶³—formally occurred on 1 April 2018. Its first chief executive was **Professor Sir Mark Walport**⁶⁴, former Government Chief Scientific Adviser, and its inaugural chair was **Sir John Kingman**, former second permanent secretary at HM Treasury and now Chairman of the insurer, Legal & General.⁶⁵

2.2 UK Research and Innovation (UKRI)

Expectations were high for the new UKRI.⁶⁶ The new agency launched with an initial budget of roughly £6.5 billion a year, but a core part of the case for its creation was that its capacity for strategic oversight of the public R&D system would enable it to make a compelling case to the government, and ultimately to the wider public, for increased investment.

⁶¹ <https://wonkhe.com/blogs/analysis-concerns-ukri-blueprint/>

⁶² <https://www.legislation.gov.uk/ukpga/2017/29/part/3/crossheading/research-and-innovation-functions-and-role-of-the-councils/enacted>

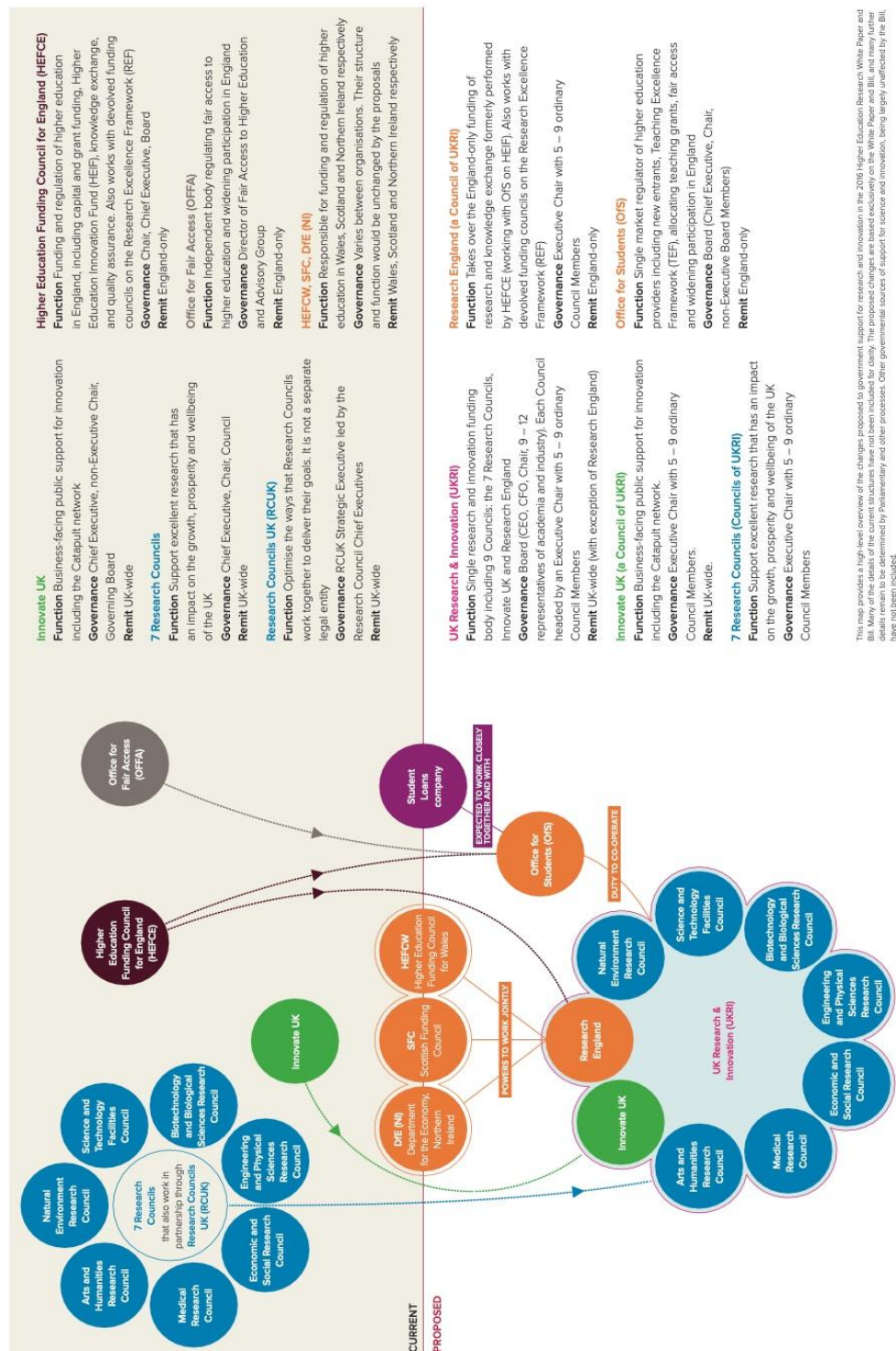
⁶³ <https://wonkhe.com/blogs/nine-brains-or-megabrain-whos-making-ukri/>

⁶⁴ <https://www.bbc.co.uk/news/science-environment-38830007>

⁶⁵ <https://www.timeshighereducation.com/news/john-kingman-confirmed-chair-uk-research-and-innovation>

⁶⁶ <https://www.sciencemag.org/news/2018/03/expectations-are-high-ukri-united-kingdom-s-new-6-billion-research-behe-moth>

Figure 9: a diagram of research funding system reforms in the 2017 HER Act (Source: The Royal Society)⁶⁷



⁶⁷ <https://royalsociety.org/-/media/policy/Publications/2016/higher-education-and-research-background.pdf>

Soon after its launch, in May 2018, UKRI published a **strategic prospectus** which, although it paints with a broad brush, remains the most comprehensive statement of the agency's vision to date.⁶⁸ This has been followed by a series of one-year corporate plans⁶⁹ and delivery plans for UKRI's constituent parts. To some extent, the government's R&D Roadmap, although it covers much more than the role of UKRI in the system, now provides the primary strategic context in which UKRI is operating.



Figure 10: Professor Dame Ottoline Leyser DBE FRS, who took over as CEO of UKRI in June 2020.

Sir Mark Walport's retirement as UKRI's CEO in 2020, and the appointment of Professor Dame Ottoline Leyser as his successor,⁷⁰ has given fresh impetus to some agendas: notably around research culture, diversity and inclusion.⁷¹ UKRI's response to COVID-19 has also accelerated more agile interdisciplinary modes of working and funding.⁷²

So as it marks its third birthday, in April 2021, to what extent has UKRI lived up to the aspirations of its architects?

In important respects, yes. While a range of factors lie behind the government's adoption of more ambitious R&D targets, there is little doubt that UKRI's scale, and the influence of its senior leadership, have helped to secure extra public investment in the R&D system. UKRI itself has been a major beneficiary of this, with its consolidated budget rising steadily to over **£8bn in 2019-20**,⁷³ and sizable uplifts for the next three years built into the latest spending review.

Beyond budgets, managing to keep the funding system running smoothly through the **merger of nine organisations and 7,000 staff into one body** is no small achievement. UKRI has also succeeded in introducing new ways of working, notably via funding schemes and modes which transcend traditional disciplinary and council silos. This includes the various challenge funds (see

⁶⁸ <https://wonkhe.com/blogs/seven-things-we-learnt-from-the-launch-of-ukris-strategy/>

⁶⁹ <https://www.ukri.org/about-us/what-we-do/corporate-plan/>

⁷⁰ <https://www.gov.uk/government/news/dame-ottoline-leyser-appointed-new-ceo-of-uk-research-and-innovation-ukri>

⁷¹ See e.g. <https://www.nature.com/articles/d41586-020-02424-z>;

<https://science.sciencemag.org/content/370/6519/886.summary>

⁷² <https://www.ukri.org/news/update-from-uk-research-and-innovation-chief-executive-ottoline-leyser/>

⁷³ <https://www.ukri.org/wp-content/uploads/2020/10/UKRI-050920-AnnualReport2019-2020.pdf>

section 2.3) and the well-regarded **Future Leaders Fellowships**, which provide longer-term funding for researchers in the earlier stages of their careers.⁷⁴

With further announcements expected this year from the government and UKRI on a range of topics, including research culture⁷⁵, open research⁷⁶ and the role of place in the funding system,⁷⁷ there is a sense in which UKRI's full strategic potential is yet to be realised. It has also proved harder than envisaged for UKRI to pursue avenues and opportunities that are semi-independent of wider government priorities. Speaking to the House of Commons Science and Technology Committee after he stepped down as CEO, Sir Mark Walport admitted that: "one of the challenges for UKRI has been that, because it is new and there is a lot of money associated with it, there has been a desire across government for quite a lot of micromanagement of UKRI's activity."⁷⁸

Above all, having lived only in unusually bumpy times, UKRI needs a period of financial and policy stability, in which it can consolidate, evaluate and embed new cultures and practices. Unfortunately there is little sign of this being possible any time soon.

Even while the government continues to restate its commitment to an R&D investment target of £22bn per year—which would, on current ratios, see UKRI's budget rise to around £12bn by 2025—the newly-announced **cuts of £120m to UKRI's ODA-funded programmes in 2021-22**, have provoked consternation from university leaders and researchers who have spent the past few years building up projects and partnerships with developing countries—in response to government and UKRI encouragement—only to see those priorities suddenly shift.⁷⁹

Until recently, another source of uncertainty was the cost of association to **Horizon Europe**, of around £1bn in this financial year, and more in subsequent years. Despite concerns that these costs would need to be absorbed into UKRI's existing budgets⁸⁰—requiring significant cuts elsewhere—the government's April 2021 announcement of additional funding for Horizon Europe in 2021-22 means these problems have been averted. However, a longer term funding model for the UK's association to Horizon Europe, from 2022-23 onwards, still needs to be determined, and may necessitate some trade-offs with domestic budgetary priorities.

⁷⁴ <https://www.ukri.org/our-work/developing-people-and-skills/future-leaders-fellowships/>

⁷⁵ <https://www.gov.uk/government/groups/rd-people-and-culture-strategy-steering-group>

⁷⁶ <https://www.ukri.org/our-work/supporting-healthy-research-and-innovation-culture/open-research/>

⁷⁷ <https://www.gov.uk/government/groups/rd-place-advisory-group>

⁷⁸ <https://www.ukri.org/our-work/ukri-oda-letter-11-march-2021/>

<https://www.researchprofessional.com/0/rr/news/uk/politics/parliament/2020/10/Former-UKRI-chief-complains-of-governments-micromanagement.html#sthash.NO33VsoR.dpuf>

⁷⁹ <https://www.theguardian.com/science/2021/mar/14/uk-scientists-attack-reckless-tory-cuts-to-international-research>

⁸⁰ <https://www.universitiesuk.ac.uk/news/Pages/govt-must-urgently-reconsider-research-budget-cuts.aspx>;

<https://russellgroup.ac.uk/news/russell-group-calls-for-clarity-on-funding-for-uk-science-and-research/>;

<https://wellcome.org/press-release/science-superpower-ambitions-risk-being-undermined-lack-investment>

Finally, there are more muted, if persistent, criticisms of UKRI from some parts of government and the research community for its **perceived bureaucracy** and failure to move faster in streamlining systems of funding and evaluation.⁸¹ This is one of the reasons why, in September 2020, the government launched a review of research bureaucracy⁸²—which remains ongoing—prompting UKRI to launch a ‘Simpler and Better’ programme to optimise its own processes (see 4.5 below).⁸³

Such concerns are also part of the rationale presented by ministers for a **new funding agency**, which would sit outside of UKRI (see 2.4 below).⁸⁴ Arguments for a greater diversity of structures and funding modes in the funding system are well made, but it is only three years since the government made a forceful **strategic case for consolidation** (through the 2017 Act which created UKRI). It may be that in some quarters of government, it is felt that UKRI has not yet delivered all that it promised. Support for an additional agency could also reflect a failure by policymakers to understand the pace at which complex systems are amenable to change. Or it could simply reflect a desire to mimic a perceived success story from overseas.

2.3 The rise of challenge-led funding

As noted above, UKRI’s overall budget has grown significantly over the past three years—from £6.5bn to £8.1bn per annum—and is expected to keep rising through to 2025. Much of this growth has been in newer, **interdisciplinary funding programmes directed towards specific challenges**, where the structural reach of UKRI across the system is a potential asset.

By contrast, standard funding mechanisms—such as the rolling, responsive grant schemes run by each of the disciplinary councils—have grown little in the past decade. This shift is far from unique to the UK, and can be observed in the heightened emphasis on challenges, missions, moonshots and related prioritisation devices in STI funding systems worldwide.⁸⁵

From UKRI’s own data, it can be difficult to obtain a comparable year-on-year breakdown of how funding is being distributed across different programmes and modes. But there is good evidence to support the Campaign for Science and Engineering (CaSE) in its conclusion that: *“uplifts in challenge funds, alongside broadly flat funding for R&I budgets, means the balance of funding within UKRI is changing.”*⁸⁶

⁸¹ See e.g. Ch. 4 of this recent report by the House of Commons Science and Technology Committee (2021):

<https://publications.parliament.uk/pa/cm5801/cmselect/cmsctech/778/77802.htm>

⁸² <https://www.gov.uk/government/publications/reducing-bureaucratic-burdens-higher-education/reducing-bureaucratic-burdens-on-research-innovation-and-higher-education>;

⁸³ <https://www.ukri.org/news/ukri-reducing-unnecessary-bureaucracy/>

⁸⁴ <https://www.timeshighereducation.com/news/dominic-cummings-give-aria-extreme-freedom-red-tape>

⁸⁵ <https://link.springer.com/article/10.1007/s10842-019-00329-w>;

<https://www.sciencemag.org/news/2020/09/europe-unveils-targets-hyped-research-missions>

⁸⁶ <https://www.sciencecampaign.org.uk/news-media/case-comment/challenge-funds-and-flat-cash-cores.html>

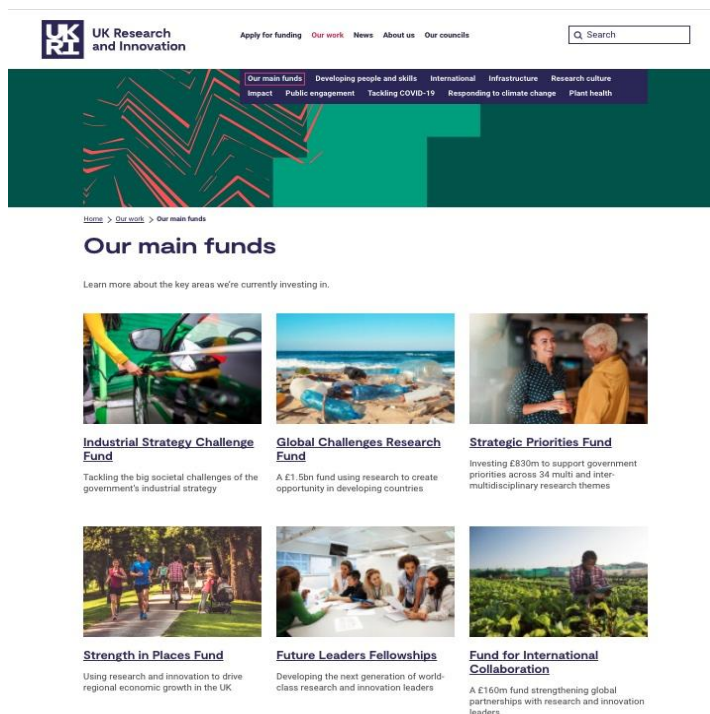


Figure 11: An overview of the main funding schemes at UKRI.

Three funds have been particularly significant since UKRI's launch: **Industrial Strategy Challenges Fund (ISCF)**; **Global Challenges Research Fund (GCRF)**; and **Strategic Priorities Fund (SPF)**. The future of two of these is now uncertain, such that the outlook for challenge funding is less assured. But the UK seems unlikely to abandon this approach, given global moves towards challenge or mission funding—even if it refreshes its choice of challenges for the next few years.

- Industrial Strategy Challenges Fund (ISCF)**—The ISCF was announced in the November 2016 Budget (when Theresa May was PM), with a budget allocation of £4.6bn from 2017 onwards.⁸⁷ Since then, 24 sectoral or technological challenges have been identified and funded, clustered under the four headings of the government's 2017 industrial strategy: clean growth; ageing society; future of mobility; artificial intelligence and data economy. ISCF projects are typically business and industry-led, with support from academic partners, so within UKRI, the business-facing team at **Innovate UK** is often in the lead (though some topics and themes lend themselves to a stronger role for other UKRI councils). A recent review of the ISCF by the National Audit Office (NAO) was broadly positive and found that: *"By January 2021 the Fund was supporting 1,613 projects, contributing to one of the 24 approved challenges. To date, UKRI has spent around £1.2 billion of the Fund's eight-year budget..."*⁸⁸ However, following the government's review of the 2017 industrial strategy and its replacement with a **Plan for Growth** (see 4.1 below), the future of the ISCF is unclear. It seems likely to be superseded by new schemes for

⁸⁷ <https://www.gov.uk/government/publications/autumn-statement-2016-documents/autumn-statement-2016>; <https://www.theguardian.com/science/political-science/2016/nov/24/autumn-statement-what-will-an-extra-47-billion-do-for-uk-science-and-innovation>; <https://innovateuk.blog.gov.uk/2017/02/03/industrial-strategy-challenge-fund-what-is-it-and-how-is-it-being-formed/>

⁸⁸ <https://www.nao.org.uk/report/the-ukris-management-of-the-industrial-strategy-challenge-fund/>

business-led R&D and university-business collaboration aligned to post-pandemic priorities for economic recovery.⁸⁹

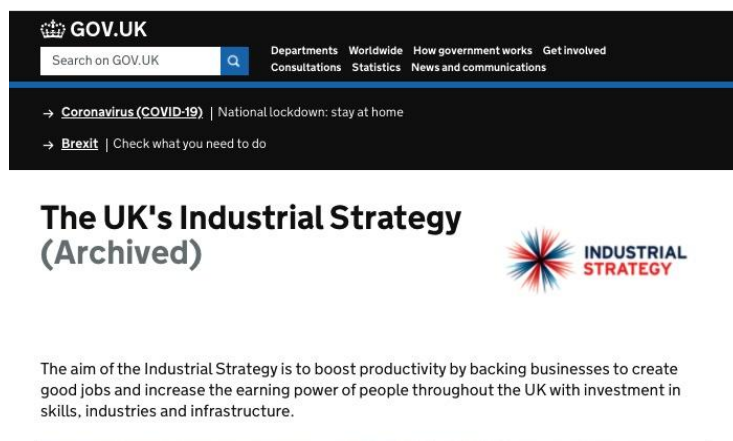


Figure 12: The government webpage for its industrial strategy (originally published in 2017) now says it is “Archived”, casting uncertainty over the future of related initiatives, including the Industrial Strategy Challenges Fund (ISCF).⁹⁰

- Global Challenges Research Fund (GCRF)**—Launched in 2016, the GCRF is a £1.5 billion fund, managed collaboratively by UKRI, the UK National Academies, national funding bodies and UK Space Agency. Its three aims are: to fund challenge-led disciplinary and interdisciplinary research; to strengthen capability for research, innovation and knowledge exchange in the UK and developing countries; to provide an agile response to emergencies where there is an urgent research or on-the-ground need. The budget for GCRF forms part of the UK’s official development assistance (ODA), and since global agreement in 2016 of the United Nations Sustainable Development Goals (SDGs), the GCRF has been broadly aligned towards these. If the primary focus for the ISCF is on R&D partnerships with business, for the GCRF it is R&D partnerships with universities, researchers, governmental and non-governmental partners in ODA-eligible countries. To date, the GCRF has supported the creation of twelve interdisciplinary research hubs with between £13m and £20m over five years. A further £225 million has been invested in 37 projects to grow research capacity around the globe. And more than 140 projects have been funded through its Collective Programme, under the themes of global health; education; sustainable cities; food systems; conflict; and resilience.⁹¹ While there had been an expectation that the GCRF would continue in some form beyond its initial five-year timeframe (2016 to 2021), this was thrown into doubt following the November 2020 spending review’s announcement of cuts to the UK’s ODA commitments from 0.7% to 0.5% of GDP. The implications of this for ODA-funded research became clear in March

⁸⁹ See <https://www.ft.com/content/013ce682-09c8-4132-9a14-232f7e9f311a>; <https://www.ft.com/content/372ae7ec-0ad7-4111-b319-db0a8f4abb7b>;

⁹⁰ <https://www.gov.uk/government/topical-events/the-uks-industrial-strategy>

⁹¹ <https://www.gov.uk/government/publications/global-challenges-research-fund/global-challenges-research-fund-gcrf-how-the-fund-works>; <https://www.ukri.org/our-work/collaborating-internationally/global-challenges-research-fund/>

2021, with the imposition of **£120m of immediate cuts**, mainly to ongoing GCRF-funded projects.⁹² According to UKRI data, its ODA allocation has fallen from £422 million in 2020-21 (of which £367 million went to the GCRF and £55 million to the Newton Fund) to £125 million in 2021-22—**overall a 70 per cent reduction**. This decision has provoked a strong reaction across the UK research community, and among international partners, with many frustrated by what they perceive as an inconsistent and damaging approach to sustaining long-term collaborative relationships (see 3.2 below for more on this).⁹³

- **Strategic Priorities Fund (SPF)**—The newest of the large challenge funds, SPF is now an **£830 million** investment in interdisciplinary research across **34 themes**. This money comes from the government’s National Productivity Investment Fund, and the funds are managed by UKRI.⁹⁴ The SPF has **three headline goals**: to increase high-quality multi- and interdisciplinary research and innovation; to ensure UKRI investment links up effectively with government research and innovation priorities; and to respond to strategic priorities and opportunities. There has been less attempt to brand and present SPF as a coherent programme, but if ISCF aligns with government’s priorities for business and industry, and GCRF with its ODA priorities; then perhaps the simplest way to explain SPF is as a fund for research which aligns with government’s other priorities. SPF investments are now clustered in eight broad areas, and examples of investments include: a productivity institute based at the Alliance Manchester Business School; the Modern Slavery and Human Rights Policy and Evidence Centre; the Nucleic Acid Therapy Accelerator; and the Trustworthy Autonomous Systems Hub.⁹⁵

⁹² <https://www.ukri.org/our-work/ukri-oda-letter-11-march-2021/>

⁹³ <https://wellcome.org/press-release/science-superpower-ambitions-risk-being-undermined-lack-investment>; <https://www.universitiesuk.ac.uk/news/Pages/cuts-oda-limit-uk-universities-role-solving-global-challenges.aspx>; <https://www.ucl.ac.uk/research/news/2021/mar/statement-professor-david-price-cuts-oda-funding>; <https://www.timeshighereducation.com/news/sir-paul-nurse-ukri-cuts-are-existential-threat-science>

⁹⁴ <https://www.ukri.org/our-work/our-main-funds/strategic-priorities-fund/>

⁹⁵ <https://www.alliancembs.manchester.ac.uk/research/productivity/>; <https://modernslaverypec.org/>; <https://www.natahub.org/>; <https://www.tas.ac.uk/>

2.4 The uncertain promise of ARIA

While the creation of UKRI had its origins in a government strategy and a review led by a Nobel Laureate (Sir Paul Nurse), the newest addition to the UK's R&D funding landscape—the **Advanced Research and Invention Agency (ARIA)**—began its life as a blogpost.

Dominic Cummings, an influential player in the “Leave” campaign during the UK's EU referendum, wrote in September 2018 about his admiration for the approach of the US Advanced Research Projects Agency during a specific period—from 1962 to 1975—that he regarded as extraordinarily productive, and a potential blueprint for STI funding in the UK. Under a year later, Cummings was inside Number 10 as one of PM Boris Johnson's closest advisers, and by his own account insisted that the PM commit to this new agency as part of the price for his support.⁹⁶

In October 2019, Johnson included a commitment to “a new approach to funding emerging fields of research and technology, broadly modelled on the US Advanced Research Projects Agency” in his first Queen's Speech.⁹⁷ Shortly afterwards, the idea reappeared in the Conservative Party's 2019 election manifesto as a “new agency for high-risk, high-payoff research”.⁹⁸

By March 2020, the government had arrived at a budget for the new agency—**£800 million over four years**—which was also referenced in the draft R&D Roadmap.⁹⁹ When its architect, Dominic Cummings, left the government suddenly in November 2020, there was speculation that the idea for the new agency would be quietly shelved.¹⁰⁰ But in February 2021, the government confirmed plans to move ahead, and announced the ARIA name, followed soon after by a draft Bill to enable its creation, which is now working its way through Parliament.¹⁰¹ The envisaged timetable for ARIA has slipped, and it is now not expected to be fully operational until 2022.

Within the research community, there is broad support for the idea of a new agency with a distinct remit and approach to that of UKRI—particularly in light of the government's plans for extra R&D investment. However, there have also been repeated calls for greater clarity as to the purpose and mission of the new agency, and its relationship to existing structures within the funding

⁹⁶ <https://www.ft.com/content/e654a6fa-4e75-4365-8025-9aa2a6198c12>;

<https://www.independent.co.uk/news/uk/politics/dominic-cummings-boris-johnson-no-10-brexiteer-b1818359.html>

⁹⁷ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839370/Queen_s_Speech_Lobby_Pack_2019_.pdf

⁹⁸ https://assets-global.website-files.com/5da42e2cae7ebd3f8bde353c/5dda924905da587992a064ba_Conservative%202019%20Manifesto.pdf

⁹⁹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/896799/UK_Research_and_Development_Roadmap.pdf, see p.17

¹⁰⁰ <https://www.bbc.co.uk/news/uk-politics-54938050>

¹⁰¹ <https://www.gov.uk/government/news/bill-introduced-to-create-high-risk-high-reward-research-agency-aria>

system. The **House of Commons Science and Technology Committee** criticised this ambiguity in a recent report, describing ARIA as “a brand in search of a product”.¹⁰²

There are plenty of proposals circulating for what the new agency could or should do—as reflected in contributions to an FST discussion meeting in January 2021.¹⁰³ But the government is yet to choose between these, and it is hard to see how a single agency could simultaneously be an “international lynchpin for business investment...and ultimately deliver new products” (the view of the Confederation of British Industry¹⁰⁴), a funder of “multidisciplinary research teams with the capacity to take a holistic approach” to complex problems (the preferred model of the Russell Group of universities¹⁰⁵) and a “public sector new technology seed fund” (the view of Ruth McKernan, former chief executive of Innovate UK). This is particularly so given an annual budget of around £200m (£800m over four years)—which will soon be less than 1 per cent of the UK’s public R&D budget, assuming the government hits its £22bn a year target by 2025.

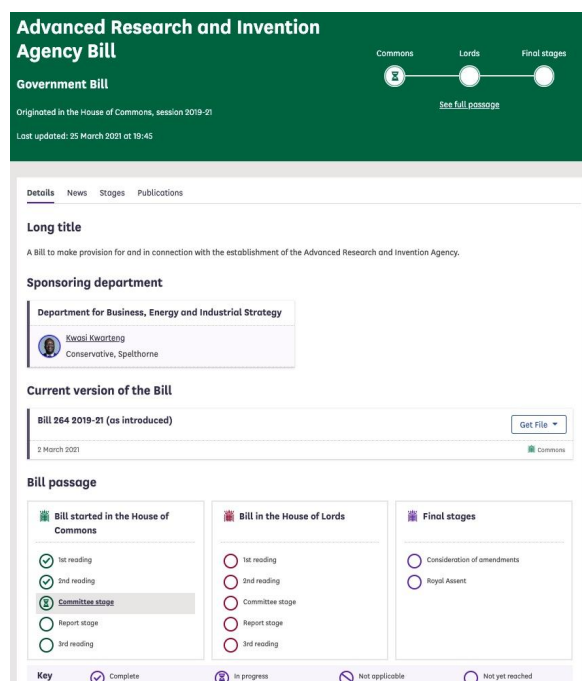


Figure 13: As of 25 March 2021, the ARIA Bill is in Committee stage in the House of Commons, as it makes its passage into legislation.¹⁰⁶

Instead of resolving these issues now, the ARIA bill enables ministers and ARIA’s leadership to determine its purposes at a later date. There is no doubt that the Bill will be passed, and ARIA will be operational by 2022. But given pressures elsewhere in the research budget (e.g. over Horizon Europe and the ODA cuts) questions are likely to persist over the need for ARIA, its priorities and its relationship to UKRI.¹⁰⁷ There is also some concern that ARIA is drawing political attention away from more pressing priorities in the remaining 99 per cent of the UK’s public R&D system.¹⁰⁸

¹⁰² <https://committees.parliament.uk/publications/4665/documents/47032/default/>

¹⁰³ <https://www.foundation.org.uk/Events/2021/Creating-a-UK-ARPA%E2%80%9D%E2%80%93and-making-it-a-success>

¹⁰⁴ <https://www.cbi.org.uk/media/4040/arpa-position-paper-no-watermark.pdf>

¹⁰⁵ https://russellgroup.ac.uk/media/5893/russell-group_a-new-uk-research-funding-agency_written-evidence.pdf

¹⁰⁶ <https://bills.parliament.uk/bills/2836> (screengrab taken on 26 March 2021)

¹⁰⁷ <https://commonslibrary.parliament.uk/research-briefings/cbp-9176/>

¹⁰⁸ <https://www.researchprofessionalnews.com/rr-news-political-science-blog-2021-3-aria-is-an-oldie-but-there-s-no-sign-it-will-be-a-hit/>

2.5 Research funding in England, Scotland, Wales and Northern Ireland

As Figure 5 shows, most public R&D funding is administered on a UK-wide basis. But important funding streams are also managed by bodies in England, Scotland, Wales and Northern Ireland:

- **Research England** is one of the constituent councils established in 2018 under UKRI, with responsibility for UKRI's England-only support for university research and knowledge exchange. This includes implementing the Research Excellence Framework (REF), in partnership with the other national funding councils, and allocating **quality-related funding (QR)** as a result; funding English universities to undertake research and knowledge exchange activities; administering the £230m Higher Education Innovation Fund (HEIF);¹⁰⁹ overseeing the sustainability of the university research base in England; and managing the UK Research Partnership Investment Fund, which since 2012 has provided over £900 million of capital funding to 54 university research centres or facilities across the UK.¹¹⁰ **In 2020-21, Research England distributed a total of £2.23bn**, of which £1.73bn was allocated by formula in light of the REF, £230m was for knowledge exchange, and £204m for capital funding.¹¹¹ This constitutes the **largest stream of funding for university research**, and its importance to the overall sustainability of the system cannot be overstated.
- **The Scottish Funding Council (SFC)** allocates a further £240m annually to university research in Scotland, on the basis of the UK-wide Research Excellence Framework.¹¹² A further £60m is invested in research infrastructure, knowledge exchange and other national priorities.¹¹³ In May 2020, the Scottish government made an extra one-off investment of £75m in university research, to offset the negative impacts of COVID-19 on university finances.¹¹⁴ The Scottish government has also developed its own strategies in priority R&D areas: including health and social care¹¹⁵; environment and agriculture¹¹⁶; and artificial intelligence (AI).¹¹⁷

¹⁰⁹ <https://re.ukri.org/knowledge-exchange/the-higher-education-innovation-fund-heif/>

¹¹⁰ <https://re.ukri.org/funding/our-funds-overview/uk-research-partnership-initiative-fund/>

¹¹¹ <https://re.ukri.org/sector-guidance/publications/research-and-knowledge-exchange-funding-2020-21/>

¹¹² <http://www.sfc.ac.uk/funding/university-funding/university-research-funding.aspx>

¹¹³ <http://www.sfc.ac.uk/about-sfc/about-us/about-us.aspx>

¹¹⁴ <https://www.gov.scot/news/minister-announces-gbp-75m-boost-for-university-research/>

¹¹⁵ <https://www.gov.scot/binaries/content/documents/qovscot/publications/research-and-analysis/2015/10/delivering-innovation-through-research-scottish-government-health-social-care-research/documents/00488082-pdf/00488082-pdf/govscot%3Adocument/00488082.pdf>

¹¹⁶ <https://www.gov.scot/publications/strategy-environment-natural-resources-agriculture-research-2022-2027/>

¹¹⁷ <https://www.gov.scot/publications/scotlands-ai-strategy-trustworthy-ethical-inclusive/>

- **The Higher Education Funding Council for Wales (HEFCW)** allocates £71m annually to university research in Wales, on the basis of the UK-wide Research Excellence Framework. A further £3.5 million is invested in enhancing HE-FE collaboration in innovation and engagement; £1.8 million in enhancing civic mission and community engagement; and £6.6 million in support for external income capture and infrastructure.¹¹⁸ Following a 2017 review by Professor Graeme Reid of publicly-funded R&D in Wales,¹¹⁹ HEFCW in 2019 published a vision statement for the future of the Welsh research system.¹²⁰
- **Northern Ireland's Department for the Economy** plays the same role for university research there—with the bulk of its funding going to Queen's and Ulster Universities.¹²¹

2.6 University-business interactions

As the draft R&D Roadmap reminds us, the UK's environment for business R&D and innovation has several strengths: *"The UK is ranked...in the top 10 best countries worldwide to start, locate and scale a business. We already attract significant venture capital – at a level that exceeds that of Germany, France and Sweden combined. We are home to 77 unicorns (start-ups valued over US \$1 billion), more than a third of the total across Europe and Israel."* Yet concerns persist that *"we underperform in innovation compared to research. We need to do more to make the most of our world-class research base and to increase the productivity of UK businesses..."*¹²²

As a result, university-business interactions in support of R&D have been a regular focus of reviews and initiatives. When **Professor Dame Ann Dowling** chaired one such effort in 2015, she noted that hers was the 14th review on this topic, in the space of 12 years (see Figure 14).

Policy and funding is also informed by the **Higher Education Business & Community Interaction (HE-BCI) survey**, which has collected financial and output data related to **knowledge exchange (KE)** every year since 1999.¹²³ This survey covers a range of activities, from business and public or third sector involvement in research, to consultancy and the commercialisation of intellectual property. Since 2017, there has been a push from the government to build on the HE-BCI data to generate a more comprehensive audit and reporting mechanism: the **Knowledge Exchange Framework (KEF)**. But following the completion of a first iteration of KEF, and the publication of its

¹¹⁸<https://www.hefcw.ac.uk/en/our-responsibilities/research-innovation-and-engagement/research-and-innovation-initiatives/>

¹¹⁹<https://gov.wales/sites/default/files/publications/2019-04/review-of-government-funded-research-and-innovation-reid-review.pdf>

¹²⁰ <https://www.hefcw.ac.uk/wp-content/uploads/2020/09/Research-and-Innovation-the-vision-for-Wales-English.pdf>

¹²¹ <https://www.economy-ni.gov.uk/articles/higher-education-quality-related-research-gr-funding>

¹²² HM Government (2020) UK Research and Development Roadmap. 1 July 2020, p.24

<https://www.gov.uk/government/publications/uk-research-and-development-roadmap>

¹²³ <https://www.hesa.ac.uk/data-and-analysis/business-community;>

[https://re.ukri.org/knowledge-exchange/the-he-bci-survey/;](https://re.ukri.org/knowledge-exchange/the-he-bci-survey/)

results in March 2021, it is now under review, and may end up being scaled back, or incorporated into other frameworks.¹²⁴



Figure 14: Reviews of university-business interactions since 2003 (source: Dowling Review, 2015)¹²⁵

Another valuable source of data, analysis and practical support is the **National Centre for Universities and Business (NCUB)**—itself the product of Sir Tim Wilson’s 2012 review (see Figure 14). NCUB compiles an annual **State of the Relationship** report, which incorporates 25 metrics relating to skills and talent, as well as research and innovation.¹²⁶ The 2020 report notes an 8.7% annual rise in levels of investment by UK businesses in university R&D—taking the total £389m in 2017-18. But it warns that this will be followed by a significant drop as a consequence of COVID-19. In July 2020, NCUB was asked by the government to convene an R&D Taskforce on this issue.¹²⁷ The resulting report, published in November 2020, made ten recommendations designed to support an R&D-led economic recovery from the pandemic.¹²⁸

Within the funding system, significant sources of support for **R&D-based university-business** interactions are:

¹²⁴ <https://re.ukri.org/knowledge-exchange/knowledge-exchange-framework/>

¹²⁵ <https://www.raeng.org.uk/publications/reports/the-dowling-review-of-business-university-research>, p.13

¹²⁶ <https://www.ncub.co.uk/reports/state-of-the-relationship-report-2020>

¹²⁷ <https://www.ncub.co.uk/latest-news/new-collaboration-taskforce-announced-to-aid-economic-recovery>

¹²⁸ <https://www.ncub.co.uk/reports/r-d-taskforce-report-research-to-recovery>

- **Knowledge exchange funding**—administered by Research England and the other national higher education funding councils (see section 2.5). This includes targeted funds via the **Higher Education Innovation Fund (HEIF)**, which grew to £255m annually from 2020-21; and the **Connecting Capability Fund (CCF)**, which supports higher education to forge external technological, industrial and regional partnerships, aligned to Industrial Strategy priorities—currently through 18 projects, involving 60 HE partners and 128 businesses.¹²⁹
- **Innovate UK**—now another of the constituent councils of UKRI, Innovate UK has its origins in a 2003 review by Sir Richard Lambert (see Figure 14). Set up initially as the **Technology Strategy Board**, it has since 2007 invested around £2.5 billion to support business innovation, with match funding from industry taking the total value of projects above £4.3bn. By its own estimates, these have generated around 70,000 jobs and added almost £18bn of value to the UK economy.¹³⁰ As noted in 2.3 above, since 2017, Innovate UK has been central to the operation of the Industrial Strategy Challenges Fund (ISCF). It also operates a number of other funding and support mechanisms, including: **Smart Grants**—the core funding model for business-led collaborative R&D; **Catalyst Programmes**—aimed at emerging technologies or sectors, for example in industrial biotechnology or digital health technology; **Knowledge Transfer Partnerships (KTPs)**—which part-fund businesses to bring academic expertise in-house for between 12 and 36 months¹³¹; and the **Small Business Research Initiative (SBRI)**, an innovation procurement programme, designed to give small firms and start-ups an opportunity to show how their products and services can help solve public sector challenges.¹³²
- **Knowledge Transfer Network (KTN)**—this is a separate body, which supports the KTP model and wider Innovate UK goals by helping innovators to find collaboration partners; convening sectoral and technology-specific interest groups; and providing project-level support for the KTP programme. In August 2020, KTN launched a new five-year strategy with a focus on linking economic prosperity to societal and environmental benefits, with an initial focus on innovations for net-zero carbon emissions.¹³³
- **The Catapult Network**—the outcome of another review (led by Dr Hermann Hauser in 2010), Catapults are technology and innovation centres focused in priority areas. Nine are now operating, spread across 40 locations, working in areas such as medicines discovery;

¹²⁹ <https://re.ukri.org/knowledge-exchange/the-connecting-capability-fund-ccf/>

¹³⁰ <https://www.gov.uk/government/organisations/innovate-uk/about>

¹³¹ <https://www.gov.uk/guidance/knowledge-transfer-partnerships-what-they-are-and-how-to-apply>

¹³² <https://www.gov.uk/government/collections/sbri-the-small-business-research-initiative>

¹³³ <https://ktn-uk.org/news/ktn-unveils-its-ambitious-five-year-strategy/>

cell and gene therapy; offshore renewable energy; and high value manufacturing (see Figure 15). The network was last reviewed in 2017 by Ernst & Young, which concluded that the Catapult concept “remains sound”, but had been implemented inconsistently, with funding levels in some areas that were below expectations. As a result, the network was overhauled, under a sharper coordinating mission, reflected in its latest annual report.¹³⁴

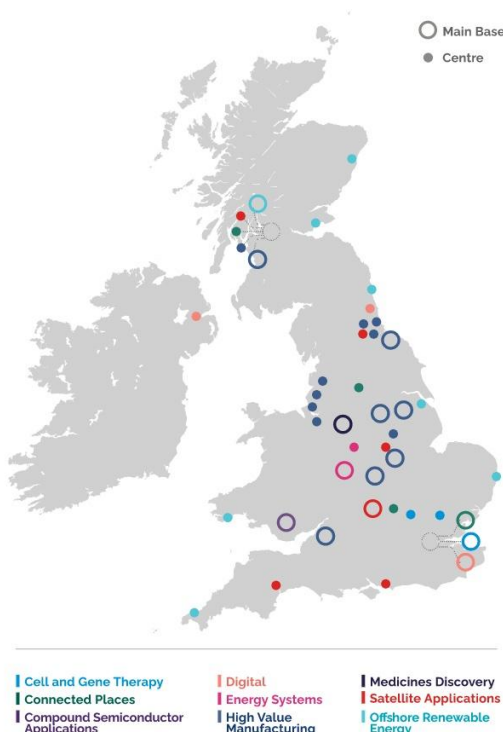


Figure 15: The UK Catapult Network¹³⁵

The Catapults receive core funding from Innovate UK, but are independent organisations. Between 2013 and 2020, they supported 14,750 industry and 5,108 academic collaborations. **In 2019-20, core grants to the network of £236m yielded total investments of £744m.**¹³⁶ They and other Innovate UK programmes received a £490m funding boost for 2020-21 in the November 2020 spending review.

Yet uncertainties persist over the longer-term sustainability of the model, with some concerns that the new ARIA may be more of a priority for future investment.¹³⁷ On 6 April 2021, BEIS published a review of the Catapult Network aimed at clarifying their contribution to the UK’s wider R&D strategy.¹³⁸

- **Impact Acceleration Accounts (IAAs)**—in addition to pan-institutional support for KE through the HE funding councils, many of the research councils within UKRI have at various points operated IAAs to support KE and impact from their funded research at specific institutions. Four councils—EPSRC, ESRC, BBSRC and STFC—have been most active in their use of this mechanism.¹³⁹ Previously, **Wellcome Trust** offered a similar model, through its Translational Partnership Awards, but this is now under review.¹⁴⁰

¹³⁴ <https://catapult.org.uk/wp-content/uploads/2020/12/Catapult-Network-Impact-Brochure-2020-FINAL.pdf>

¹³⁵ Diagram from Catapult network Impact Brochure, 2020, p.2

¹³⁶ <https://catapult.org.uk/wp-content/uploads/2020/12/Catapult-Network-Impact-Brochure-2020-FINAL.pdf>

¹³⁷ Ibid, p.4

¹³⁸ <https://sciencebusiness.net/news/stop-endless-reviewing-uk-research-chief-appeals-more-room-deliver>

¹³⁹ <https://www.gov.uk/government/publications/catapult-network-review-2021-how-the-uks-catapults-can-strengthen-research-and-development-capacity>

¹⁴⁰ <https://epsrc.ukri.org/innovation/fundingforimpact/impact-acceleration-accounts/>;
<https://esrc.ukri.org/collaboration/collaboration-opportunities/impact-acceleration-accounts/>;
<https://bbsrc.ukri.org/innovation/maximising-impact/impact-acceleration-accounts-iaas/>;
<https://stfc.ukri.org/funding/stfc-knowledge-exchange/impact-acceleration-accounts/>

¹⁴⁰ <https://wellcome.org/grant-funding/schemes/translation-fund>

2.7 The future of the Research Excellence Framework (REF)

The UK first introduced a performance-based research assessment exercise in 1986, and has been through seven cycles in the 35 years since then (see Figure 16 for an overview). The submission deadline for the current cycle—REF 2021—has just passed, and although its results will not be known until early 2022, thoughts are already turning to ways in which the assessment process might be streamlined and improved.

Date	Exercise	Coordinating body	Key features
1986	Research Selectivity Exercise	Universities Grants Committee	37 cost-centres; 4-part questionnaire on research income, expenditure, planning priorities & output
1989	Research Selectivity Exercise	Universities Funding Council	152 units of assessment; 70 peer review panels; 2 outputs per member of staff
1992	Research Assessment Exercise (RAE)	HEFCE	HEIs select which staff to submit; 5-point scale; 2800 submissions to 72 UoAs; introduction of census date
1996	Research Assessment Exercise (RAE)	HEFCE	Up to four outputs per researcher; 69 UoAs
2001	Research Assessment Exercise (RAE)	HEFCE	2600 submissions to 69 units of assessment; 5 umbrella groups of panel chairs for consistency
2008	Research Assessment Exercise (RAE)	HEFCE	67 sub-panels under 15 main panels; results presented as quality profiles
2014	Research Excellence Framework (REF)	HEFCE	4 main panels; 36 sub-panels; introduction of 20% impact element
2021	Research Excellence Framework (REF)	UKRI (Research England + devolved funding councils)	All staff with significant responsibility for research included. Impact 25% weighting. Flexible number of outputs.

Figure 16: Cycles of research assessment in the UK system since 1986.¹⁴¹

Commentary about the REF across the sector is often critical. It has been suggested by some that the REF is “a bloated boondoggle”, a “Frankenstein monster”, responsible for a “blackmail culture”, a “fever” and a “toxic miasma” that hangs over our campuses.¹⁴² Yet the exercise also performs several **important purposes**, as identified by Lord Stern in a 2016 review:¹⁴³

- Supporting the allocation of around £2bn of quality-related research funding each year;
- Informing strategic decision-making about national research priorities;
- Providing an accountability mechanism for public investment in research;
- Creating performance incentives for HE institutions, departments and academics;
- Giving HEIs information to inform decisions on resource allocation;

¹⁴¹ Figure 16 produced by James Wilsdon.

¹⁴² Wilsdon, J. (2015) In defence of the REF. *The Guardian*, 27 July 2015

¹⁴³ <https://www.theguardian.com/science/political-science/2015/jul/27/in-defence-of-the-ref>

¹⁴³ <https://www.gov.uk/government/publications/research-excellence-framework-review>

- Providing a periodically-updated reputational benchmark, that may be especially important for less known institutions.

In October 2020, Amanda Solloway MP, the science minister, announced the government's intention to **review the REF**, following the completion of the current cycle, saying: "*We must be prepared to look to the future and ask ourselves how the REF can be evolved for the better, so that universities and funders work together to help build the research culture we all aspire to.*"¹⁴⁴

The details of any review are not yet clear, but it is likely to get underway in the summer of 2021, and will be closely watched, given the significance of the REF in the landscape of incentives and funding for university-based research. Any review will be informed by evidence and analysis of the most recent cycle, including a "real-time" evaluation which is ongoing.¹⁴⁵ It may also develop links to a separate government review of research bureaucracy, to be chaired by Professor Adam Tickell, Vice-Chancellor of the University of Sussex, which was initiated in March 2021.¹⁴⁶

¹⁴⁴ <https://www.gov.uk/government/speeches/science-minister-on-the-research-landscape>

¹⁴⁵ <https://re.ukri.org/sector-guidance/publications/real-time-ref-review/>

¹⁴⁶ <https://www.gov.uk/government/publications/review-of-research-bureaucracy>

3. Global research collaboration after Brexit



Figure 17: Mixed signals from the UK government in recent weeks have led some research leaders—including Sir Jeremy Farrar, director of the Wellcome Trust—to question the seriousness of its commitment to globally collaborative R&D.¹⁴⁷

3.1 The Integrated Review and the UK as an “S&T superpower”

The approach that any advanced research system adopts towards international collaboration is typically a mix of at least three elements:

- Well-established, researcher-driven, bottom-up networks and connections that reflect geographic, historic, cultural, disciplinary, institutional or personal ties;
- National strategic or diplomatic priorities that prompt government or funder-led initiatives, aimed at protecting national interests, fostering R&D alliances or researcher mobility;
- Convergent ideas that are adopted or adapted from one or multiple national contexts, and applied elsewhere.¹⁴⁸

For the UK, each of these has been in some flux since the Brexit vote in 2016. Prior to this, EU collaborators had grown steadily in significance to account for almost 60% of all the UK’s international co-authors on academic papers.¹⁴⁹ And the UK won the second largest share of funding through the EU Framework Programmes (more than €7 billion through the Horizon 2020 programme, or 12.1% of the total—just behind Germany on 14.9%).¹⁵⁰

¹⁴⁷ <https://www.theguardian.com/commentisfree/2021/mar/19/uk-science-research-budgets-scientific>

¹⁴⁸ See e.g. the interesting concept of “isomorphic difference” as advanced in Irwin et al (2021) Isomorphic difference: Familiarity and distinctiveness in national research and innovation policies. *Research Policy*. Volume 50, Issue 4, May 2021, 104220. <https://doi.org/10.1016/j.respol.2021.104220>

¹⁴⁹ <https://royalsociety.org/topics-policy/projects/uk-research-and-european-union/role-of-eu-researcher-collaboration-and-mobility/would-international-collaboration-be-affected-if-the-uk-left-the-eu/>

¹⁵⁰

As noted earlier, the UK has now agreed its association to Horizon Europe—the new €95.5bn EU framework programme—which should preserve many, if not all, of these linkages. But a more profound strategic realignment is underway, as the UK shifts emphasis away from its immediate neighbours in Europe, and towards the rest of the world.

What this realignment will mean for international research collaboration is far from clear. While there have been some thoughtful efforts to explore and map this terrain—notably a 2019 review by Sir Adrian Smith and Professor Graeme Reid¹⁵¹, and a 2020 report by Wellcome¹⁵²—the UK government has not yet arrived at a stable and consistent position.

At a macro policy scale, the most important statement of the UK position is the **Integrated Review of Security, Defence, Development and Foreign Policy**, published on 16 March 2021.¹⁵³ This 100-page document was heralded by Number 10 as “*the most comprehensive articulation of a foreign policy and national security approach published by a British Government in decades.*” Hubris aside, it does offer the best guide yet to emerging UK priorities, including an aspiration for closer alignment with Japan and the Indo-Pacific region.

From an STI system perspective, points of interest include: its emphasis on **openness as a source of prosperity**; its more **robust position on security and resilience**; its **renewed commitment to the UK as a force for good** in the world; and its increased determination to seek **multilateral solutions** to challenges like climate change.

Most striking is the prominent inclusion of science and technology as the first of four overarching objectives: “*we will incorporate S&T as an **integral element of our national security and international policy**, fortifying the position of the UK as a global S&T and responsible cyber power. This will be essential in gaining economic, political and security advantages in the coming decade and in shaping international norms in collaboration with allies and partners.*”¹⁵⁴

Collaboration is in there, but now takes a backseat to a more muscular agenda. The UK is to become “**an S&T superpower by 2030**”, with S&T now viewed as “*an arena of systemic competition...the ability to advance and exploit S&T will be an increasingly important metric of global power, conferring economic, political and military advantages. The tech ‘superpowers’ are investing to maintain their lead...Competition is therefore intensifying, shaped in particular by multinational firms with the backing of states, some of which take a ‘whole-of-economy’*

¹⁵¹<https://www.gov.uk/government/publications/future-frameworks-for-international-collaboration-on-research-and-innovation-independent-advice>

¹⁵² <https://wellcome.org/sites/default/files/uk-role-global-research-report.pdf>

¹⁵³ <https://www.gov.uk/government/publications/global-britain-in-a-competitive-age-the-integrated-review-of-security-defence-development-and-foreign-policy>

¹⁵⁴ Ibid, p.18

approach to ensure dominance in critical areas. Maintaining competitive edge will rely on preeminence in and access to technology - as well as access to the human and natural resources needed to harness it - and the ability to protect intellectual property.”¹⁵⁵

A full chapter follows which expands on this strategic assessment of the importance of STI, and includes the following objectives:¹⁵⁶

- to grow the **UK’s science and technology power** in pursuit of strategic advantage;
- to cement the UK’s position as a **responsible and democratic cyber power**, able to protect and promote our interests in, and through, cyberspace;
- to ensure that the success of our research base translates into **influence over the design and use** of critical and emerging technologies;
- to unlock the full potential of the UK’s S&T and data ecosystem by **improving and accelerating the ‘pull through’** from research to commercialisation;
- to better **protect our intellectual property** and sensitive research;
- to become the **top destination for international talent**, offering the professional opportunities, skills environment and high quality of life to attract the best scientists, researchers and innovators worldwide to come to the UK and make it their home;
- to improve our **ability to identify, build and use the UK’s strategic S&T capabilities** through new S&T horizon-scanning, assessment and policy capabilities in government;
- to build a **strong and varied network of international S&T partnerships**, as an essential component of the own-collaborate-access framework and to shape the responsible use of technology.

It is unusual for STI to be given this degree of prominence in such an important UK government statement of foreign, defence and security policy. This means that the Integrated Review has effectively overwritten earlier policy statements, including a 2019 **International Research and Innovation Strategy** which, although only 18 months old, now feels misaligned in its emphasis on collaboration, including via ODA-funded partnerships with the developing world.¹⁵⁷

What the Integrated Review means in practice will become clearer over the course of 2021, when the UK is playing a high profile diplomatic role. It currently holds the **G7 presidency**, and in June 2021, PM Boris Johnson will host one of the first post-pandemic physical summits for G7 leaders, in Cornwall. This will be followed in November by the **COP-26 UN Climate Change Conference**, in Glasgow. “Global Britain” will be on display for the world to judge how much has changed.

¹⁵⁵ Ibid. p.30

¹⁵⁶ Ibid, pp.34-37

¹⁵⁷ <https://www.gov.uk/government/publications/uk-international-research-and-innovation-strategy>

3.2 ODA-funded partnerships and collaboration

A common refrain in debates over research collaboration is the need for patient, long-term investment in building and maintaining networks of mutual trust and benefit. Abrupt shifts in emphasis can be problematic, because of the patient lead-times required to assemble and fund collaborations, and ensure they are working well.¹⁵⁸

Given the UK government's headline commitments to R&D investment, its ambitions for a "Global Britain" pursuing alliances beyond the EU, and its conviction about the centrality of STI to the UK's long-term interests, many in the R&D community are dismayed at the sudden reversal that has occurred with respect to ODA-linked R&D, following the November 2020 spending review.¹⁵⁹



Figure 18: GCRF and the Newton Fund¹⁶⁰

As noted earlier, the implications of this only became clear in recent weeks, with **UKRI's announcement of a 70% cut in its ODA-linked budgets**, including £120m of cuts in the 2021-22 financial year.¹⁶¹ While GCRF accounts for the largest share of ODA-linked R&D spending, it is also the basis of

the **Newton Fund**, which supports equitable research partnerships with middle income countries, and has received funding cuts of 24% to all its projects this financial year.¹⁶²

Professor Melissa Leach, director of the Institute for Development Studies (IDS), the UK's largest centre in this field, draws a direct line between GCRF cuts and the Integrated Review, which she says: *"absconded from the vital opportunity to set out a new strategic vision for the three key pillars of development, diplomacy and defence....The lack of ambition for the UK's role in international development is seriously disappointing and goes alongside the damning decision to reduce the overseas aid budget and funding for international research. These budget*

¹⁵⁸ <https://onlinelibrary.wiley.com/doi/full/10.1002/jid.3417>

¹⁵⁹ <https://wellcome.org/press-release/science-superpower-ambitions-risk-being-undermined-lack-investment>;
<https://www.universitiesuk.ac.uk/news/Pages/cuts-oda-limit-uk-universities-role-solving-global-challenges.aspx>;
<https://www.ucl.ac.uk/research/news/2021/mar/statement-professor-david-price-cuts-oda-funding>;
<https://www.timeshighereducation.com/news/sir-paul-nurse-ukri-cuts-are-existential-threat-science>

¹⁶⁰ <https://www.newton-gcrf.org/>

¹⁶¹ <https://www.ukri.org/our-work/ukri-oda-letter-11-march-2021/>

¹⁶² <https://www.researchprofessionalnews.com/rr-news-uk-research-councils-2021-4-latest-oda-blow-newton-fund-grants-cut-by-a-quarter/>

*cuts...will dismantle global science partnerships and lead to the effective downgrading of the UK's long-established and world-respected development and research expertise.*¹⁶³

Is this a short-term setback, or does it spell the **end of ODA-linked funding** as a vital ingredient in the UK's wider R&D mix? The government's stated position is that the ODA cuts are a temporary measure, and its commitment to investing 0.7% of GDP—currently enshrined in UK law—will be reinstituted soon.¹⁶⁴ But it has refused to spell out a timetable for this, and given the likely magnitude of a pandemic-related economic hangover, it seems unlikely that restoring GCRF and the Newton Fund to full strength will be a priority for the next few years.

This begs further questions of the goals in the Integrated Review: how will a “*strong and varied network of international S&T partnerships*” be funded and sustained in the absence of these, or other dedicated funding schemes? The review affirms that the UK “*will continue to use ODA to support R&D partnerships with developing countries, sharing research expertise in support of the SDGs.*”¹⁶⁵ This perhaps implies that GCRF will persist in a scaled-down form. Further details of this, or successor mechanisms directed towards specific goals or regions, seem unlikely to emerge before a full Spending Review in the autumn of 2021.



In the meantime, GCRF cuts—which apply from 1 April 2021—illustrate a shift in the weighting of competition and collaboration in the UK's STI policies.¹⁶⁶ Competition is now the main prism through which choices are being viewed, and reframed as zero sum games.

Figure 19: A Twitter response to GCRF cuts by Professor David Price, Vice-Provost for Research at UCL, reflecting high-level disquiet in the UK system.¹⁶⁷

From a global perspective, as STI systems continue to strengthen worldwide, particularly in developing and emerging economies, this may prove a risky choice. The UK's share of overall global STI will almost inevitably reduce over time, as other nations grow and become more active. So one of the most effective ways for the UK to expand its R&D system may be through

¹⁶³ <https://www.ids.ac.uk/news/ids-response-to-the-uks-integrated-review/>

¹⁶⁴ <https://www.theguardian.com/global-development/2020/nov/26/no-new-legislation-needed-cut-uk-aid-budget-rishi-s-unak>

¹⁶⁵ <https://www.gov.uk/government/publications/global-britain-in-a-competitive-age-the-integrated-review-of-security-defence-development-and-foreign-policy>, p.37

¹⁶⁶ <https://rethinkingresearchcollaborative.com/2021/03/16/what-did-oda-ever-do-for-us-strategic-shifts-behind-the-devastating-cuts-to-oda-funded-research-in-the-uk/>

¹⁶⁷ <https://twitter.com/DavidPriceUCL/status/1370095534418059264?s=20>

partnerships of precisely the kind fostered by GCRF and the Newton Fund.¹⁶⁸ There is particular concern that ODA-funded partnerships and projects, which may have taken years to build, are now being dismantled or subject to significant cuts without sufficient consideration of the strategic benefits of such collaborations.

3.3 Horizon Europe

By the time the EU and UK reached a trade agreement on 24 December 2020—which included provisions for the UK to become an associate member of Horizon Europe—a fair amount of damage had already been done. From a 2015 baseline, when the UK was both the second largest contributor to Horizon 2020 (the previous Framework Programme) and its second largest beneficiary, analysis by the Royal Society suggests that by 2019, there had been a 40% drop in UK applications, and its annual share of EU funding had fallen by around €500m.¹⁶⁹

With the UK's association in principle agreed, the precise details of how much this will cost, and where the money will come from, are still being finalised.¹⁷⁰ At the EU level, three steps are required: the EU has to ratify the Horizon Europe Regulation (which is imminent); the UK and EU have to finalise what is known as “Protocol I”, which specifies the details of how association will work¹⁷¹; and the UK then has to be formally associated. Within the UK system, as noted earlier, a decision has to be reached on where the budget to pay for association will come from: as new money from HM Treasury, or redirected from within existing domestic budgets.

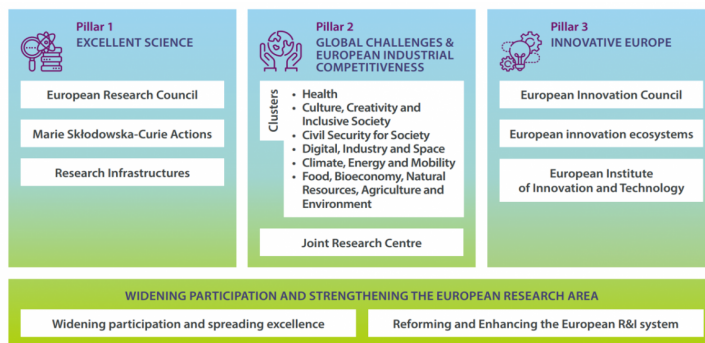


Figure 20: Pillars of Horizon Europe¹⁷²

Now that Horizon Europe, which runs until 2027, is underway—with initial calls in February 2021—these remaining steps need to be taken as soon as possible, to avoid an extended hiatus in UK participation. Once association is finalised, UK researchers will be able to

participate in much the same way as their EU colleagues across the **three pillars** of Horizon Europe (see Figure 20), with the exception of the new Innovation Council Fund, which is restricted

¹⁶⁸ <https://royalsociety.org/topics-policy/projects/knowledge-networks-nations/report/>; https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/660855/uk-research-base-international-comparison-2016.pdf

¹⁶⁹ <https://royalsociety.org/news/2019/10/brexit-uncertainty-harming-UK-science/>

¹⁷⁰ <https://www.nature.com/articles/d41586-021-00009-y>

¹⁷¹ See pp. 15-23

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/948105/EU-UK_Declarations_24.12.2020.pdf

¹⁷² Figure sourced from European Commission: https://ec.europa.eu/info/horizon-europe_en

to EU firms and researchers. The UK will also associate to the **Euratom** nuclear research programme, and to **ITER**, the world's largest nuclear-fusion experiment, now under construction in Provence, southern France.¹⁷³

The **costs of association** have been the focus of intense negotiation. The EU's starting position was that contributions should be proportional to national share of the EU's GDP. For the UK (pre-Brexit) this would be 18%, meaning a contribution to Horizon Europe's budget of around €17bn, or €2.4bn per year.¹⁷⁴ There has been a good deal of haggling on the edges of this, particularly over the need for **correction mechanisms** to compensate either side if the UK secures a **higher or lower than anticipated share** of the available funding.

The agreed position is an elegant compromise: if, over two consecutive years, the UK wins more than 8% over the amount it pays in, then it will need to top up its payments. If the UK receives 12% less than its contributions, then it can call for a performance review, to check that the rules are working. Further equalising measures can be applied if the shortfall reaches 16%.

There is also a recognition that UK participation will be slower initially, while these final details are hammered out. So **UK contributions in year one are likely to be around €1bn, rising to just over €2bn in each subsequent year**. The headline budget of Horizon Europe will also rise above €95.5bn, reflecting the UK's contributions and those of other associating countries.

With an EU-UK deal in place, there has been further haggling across Whitehall over who will pay the bill. As noted earlier, concerns that the government would raid existing UKRI budgets to cover the costs of association¹⁷⁵ proved unfounded, with the April 2021 confirmation of an extra £250m from HM Treasury, to be combined with around £700m of unallocated funds in BEIS, to cover the first year costs for 2021-22.¹⁷⁶ A funding model for 2022-23 onwards still needs to be agreed, but it should be feasible to absorb these costs within what will—in theory—be an expanding public R&D budget until at least 2025. Less certain is how quickly any **intangible, reputational harms of Brexit** to UK research can be repaired. The Royal Society's finding of a 40% reduction in UK applications from 2016-19—while the UK was still in the EU—serves as a reminder that it takes more than simply money for collaborations to be attractive and effective.

Even with UK association to Horizon Europe secured, it will take patience and commitment for cooperation to build back to pre-2016 levels. And the UK's Integrated Strategy is relatively quiet

¹⁷³ <https://www.iter.org/org/ITERinFrance>

¹⁷⁴ <https://sciencebusiness.net/framework-programmes/news/uk-science-minds-harden-horizon-europe-price-tag>

¹⁷⁵ <https://www.sciencemediacentre.org/expert-reaction-to-cuts-to-the-science-budget/>;

<https://www.theguardian.com/science/2021/mar/31/uk-scientists-funding-cuts-grants-foreign-aid>

¹⁷⁶ <https://www.gov.uk/government/news/250-million-additional-funding-to-boost-collaboration-and-protect-ongoing-research>; <https://www.sciencemediacentre.org/expert-reaction-to-new-government-funding-announcement-from-beis-of-250-million-for-scientists-and-researchers/>

on the contribution of EU research cooperation to the UK's new S&T-related goals. That the UK will no longer easily be able to influence the direction and priorities of Horizon Europe and future frameworks—instead buying in after these have been agreed by the EU—sits awkwardly with UK ambitions for a proactive approach to shaping priorities in pursuit of national strategic advantage.

3.4 Migration, visas and talent attraction

Alongside worries over EU funding, the other post-Brexit issue of intense concern to the research community was what it would mean for **visa rules and mobility of researchers** into and out of the UK. In 2018, of UK academics with a known nationality, 18% had a (non-UK) EU nationality, and 14% were from outside of the EU.¹⁷⁷ Contrary to expectations in some quarters of a post-Brexit exodus of talent, these proportions have in fact risen, from 16% and 12% in 2016. And in 2018, a 54% majority of postgraduate students were non-UK nationals.¹⁷⁸

To the credit of the current government, from the PM downwards, the key players quickly grasped the importance of maintaining mobility, and ensuring that the UK remains an attractive destination with flexible visas for researchers and other highly-skilled workers. Several measures have now been put in place to tackle these issues:

- **EU researchers** moving to the UK after 1 January 2021 are most likely to take the new **points-based “skilled worker” route** which requires a job offer, minimum salary, and gives additional points to applicants with a PhD in a STEM subject.
- **Non-EU researchers** (and a few from within the EU) are more likely to apply for the new **Global Talent Visa**, which the government announced in February 2020. This is intended to be more flexible, enabling talented people to move to the UK to work, even without a prior job offer.¹⁷⁹
- For **international graduates from UK universities**, the government has reverted to the more relaxed regime that was in place before 2012, which allows graduates to stay and work in the UK for up to two years. This extends to **three years for PhD graduates**.¹⁸⁰

¹⁷⁷HESA, 'Higher education Staff Statistics: UK, 2018/29', 23 January 2020,

www.hesa.ac.uk/news/23-01-2020/sb256-higher-education-staff-statistics

¹⁷⁸<https://www.universitiesuk.ac.uk/facts-and-stats/data-and-analysis/Documents/higher-education-in-facts-and-figures-2018.pdf>

¹⁷⁹<https://www.gov.uk/global-talent>

¹⁸⁰<https://www.theguardian.com/education/2019/sep/10/uk-work-visas-for-foreign-graduates-to-be-extended-to-two-years>

- From September 2021 onwards, **PhD funding through UKRI** is also being made available to all international applicants (beyond the EU) for the first time.¹⁸¹ With other schemes such as the prestigious **UKRI Future Leader Fellowships**¹⁸² similarly open to international applicants, the aim is to create entry points and pathways into the UK research system at multiple levels.
- The government has also established an **Office for Talent**, based in Number 10, which will continue working to reform and simplify visa and migration rules, and make it more attractive for highly-skilled researchers and other talented people to move to the UK.¹⁸³

As a package, **these reforms to policy, visa and funding rules go a long way to mitigating the negative effects of Brexit**—whether actual or perceived—on the UK’s attractiveness to mobile global talent. Some frustrations persist over **visa costs**, which remain high, particularly for those moving to the UK with a partner or children. And there are continued efforts, with some success, to broaden definitions of “talent” beyond an initial focus on individual scientists, to encompass diverse aspects of interdisciplinary, team-based research. In its March 2021 Budget, the government redoubled its commitment to fine-tuning the researcher visa system, in pursuit of “radically simplified bureaucracy.”¹⁸⁴

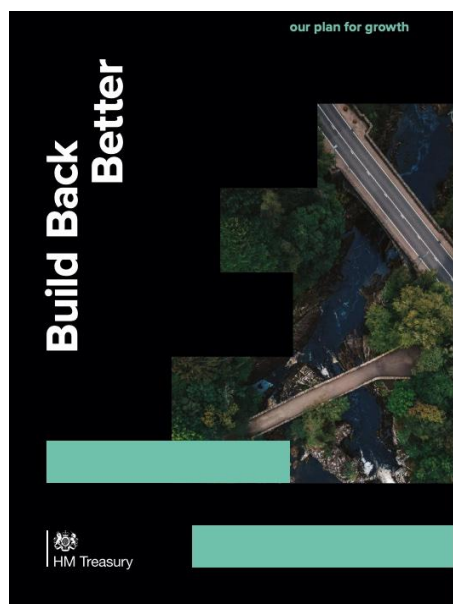
¹⁸¹ <https://www.timeshighereducation.com/news/opening-uk-phd-funding-international-students-abig-shift>

¹⁸² <https://www.ukri.org/our-work/developing-people-and-skills/future-leaders-fellowships/what-are-future-leaders-fellowships/>

¹⁸³ <https://www.theguardian.com/uk-news/2020/jul/01/office-for-talent-to-be-set-up-for-scientists-who-want-to-work-in-uk>

¹⁸⁴ <https://www.gov.uk/government/topical-events/budget-2021>

4. Post-pandemic priorities



In this report, we have described the changing economic and political context for the UK's STI policies, including the 2.4% GDP and £22bn targets for public investment. We have reviewed how the institutions, structures and mechanisms of public R&D funding have evolved in recent years. And we have explored changing dynamics and priorities for international collaboration. Looming over all of these are the ongoing and longer-term impacts of the pandemic, which is likely to generate sustained pressures on public spending, and on the organisation and effectiveness of the R&D system for years to come.

Figure 21: HM Treasury's new Plan for Growth, published alongside the March 2021 Budget.¹⁸⁵

The British Academy recently warned of a **COVID decade**—and as light slowly grows at the end of the pandemic tunnel, it seems increasingly plausible to contemplate its consequences in such terms.¹⁸⁶ In this final section, we will briefly outline **five post-pandemic, post-Brexit priorities** for UK research. We hear a lot about the government's input targets for the STI system, in terms of investment. What are its biggest outcome-oriented priorities for the next few years?

4.1 From industrial strategy to a Plan for Growth

After a long journey from outright opposition to industrial strategy in the 1980s and 1990s, to fully embracing the concept in 2017 under PM Theresa May,¹⁸⁷ the UK government is again cooling towards the idea. As noted earlier, the section of the government's website devoted to industrial strategy is now visibly "Archived",¹⁸⁸ and the high-powered **Industrial Strategy Council** appointed to advise on progress against the 2017 strategy has been disbanded.¹⁸⁹

However it appears that this is more of a shift in semantics than it is of substance. The government continues to accept the case for an active role for the state in planning, shaping and

¹⁸⁵ <https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth>

¹⁸⁶ <https://www.thebritishacademy.ac.uk/projects/covid-decade/>

¹⁸⁷ <https://issues.org/the-second-coming-of-uk-industrial-strategy/>

¹⁸⁸ <https://www.gov.uk/government/topical-events/the-uks-industrial-strategy>

¹⁸⁹ <https://www.thetimes.co.uk/article/government-scraps-industrial-strategy-council-csrxrthz5>

investing in priority sectors, places, technologies and ideas. But a change in the language and framing is underway.

Having initially set out to produce a replacement industrial strategy, Rishi Sunak, Chancellor of the Exchequer, announced alongside his March 2021 Budget the government's **Plan for Growth**. This, in essence, is industrial strategy Mark 2, with added elements that respond to the economic ravages of the pandemic, and incorporate perceived lessons about the importance of national self-sufficiency and “technological sovereignty” in priority areas such as vaccine development, medical equipment, diagnostics and testing. As one government source recently told *The Times*: “The pandemic has shown the importance of having UK-owned strategic assets.”¹⁹⁰

Level up the whole of the UK	<p>Regenerate struggling towns in all parts of the UK via the UK Shared Prosperity Fund and the UK-wide Levelling Up Fund.</p> <p>Realise our long-term vision for every region and nation to have at least one globally competitive city at its heart to help drive prosperity. This includes City and Growth Deals, £4.2 billion in intra-city transport settlements from 2022-23, and continued Transforming Cities Fund investment to 2022-23.</p> <p>Catalyse centres of excellence, supporting individuals across the country to access jobs and opportunities by ensuring digital and transport connectivity, by establishing a new UK Infrastructure Bank in the North of England and by relocating 22,000 Civil Service roles out of London.</p> <p>Strengthen the Union, creating Freeports across the country – including in Scotland, Wales and Northern Ireland – and delivering the Union Connectivity Review, reviewing options to improve our sea, air and land-links across the four nations.</p>
Support the transition to Net Zero	<p>Invest in net zero to create new opportunities for economic growth and jobs across the country, including supporting up to 60,000 jobs in the offshore wind sector, 50,000 jobs in carbon capture, usage and storage (CCUS) and up to 8,000 in hydrogen in our industrial clusters.</p> <p>Grow our current net zero industries and encourage new ones to emerge. This includes working with industry, aiming to generate 5GW of low carbon hydrogen production capacity and capture 10Mt CO2/year using CCUS by 2030, and ending the sale of new petrol and diesel cars and vans in 2030.</p>
Support our vision for Global Britain	<p>Cooperate with partners to inspire and shape international action on our domestic priorities, including through our G7 Presidency and COP26.</p> <p>Role-model openness to free and fair trade, working internationally to strengthen the multilateral system and the World Trade Organization and using preferential agreements and bilateral trade relationships to directly expand trading opportunities for UK businesses.</p> <p>Develop a new export strategy to align our support for exporters with our plan for growth and sectoral priorities, opening UK Government trade hubs in Scotland, Wales and Northern Ireland and increasing UK Export Finance lending capacity.</p>

Figure 22: Three goals of the Plan for Growth.¹⁹¹

Built on **core pillars** of growth—**infrastructure, skills and innovation**—the plan aims to direct growth in pursuit of **three goals**: levelling up the entire UK economy; accelerating the transition to Net Zero carbon emissions; and supporting the government vision for “Global Britain”. In many respects, the Plan for Growth does for economic and industrial policy what the Integrated Review does for foreign, security and defence policy.

Read together, these two documents—both published in the last month—provide the most coherent statement of what may yet develop into a distinctive philosophy and framework for government. Both also paint with a broad brush, with specifics to follow later. On research and innovation, the Plan rarely extends beyond what was in the July 2020 draft **R&D Roadmap**, bar a commitment to review the system of R&D tax credits, and to develop a full **Innovation Strategy**, which is now expected in late June 2021, and may provide more detail.¹⁹²

¹⁹⁰ <https://www.thetimes.co.uk/article/covid-has-taught-the-uk-the-importance-of-self-sufficiency-2slvz3vkn>

¹⁹¹ <https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth>

¹⁹² <https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth>, Ch.4, pp.50ff

4.2 Regional inequalities and levelling up

Tackling regional imbalances in economic growth, productivity and prosperity has been an on-off priority for UK governments of various hues, but has assumed greater urgency in the aftermath of the 2007-08 financial crisis, the EU referendum and now COVID-19, which have made such inequalities more visible and stark. Indeed, analysis in 2019 by Philip McCann shows that the **UK is now more inter-regionally unequal than 28 other advanced OECD countries**.¹⁹³

These imbalances are reflected and engrained in the R&D system, as Figure 6 above illustrates. One 2018 study found that **more than half of all UK biomedical research is spent in only three cities**—London, Oxford and Cambridge—despite variations in life expectancies of up to eight years across the country as a whole.¹⁹⁴



Figure 23: *The Missing £4 Billion*, an influential recent study by Tom Forth and Richard Jones

UK research funding has traditionally been **place-blind**: focusing on the quality of ideas and applicants, rather than their location. But cumulative decades of individual funding decisions, exacerbated by **Matthew effects**¹⁹⁵ and complex patterns of **geographic and institutional bias**, have led to narrowing concentrations of investment. One recent study, by Tom Forth and Richard Jones, estimates that “many parts of the UK have missed out government R&D spending, to the tune of **£4bn each year**...[money which] could have leveraged a further £8 billion from the private sector.”¹⁹⁶

There is now an explicit commitment—from the government and UKRI—to give **geography and place greater weight in the R&D funding system**. Warm words still outnumber concrete actions, but the Industrial Strategy Challenge Fund (ISCF) included some regional elements, and UKRI’s Strength in Places Fund (SIPF), which invests in place-based R&D projects has so far invested £186m, with promising results.¹⁹⁷ Although the **levelling up** section of the Plan for Growth is vague about its alignment with the draft R&D Roadmap, place-based funding is likely to remain high on the agenda. A detailed **Place-based R&D Strategy** is expected later this year, probably alongside the next three-year Spending Review in autumn 2021.

¹⁹³ <https://www.sheffield.ac.uk/news/nr/uk-higher-regional-inequality-large-wealthy-country-1.862262>

¹⁹⁴ <https://www.nesta.org.uk/report/biomedical-bubble/>

¹⁹⁵ https://en.wikipedia.org/wiki/Matthew_effect

¹⁹⁶ <https://www.nesta.org.uk/report/the-missing-4-billion/>

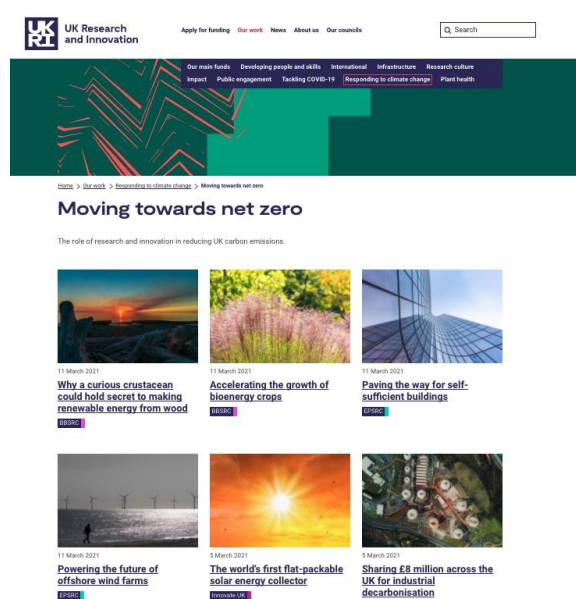
¹⁹⁷ <https://www.ukri.org/our-work/our-main-funds/strength-in-places-fund/>

This increased emphasis on place in R&D has not received universal support. Some critics argue that, although the UK's overall economy is unequal, by international comparisons, research funding is not so highly concentrated. Accounts of geographic distribution, such as that presented in *The Missing £4 Billion* report, rely on one version of geographic granularity (based on NUTS1 regions¹⁹⁸), and different interpretations of the data are possible.¹⁹⁹

4.3. Net Zero and low-carbon innovation

The Plan for Growth notes that the UK “has long been at the forefront of tackling climate change - the 2008 Climate Change Act was the first legislation in the world to provide a comprehensive framework to tackle global warming. In 2019 Parliament amended the act to commit the UK to net zero emissions by 2050.”²⁰⁰

Building on these legislative commitments, in 2020, the government published a **Ten Point Plan for a Green Industrial Revolution**, to capitalise on opportunities presented by the shift to net zero. This included **£12 billion of extra government investment**, and a target to leverage **three times as much in private investment by 2030** across key technologies such as hydrogen, offshore wind, nuclear, electric vehicles, heat and buildings.



R&D runs through the Ten Point Plan and is directly targeted via the **Net Zero Innovation Portfolio**—a £1bn fund to accelerate commercialisation of low-carbon technologies, systems and business models in power, buildings, and industry.²⁰¹ Net Zero objectives are also reflected in the R&D Roadmap, and a growing number of UKRI funding calls. This area is expected to receive **sharper emphasis over the next 12-18 months**—with the prospect of additional R&D-related commitments linked to the UK’s hosting of the **COP-26 climate change summit** in November 2021.

Figure 24: A selection of Net Zero-related investments and initiatives, as profiled on UKRI’s website.²⁰²

¹⁹⁸ https://en.wikipedia.org/wiki/NUTS_1_statistical_regions_of_England

¹⁹⁹ <https://www.researchprofessional.com/0/rr/news/uk/views-of-the-uk/2019/5/The-geography-of-UK-R-D.html>

²⁰⁰ <https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth>, Ch.6, pp.82ff

²⁰¹ <https://www.gov.uk/government/collections/net-zero-innovation-portfolio>

²⁰² <https://www.ukri.org/our-work/responding-to-climate-change/moving-towards-net-zero/>

4.4 Government Areas of Research Interest (ARIs)

As well as calling for an integrated funding agency, the 2015 Nurse Review concluded that government departments lacked a “strategic approach” to R&D. This led to the development of **Areas of Research Interest (ARIs)**, aimed at providing transparency and direction to researchers wanting to engage with departmental research priorities. The first ARIs were published in 2017, and many departments have compiled them since; some more than once. They vary in quality, detail and length. ARIs are published by the Government Office for Science and Cabinet Office, but departments follow their own timelines.



Engaging with UK Government Areas of Research Interest:
learning and insights from
the Universities Policy Engagement Network

Neil Heckels (Durham University)

Figure 25: UPEN report on university engagement with ARIs.

Across the research community, networks like the **Universities Policy Engagement Network (UPEN)** play a valuable role in disseminating ARIs throughout academia, and brokering engagement.²⁰³ In 2019, the Economic and Social Research Council (part of UKRI) and GO Science recruited an **ARI Research Engagement Fellow** and an **ARI Policy Engagement Fellow**, to identify and convene research expertise for ARIs. In autumn 2020, the **Parliamentary Office for Science and Technology (POST)** published 20 COVID-19 related ARIs for Parliament, ranked in order of **interest to parliamentary research and select committee staff**.

A list of ARIs is regularly updated on the gov.uk site²⁰⁴, and two recent examples include:

- **The Foreign, Commonwealth and Development Office** published an ARI in June 2020 which highlighted questions around migration, misinformation and the role of emerging technologies in the global arena. It also flagged an interest in historical reviews of conflicts and pandemics, and how they intersect; and relationships between the public and international bodies such as the World Health Organisation in different countries.²⁰⁵
- **The Ministry of Justice** published the most recent ARI, in December 2020, with overarching themes of exploring lived experience, and the importance of long term evaluative research, in particular on children and families, and on how protected characteristics inform lived experiences.²⁰⁶

²⁰³ https://www.upen.ac.uk/what_we_offer/reports/ARI_Report%20WEB%20SINGLE%20PAGES.pdf

²⁰⁴ <https://www.gov.uk/government/collections/areas-of-research-interest>

²⁰⁵ <https://www.gov.uk/government/publications/fco-areas-of-research-interest-ari-2020-coronavirus-covid-19-update>

²⁰⁶ <https://www.gov.uk/government/publications/ministry-of-justice-areas-of-research-interest-2020>

4.5 Research cultures and careers

While highlighting the best of what research can offer in a global health crisis, the pandemic has also illuminated the inner workings of research, and intensified scrutiny of **systemic inequalities** in how it is funded, practised and evaluated. Social movements, such as **Me Too** and **Black Lives Matter**, have reanimated these discussions, and injected fresh urgency into efforts to make research cultures more **open, diverse, inclusive and impactful**.

Figure 26: UKRI's CEO wrote an editorial in *Science* calling for broader definitions of excellence in the funding system.²⁰⁷



The UK is now at the forefront of these debates, and alongside more familiar emphases on R&D investments, priorities and outcomes, no overview of the policy landscape would be complete without some recognition of the momentum building for change. The current science minister, Amanda Solloway MP, and chief executive of UKRI, Professor Dame Ottoline Leyser, have both identified improvements to research cultures as a priority

²⁰⁸, and these issues receive significant prominence in the draft R&D Roadmap.

Other UK funders, notably **Wellcome Trust**, have also been vocal in support of these agendas, and are reinforcing this with practical changes to funding processes, and stretch targets for improvement.²⁰⁹ Sector-wide groups and networks, such as **EDIS (Equality, Diversity, and Inclusion in Science and Health)**²¹⁰ and the **UK Forum for Responsible Research Metrics (FRM)**²¹¹ are building alliances and sharing good practices from across the UK and worldwide.

In summer 2020, UKRI published a **concordat and action plan to support research careers**.²¹² A comprehensive **R&D People and Culture Strategy**—one of the commitments in the draft R&D Roadmap—is expected shortly.²¹³ Related initiatives for open research, simplifying bureaucracy, and recognising teams are all in the works. If these efforts can be aligned in a coherent and effective way, UK research cultures in 2030 may look very different to those today.

²⁰⁷ Leyser, O. (2020) The excellence question. *Science*. Vol. 370, Issue 6519, pp. 886. 20 Nov 2020.

²⁰⁸ [https://www.gov.uk/government/speeches/science-minister-on-the-research-landscape;](https://www.gov.uk/government/speeches/science-minister-on-the-research-landscape)
<https://www.ukri.org/news/viewpoint-we-must-reshape-the-system-to-value-and-support-difference/>

²⁰⁹ <https://wellcome.org/what-we-do/our-work/diversity-and-inclusion/strategy>

²¹⁰ <https://edisgroup.org/>

²¹¹ <https://www.universitiesuk.ac.uk/policy-and-analysis/research-policy/open-science/Pages/forum-for-responsible-research-metrics.aspx>

²¹² <https://www.ukri.org/about-us/policies-standards-and-data/good-research-resource-hub/supporting-skills-and-talent/>

²¹³ <https://www.gov.uk/government/groups/rd-people-and-culture-strategy-steering-group>

Conclusion: ambitions and uncertainties on the road ahead

We began this report by revisiting the role that science, technology and innovation played from 2010 to 2020: a turbulent **ABC decade**, defined by austerity, Brexit and COVID-19. Looking forward, the next decade has the potential to be one in which UK research and innovation soars to new heights. This vision—of the UK as a reinvigorated “scientific superpower” animates the government’s draft **R&D Roadmap**, its **Integrated Review** of security, defence, development and foreign policy; and its post-pandemic **Plan for Growth**.

It is a vision reflected in **ambitious targets** to double government R&D investment to **£22bn a year by 2025**; to increase the wider R&D intensity of the UK economy to **2.4% of GDP by 2027**; to create a risk-loving funding agency in **ARIA**; and to place new technologies and innovation front and centre of efforts to **level up the UK economy**, and accelerate the **transition to Net Zero**.

In many respects, this is **a government that understands the value and importance of STI**, in a society that—thanks to the pandemic—appreciates STI like never before. We have to look back more than fifty years to find a UK prime minister—Harold Wilson—who speaks about science and technology with the frequency and passion of Boris Johnson.²¹⁴

Yet despite all the positive factors that are now aligned, such outcomes are far from guaranteed. Profound uncertainties persist over the **UK’s macroeconomic outlook**; the capacity of a **pandemic--weakened private sector** to deliver on its side of the 2.4% GDP bargain; and the **coherence of a foreign policy** that draws the UK away from its strongest alliances, and into uncharted geopolitical terrain.

Policy and investment signals are still too often contradictory—with the recent furore over **cuts to ODA-linked funding** a case in point. There can also be a destabilising inconsistency in the approach taken to priorities such as industrial strategy and levelling up.

But for association to Horizon Europe, when the pressure started to bite, extra funding was secured. The next big test of the government’s commitment to STI will be the three-year spending review expected in autumn 2021. If a path through short-term budget pressures can be found, keeping the UK on track towards the goals of £22bn and 2.4% of GDP, many will hope that brighter times lie ahead for UK science and UK society.

²¹⁴ <https://www.theguardian.com/science/political-science/2013/sep/19/harold-wilson-white-heat-technology-speech>

Appendix: further reading

This report is extensively referenced, with weblinks where possible to source material: a mix of government documents; Parliamentary inquiries; papers and reports by academics, think-tanks and scientific bodies like the Royal Society; and articles in the specialist and national media. From these sources, if we were to highlight a short list of **recommended items for further reading**, it would include:

- BEIS (2020) *UK Research & Development Roadmap*. BEIS, 1 July 2020.
<https://www.gov.uk/government/publications/uk-research-and-development-roadmap>
- UK National Academies (2020) *Investing in UK R&D*. October 2020 (updated).
<https://www.raeng.org.uk/policy/policy-themes/research-and-innovation-policy/investing-in-engineering-research-and-innovation/investing-in-uk-r-d>
- House of Commons Science and Technology Committee (2021) *A new UK research funding agency*. House of Commons, 12 February 2021.
<https://committees.parliament.uk/work/265/a-new-uk-research-funding-agency/publications/>
- National Centre for Universities and Business (NCUB) (2020) *The State of the Relationship Report 2020*. NCUB, 14 December 2020
<https://www.ncub.co.uk/reports/state-of-the-relationship-report-2020>
- Cabinet Office/FCDO/MoD (2021) *Global Britain in a Competitive Age: the Integrated Review of Security, Defence, Development and Foreign Policy*. HMSO, 16 March 2021
<https://www.gov.uk/government/publications/global-britain-in-a-competitive-age-the-integrated-review-of-security-defence-development-and-foreign-policy>
- Smith, A. and Reid, G. (2019) *Changes and Choices. Advice on future frameworks for international collaboration on research and innovation*. BEIS, July 2019
<https://www.gov.uk/government/publications/future-frameworks-for-international-collaboration-on-research-and-innovation-independent-advice>
- Wellcome Trust (2020) *The UK's Role in Global Research*. Wellcome, October 2020
<https://wellcome.org/sites/default/files/uk-role-global-research-report.pdf>
- HM Treasury (2021) *Build Back Better: Our Plan for Growth*. HM Treasury, 3 March 2021
<https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth>
- Forth, T, and Jones, R (2020) *The Missing £4 Billion: Making R&D work for the whole UK*. Nesta, 27 May 2020 <https://www.nesta.org.uk/report/the-missing-4-billion/>



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