



Is Britain losing its scientific edge?

By Dr Mann Virdee

In March 2023, His Majesty's (HM) Government published a new Science and Technology Framework.¹ This framework set out a vision to make the United Kingdom (UK) a science and technology 'superpower' by 2030. Rishi Sunak, the Prime Minister, announced: 'Trailblazing science and innovation have been in our DNA for decades. But in an increasingly competitive world, we can only stay ahead with focus, dynamism and leadership.'² That the Government is so focused on this agenda suggests it is concerned that the UK might be losing its scientific and technological edge.

This fear is not new. Nearly 200 years ago, Charles Babbage – the 'father of the computer' – published a book entitled: *Reflections on the Decline of Science in England, and on Some of Its Causes*. In this, he lamented: 'in England, particularly with respect to the more difficult and abstract sciences, we are much below other nations, not merely of equal rank, but below several even of inferior power'.³ In

¹ 'UK Science and Technology Framework', Department for Science, Innovation and Technology, 06/03/2023, <https://bit.ly/47Sgm4B> (checked: 12/12/2023).

² 'Plan to forge a better Britain through science and technology unveiled', Department for Science, Innovation and Technology, 06/03/2023, <https://bit.ly/4aeFi7T> (checked: 12/12/2023).

³ Charles Babbage, *Reflections on the Decline of Science in England, and on Some of Its Causes* (Project Gutenberg (eBook), 2008 (original release 1830)).



hindsight, such a concern seems misplaced; the UK was in fact at the forefront of the industrial revolution when Babbage was writing.

Since then, this concern has been raised time and again. Around the First World War, there was, for instance, a concern that Germany was far ahead of Britain in terms of technical education.⁴ There was particular concern about the decline of science in the UK in the 1970s and 1980s as a result of spending cuts⁵ – which led to the formation of the group ‘Save British Science’ in 1986.⁶

Today, Britain is no longer at the forefront of an economic revolution. Does this mean the country finally risks losing its scientific edge? And does it matter?

Science leadership is for Britain, perhaps more than any other country, central to its national story and prosperity.⁷ Politicians often invoke the UK’s historic scientific achievements to support their claim of Britain being a scientific superpower. But this claim is based on mixed evidence at best. The UK is falling behind in areas of science it has identified as being strategically important, and this will impact its ability to meet the great challenges of our time. Climate change and other forms of environmental degradation, public health crises, and resource scarcity will not be overcome without scientific innovation.

Science in a nutshell

In the words of the English biologist Thomas Huxley: ‘science is simply common sense at its best; that is, rigidly accurate in observation, and merciless to fallacy in logic’.⁸ Science is primarily *a way of thinking* focused on the pursuit of truth. Science is a methodical and rigorous endeavour which starts with observations about the universe, questions them, and uses testable hypotheses to come to an ever deeper understanding of the cosmos. The continually improving body of knowledge which results from this process is also called science.

⁴ Jeffrey Allan Johnson, *The Kaiser’s chemists: Science and Modernization in Imperial Germany* (University of North Carolina Press, 2009 (originally published 1990)).

⁵ John Irvine, Ben Martin, Tim Peacock and Roy Turner, ‘Charting the decline in British science’, *Nature*, 316 (1985); Ben R. Martin, John Irvine, Francis Narin and Chris Sterritt, ‘The continuing decline of British science’, *Nature*, 330 (1987); Roger Williams, ‘The decline of the British science empire’, *Bulletin of Atomic Scientists*, 43:8 (2015); Ben R. Martin, ‘British science in the 1980s – Has the relative decline continued?’, *Scientometrics*, 29:1 (2005); and, Roger Dettmer, ‘Saving British science’, *Electronics and Power*, 33:1 (1987).

⁶ ‘About’, The Campaign for Science and Engineering, No date, <https://bit.ly/3NpFMOR> (checked: 12/12/2023).

⁷ Gabriel Elefteriu, James Rogers and William Freer, ‘What is Strategic Advantage?’, Council on Geostrategy, 23/11/2023, <https://bit.ly/3tf01YA> (checked: 12/12/2023).

⁸ Thomas H. Huxley, *The Crayfish: An Introduction to the Study of Zoology* (C. Kegan Paul, 1881).

Science has roots at least as far back as Ancient Egypt and Mesopotamia.⁹ It has been shaped heavily by – amongst others – Greek and Islamic thinkers, who developed understanding in areas such as physics, mathematics, medicine, astronomy, chemistry, and biology.

British thinkers, such as Francis Bacon, John Locke, and Isaac Newton, were central to the Scientific Revolution which took place in the 16th and 17th centuries and led to the emergence of the modern conception of science. Over the centuries since then, Britain has remained at the forefront of expanding the horizon of human understanding through scientific inquiry and innovation.

A thread of inquiry and intellectual rigour connects luminaries such as Bacon, Locke, Hooke, Newton, Faraday, Babbage, Darwin, Lovelace, Fleming, Hodgkin, Turing, Crick, Franklin, Higgs, and Hawking – who have helped science become an integral part of the UK's national story.

How science benefits Britain

Scientific thinking is a noble pursuit in its own right. The British chemist Humphrey Davy once wrote: 'To me there has never been a higher source of earthly honour or distinction than that connected with advances in science'.¹⁰

In addition, basic scientific research can be combined in ways which are not always initially apparent, and basic research appears to remain relevant and have a longer-lasting impact than applied research.¹¹

But science also has practical application. As the axiom goes, 'The science of today is the technology of tomorrow.'¹² The benefits of science include:

- **Economic:** Science is fundamental to prosperity. Research and innovation in science drives productivity and sustainable growth,¹³ and creates well paying jobs and productive industries. Some of Britain's most successful economic sectors are directly based on science, and all sectors rely on science in some form. In 2022, it was estimated that 2.8 million people

⁹ David C. Lindberg, *The beginnings of Western science: The European scientific tradition in philosophical, religious, and institutional context, prehistory to AD 1450* (University of Chicago Press, 2010).

¹⁰ Humphry Davey, *The Saturday magazine*, 16:504 (1840), p. 181.

¹¹ Philip Barrett, Niels-Jakob Hansen, Jean-Marc Natal and Diaa Noureldin, 'Why Basic Science Matters for Economic Growth', *International Monetary Fund Blog*, 06/11/2021, <https://bit.ly/3taTjt3> (checked: 12/12/2023).

¹² Morris M. Leighton, *Our Natural Resources: Their Continuing Discovery and Human Progress* (Ohio: Department of natural resources, 1953).

¹³ Maxine Myers, 'Science investment boosts UK economic growth, according to new report', *Imperial College London News*, 14/05/2014, <https://bit.ly/3GF6ajO> (checked: 12/12/2023).



worked in scientific and technical roles in the UK, representing 8.5% of the workforce.¹⁴ One part of the UK's science and technology ecosystem, the life sciences sector, employed over 280,000 people and was worth over £94 billion in 2021.¹⁵ Physics has directly generated around £239 billion gross value added, or over 10% of the UK's total Gross Domestic Product (GDP).¹⁶

- **Business:** The scientific endeavour also helps businesses to improve their productivity and efficiency. The UK's manufacturing sector, for example, has benefited from advances in robotics and automation – which have helped to improve productivity, efficiency, and quality.¹⁷
- **Environmental:** Science can be pursued to protect and preserve the natural environment and to achieve Net Zero targets through developing and improving energy technologies and storage, and through improving understanding of the climate.
- **Social wellbeing and health:** Science enriches the human experience both on an individual level and collectively in its pursuit of knowledge and truth. It has also led to better ways for us to predict, prevent, diagnose, and treat diseases – and has improved health and increased life expectancy.
- **Strategic policy:** Science can also be harnessed to achieve strategic advantage by catalysing national resources for geopolitical effect.¹⁸ As Louis Pasteur pointed out: 'Science is the highest personification of the nation because that nation will remain the first which carries the furthest the works of thought and intelligence.'¹⁹ The UK's space science sector, for example, employs more than 45,000 people and is worth over £16.4 billion in economic activity.²⁰

¹⁴ 'UK Labour Market: November 2022', Office for National Statistics, 15/11/2022, <https://bit.ly/47ZaBSQ> (checked: 12/12/2023).

¹⁵ 'Chancellor reveals life sciences growth package to fire up economy', His Majesty's Treasury, 25/05/2023, <https://bit.ly/48wveFR> (checked: 12/12/2023).

¹⁶ 'Physics and the Economy – UK findings 2022', Institute of Physics, 2022, <https://bit.ly/4ak49ak> (checked: 12/12/2023).

¹⁷ 'Manufacturing and automation: Opening the gates for productive and efficient growth', The Manufacturers' Organisation, 30/10/2023, <https://bit.ly/3NFIiQ> (checked: 12/12/2023).

¹⁸ Gabriel Elefteriu, James Rogers and William Freer, 'What is Strategic Advantage?', Council on Geostrategy, 23/11/2023, <https://bit.ly/3tf01YA> (checked: 12/12/2023); 'Strategic advantage through science and technology: the engineering view', Royal Academy of Engineers, 20/04/2023, <https://bit.ly/46TXjWe> (checked: 12/12/2023); and, Sir Patrick Vallance, 'UK's quest to be a global science superpower', *Civil Service Blog*, 08/02/2022, <https://bit.ly/3RD7DgK> (checked: 12/12/2023).

¹⁹ René Dubos, *Louis Pasteur, Free Lance of Science* (Charles Scribner's Sons, 1976).

²⁰ 'National space strategy', UK Space Agency, 01/02/2022, <https://bit.ly/3ThOofH> (checked: 12/12/2023).

Britain's strength in science

There are some signs that Britain's historic excellence in science continues. The UK is home to many of the world's top universities – including four of the top ten: Cambridge, Oxford, Imperial, and University College London.²¹ This is on par with the US, which is also home to four of the top ten – the Massachusetts Institute of Technology (MIT), Harvard, Stanford, and the University of California Berkeley.

The presence of such world-class institutions was crucial, for example, in the UK's rapid procurement and development of vaccines against Covid-19, notably the Jenner Institute at the University of Oxford and the Faculty of Medicine at Imperial College London, whose capability had been built up over many years.²²

In addition, the Research Excellence Framework (REF), which assesses the quality of research at higher education institutions in Britain, found 84% of UK research it sampled to be world-leading or internationally excellent.²³

Public trust in science in the UK is generally high, and above that of countries such as France, Germany, Japan and the US.²⁴ According to Kantar Public, since the Covid-19 pandemic, trust in science has increased.²⁵ Similarly, research conducted by 3M found that UK respondents' scepticism in science dropped by 11% when comparing before (40%; August–October 2019) and during (29%; August–September 2020) the pandemic.²⁶

The UK has a strong network of science parks (see Figure 1), which bring together businesses and provide them with support and advice to help them grow, provide access to equipment and facilities, and promote collaboration between government, higher education institutions, and industry.

²¹ 'QS World University Rankings 2024: Top global universities', QS Top Universities, No date, <https://bit.ly/46PoWQl> (checked: 12/12/2023).

²² 'Coronavirus: lessons learned to date', Health and Social Care, and Science and Technology Committees, 08/10/2021, <https://bit.ly/3REFjeb> (checked: 12/12/2023).

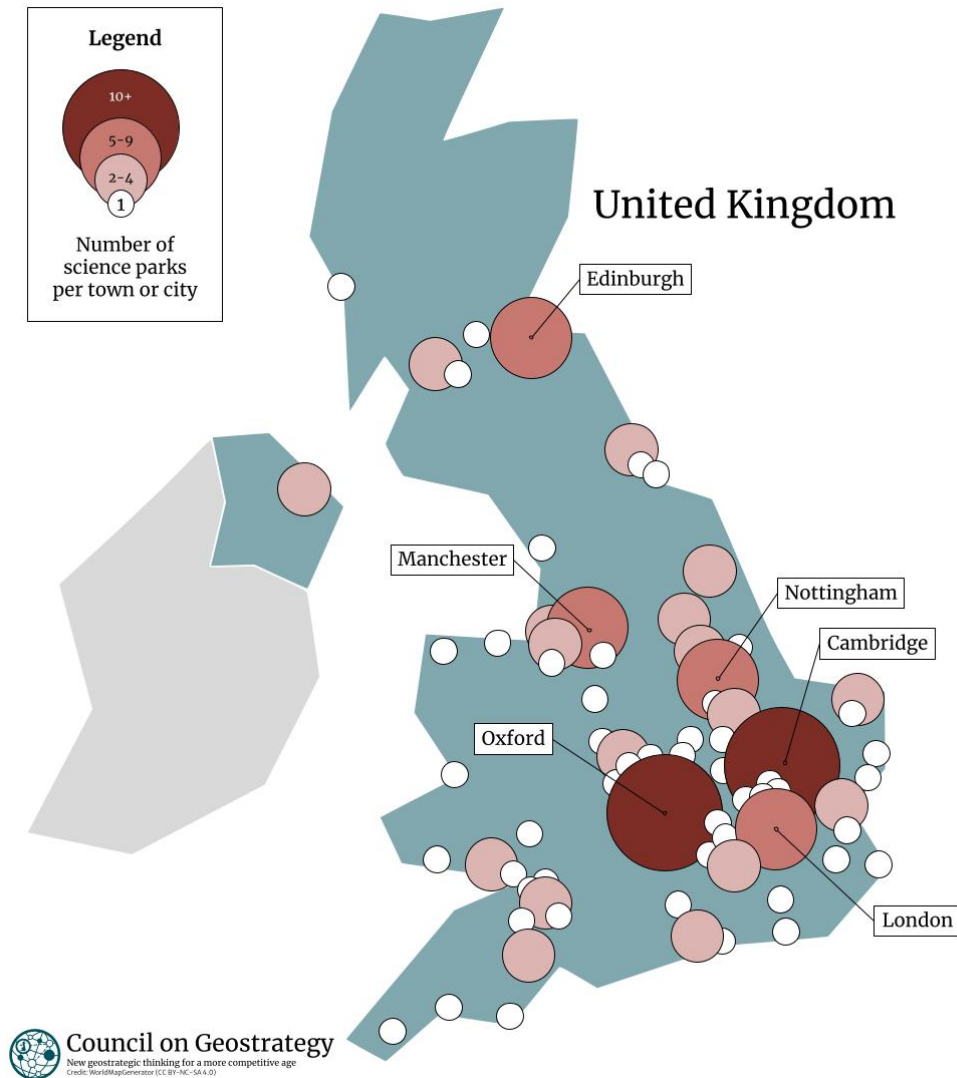
²³ 'Research and Innovation Facts and Figures: 2022', Universities UK, 2022, <https://bit.ly/3RkRThb> (checked: 12/12/2023).

²⁴ See chapter 3 of: 'Wellcome Global Monitor: How does the world feel about science and health?', Wellcome, 12/06/2019, <https://bit.ly/3TlHVyz> (checked: 12/12/2023).

²⁵ 'COVID-19 increased public trust in science, new survey shows', *University of Oxford News*, 25/01/2023, <https://bit.ly/3GDt6zV> (checked: 12/12/2023).

²⁶ 'State of Science Index: 2020 Global Report', 3M, 05/10/2020, <https://bit.ly/48aS5q6> (checked: 12/12/2023).

Figure 1: Location of business accelerators and incubators in the UK.²⁷



However, some of these measures are limited in their usefulness and therefore they should be used with caution in trying to show the UK is currently a science superpower. Critics of university rankings point to methodological shortcomings, and question whether there exists a meaningful relationship between a ranking and what a university fundamentally is and does.²⁸

A common criticism of the REF is that it increases ‘gameplaying’, whereby higher education institutions employ tactics to maximise their REF performance

²⁷ ‘Our members’, United Kingdom Science Park Association, <https://bit.ly/3ToRtZF> (checked: 12/12/2023).

²⁸ Jelena Brankovic, ‘The Absurdity of University Rankings’, *London School of Economics Blogs*, 22/03/2021, <https://bit.ly/46RMYtP> (checked: 12/12/2023).

and in doing so may have unintended negative consequences on the quality of research and staff development.²⁹ As such, the figures provided by the REF are not necessarily representative of UK research quality, and may not be a reliable indication of Britain's science prowess.

Britain's weakness in science

Although British politicians like to talk of the UK being 'world-leading'³⁰ in science, or a 'science superpower',³¹ this rhetoric does not reflect reality. That the UK's Science and Technology Framework aims for the UK to *become* a science superpower³² by 2030 seems to be closer to the reality: that, somewhere along the way, Britain lost this title and is trying to recover it. Despite the country's impressive scientific past and a few signs of continued success, the UK may be losing its edge overall.

Recent research finds that the UK is very good, but not outstanding,³³ in other areas of science and technology identified as a priority in the 2021 Integrated Review.³⁴ For example, Britain's share of citations in the top 100 recent artificial intelligence (AI) papers is 7.8%. However, once a single company, DeepMind, is removed from this statistic, the UK's performance in AI is shown to be far weaker, and its share of citations drops to just 1.9%.

This is also the case in other key areas of science and technology, such as synthetic biology and quantum. The UK was last a quantum science superpower between 2003 and 2007.³⁵ In these priority areas of science and technology, a single institution, such as MIT, matched or exceeded Britain's entire academic performance. The UK is also outperformed by some countries with lower R&D

²⁹ Catriona Manville et al., 'Understanding perceptions of the Research Excellence Framework among UK researchers', RAND Corporation, <https://bit.ly/3GCom99> (checked: 12/12/2023).

³⁰ 'UK Science and Technology Framework', Department for Science, Innovation and Technology, 06/03/2023, <https://bit.ly/47Sgm4B> (checked: 12/12/2023).

³¹ 'The science budget', House of Commons Science and Technology Committee, 05/11/2015, <https://bit.ly/3NkV3jO> (checked: 12/12/2023); The Autumn Statement 2022 speech, His Majesty's Treasury, 17/11/2022, <https://bit.ly/48dKzux> (checked: 12/12/2023); and, Grant Shapps via X, 10/11/2022, <https://bit.ly/3Tpvd1V> (checked: 12/12/2023).

³² 'UK Science and Technology Framework', Department for Science, Innovation and Technology, 06/03/2023, <https://bit.ly/47Sgm4B> (checked: 12/12/2023).

³³ Anjana Ahujia, 'World-leading? Britain's science sector has some way to go', *Financial Times*, 15/03/2023, <https://bit.ly/3Npt4PV> (checked: 12/12/2023).

³⁴ 'Global Britain in a Competitive Age: the Integrated Review of Security, Defence, Development and Foreign Policy', Cabinet Office, 07/03/2021, <https://bit.ly/3sDC1Oo> (checked: 12/12/2023).

³⁵ James W. Phillips, 'S&T - Is the UK a world leader in science?', *James W. Phillips' Newsletter* via Substack, <https://bit.ly/3RFuyYM> (checked: 12/12/2023).



spending, such as Switzerland, Singapore, and Denmark,³⁶ which seem to be funding research more effectively and generating higher quality outputs.

There are several reasons for the UK's shortcoming in science – including funding, education, and skills challenges.

Funding challenges

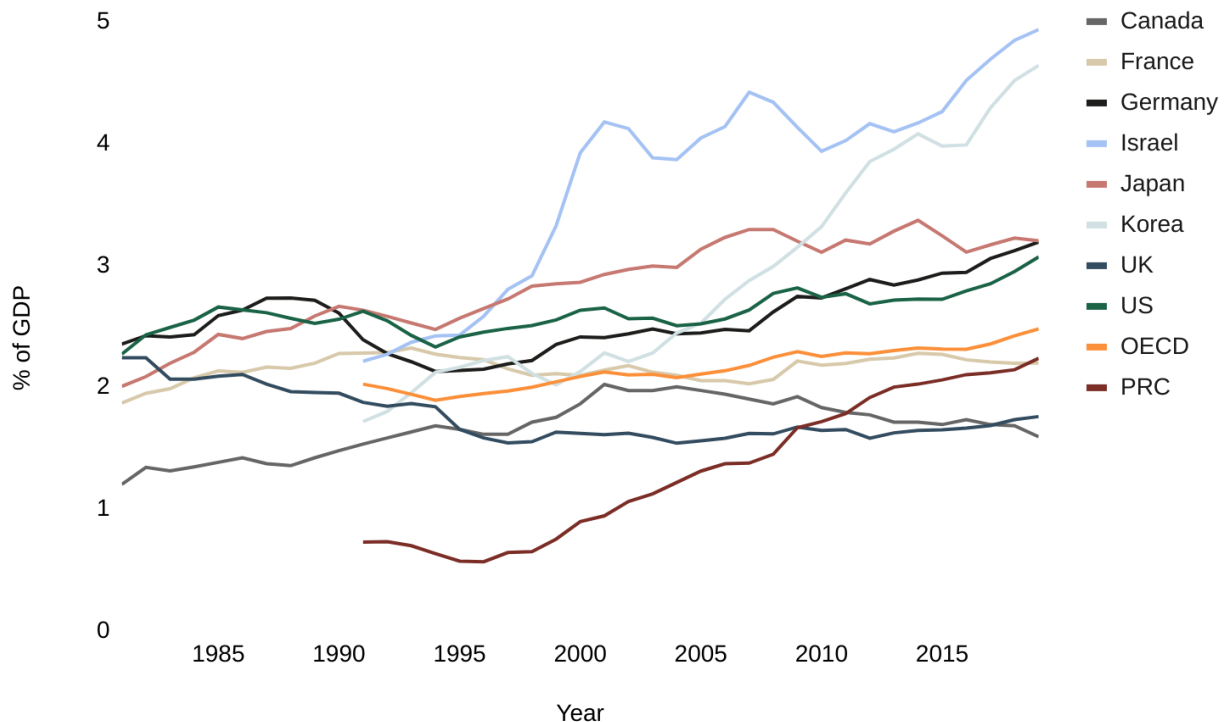
Money invested in research, development, and innovation provides broader benefits to society; it is estimated that for every pound publicly invested in research and development (R&D), this is roughly doubled by the private sector.³⁷ The returns to public investment are estimated to be significantly higher in science-intensive sectors, such as in biomedical research.³⁸ Despite this, funding for scientific R&D has long been cited as one of the UK's key weaknesses. For decades, UK R&D spending was well below the OECD average.³⁹ This changed in 2018, when British expenditure finally overtook the average. However, the UK still lags behind peer countries such as Israel, South Korea, Japan, Germany, and the United States (US) (see Figure 2).

³⁶ *Ibid.*

³⁷ Adrian Smith, Speech: 'Anniversary Day Address 2023 from President of the Royal Society, Adrian Smith', 30/11/2023, <https://bit.ly/3TgBKvS> (checked: 12/12/2023).

³⁸ *Ibid.*

³⁹ 'Our plan for growth: Science and Innovation', His Majesty's Treasury, 15/12/2014, <https://bit.ly/41mbL8s> (checked: 12/12/2023).

**Figure 2: Total expenditure on R&D of selected countries as a share of GDP⁴⁰**

British R&D expenditure has not only been low, it has also been regionally imbalanced. Indeed, UK R&D expenditure is so imbalanced, areas outside of the South East of England are not receiving adequate support to the tune of about £4 billion of R&D spending each year – which would have leveraged an additional £8 billion from the private sector.⁴¹ To put it another way, if the government were to invest in R&D outside the South East of England with the same intensity, it would spend an additional £4 billion. This underinvestment not only holds back these regions, they suffer an additional blow because the private sector tends to invest double in R&D, and therefore the UK is missing out on around £8 billion of additional private sector investment.⁴²

Cuts or lack of funding in other areas, such as global health research and medical research, have been cited as barriers that are holding UK science back.⁴³

⁴⁰ Matt Burnett and Maria Priestley, 'Rocket Science: How can the UK become a scientific superpower?', Onward UK, 04/08/2022, <https://bit.ly/47UwdiS> (checked: 12/12/2023).

⁴¹ Tom Forth and Richard A. L. Jones, 'The Missing £4 billion: Making R&D work for the whole UK', Nesta, 26/05/2020, <https://bit.ly/48hOpTD> (checked: 12/12/2023).

⁴² *Ibid.*

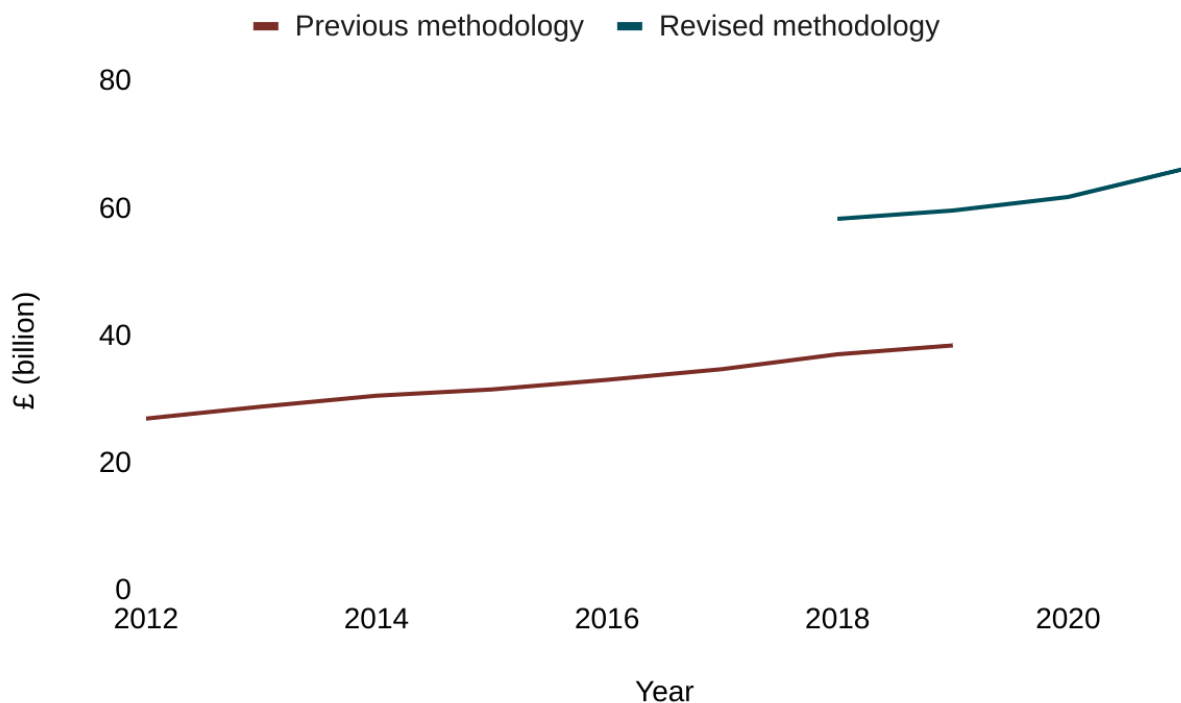
⁴³ 'UK's "science superpower" status under threat over cuts to global health research', *The Telegraph*, 31/03/2021, <https://bit.ly/47UwIJO> (checked: 12/12/2023); 'Invest now to reach science superpower status', The Academy of Medical Sciences, <https://bit.ly/47RysDT> (checked: 12/12/2023).



HM government has recognised the importance of addressing these funding challenges. In the Science and Technology Framework, for example, the government noted it had increased R&D spending, and had committed to investing £20 billion in R&D by 2024–2025.⁴⁴ It is on track to reach this goal.⁴⁵

There have been recent changes to the methodology used by the Office for National Statistics (ONS) to calculate Business Enterprise Research and Development statistics. This has led to a revision of how much the UK has been spending on R&D (see Figure 3), and it is now estimated the UK spends about 2.9% to 3.0% of GDP on R&D.⁴⁶

Figure 3: UK expenditure on R&D⁴⁷



⁴⁴ 'UK Science and Technology Framework', Department for Science, Innovation and Technology, 06/03/2023, <https://bit.ly/47Sgm4B> (checked: 12/12/2023).

⁴⁵ Mićo Tatalović, 'UK on track to meet its £20bn annual R&D investment goal', *Research Professional News*, <https://bit.ly/3Tn15o3> (checked: 12/12/2023).

⁴⁶ Claire Housley, Elizabeth Rough, Georgina Hutton, James Chandler and Lorna Booth, 'Research and Development funding policy', House of Commons Library, <https://bit.ly/3GCl76r> (checked: 12/12/2023).

⁴⁷ 'The UK is doing more R&D than was previously thought', Campaign for Science and Engineering, 29/11/2022, <https://bit.ly/47oKI3s> (checked: 12/12/2023); and, 'Gross domestic expenditure on research and development, UK: 2021', Office for National Statistics, 17/07/2023, <https://bit.ly/3GHtAWo> (checked: 12/12/2023).

When the UK was a member of the European Union (EU), it was part of the EU's flagship £82 billion Horizon research programme. Amid tensions over the Northern Ireland Protocol, the UK drew up plans for withdrawing from the programme even though the government was advised that the benefits of Horizon could not 'be fully replicated in domestic alternatives', and withdrawing 'would impact the ambition to become a science superpower'.⁴⁸ Although the UK has since re-joined the scheme,⁴⁹ many British scientists argue that the UK's years blocked from the programme have led to uncertainty, distrust, and damaged British science.⁵⁰

Education and skills challenges

There is a shortage of skilled scientists in the UK. This is due to a number of factors, including the fact that science is not seen as a popular career choice, the fact that there are not enough STEM (science, technology, engineering, and mathematics) graduates, and that many science graduates ultimately do not end pursuing science as a career. The shortage of STEM skills in the UK is an ongoing problem and has been estimated to cost the UK economy £1.5 billion per year.⁵¹ Education challenges are often cited as a reason for this.

While young people in school find science to be interesting, only one in six aspire to a career in science. The way in which science is taught in schools has been found to be a significant factor in whether students continue to study science post-16.⁵² Yet, in schools, over a quarter of teaching hours in physics in 2021–2022 were taught by teachers with no relevant post-A level qualifications.⁵³

The Royal Society has said that young people need a 'broad and balanced' education where mathematics and science lessons are at the heart of the curriculum.⁵⁴ It is estimated that more than 1 in 4 adults who are economically

⁴⁸ Harry Yorke, 'UK to ditch £15bn EU deal if Brussels goes hostile', *The Telegraph*, <https://bit.ly/3NrbFGN> (checked: 12/12/2023).

⁴⁹ 'UK joins Horizon Europe under a new bespoke deal', 10 Downing Street, 07/09/2023, <https://bit.ly/41mMML3> (checked: 12/12/2023).

⁵⁰ 'IOP: Horizon deal best for UK science community', Institute of Physics, 07/09/2023, <https://bit.ly/48f4FEJ> (checked: 12/12/2023).

⁵¹ 'STEM Skills Indicator', STEM Learning, 24/08/2018, <https://bit.ly/48jnIOt> (checked: 12/12/2023).

⁵² 'Reducing the barriers to science participation for young people globally', University College London, 12/04/2022, <https://bit.ly/48eqT9R> (checked: 12/12/2023).

⁵³ 'School workforce in England', Office for National Statistics, 08/06/2023, <https://bit.ly/41ngpmg> (checked: 12/12/2023).

⁵⁴ 'A broad and balanced curriculum', The Royal Society, No date, <https://bit.ly/4afX6j3> (checked: 12/12/2023).



active are functionally innumerate.⁵⁵ Or, to put it another way, there are currently 8 million adults in the UK who have maths skills lower than those expected of a nine-year-old.⁵⁶ Many other countries – such as Australia, Canada, France, Germany, Japan, and the US – ensure that students study some form of maths until 18.⁵⁷

When it comes to higher education, HM Government has long contended that ‘poor quality’ or ‘rip-off’ degrees are part of the problem.⁵⁸ In The King’s 2023 speech to both Houses of Parliament, he said: ‘proposals will be implemented to reduce the number of young people studying poor quality university degrees’.⁵⁹ HM Government has also argued that tackling an ‘anti-maths’ mindset is necessary to boost growth.⁶⁰

Alongside encouraging young people to study STEM subjects, part of the solution is to boost soft skills, which can lead to improved communication and collaboration, as well as improved problem-solving and decision-making.⁶¹ The increase in automation and use of artificial intelligence will mean creative skills and adaptability are even more important,⁶² and prioritising soft skills will ensure the workforce is better equipped to deal with this change. Such skills are in demand by employers.⁶³

In addition, many science graduates end up in jobs which are not in scientific or technical industries. For example, a fifth of physics graduates start work in the financial sector – which is more than the number of physics graduates who start their career in ‘science and technical industries’.⁶⁴

For Britain to become competitive in science, it needs to be able to attract and retain the best and the brightest minds. It ought to have an internationally competitive immigration offer to attract the cleverest researchers from around the world. In 2021, HM Government estimated that the UK needed 150,000 more

⁵⁵ *Ibid.*

⁵⁶ Rishi Sunak, Speech: ‘PM speech on improving attainment in mathematics: 17 April 2023’, 10 Downing Street, 17/04/2023, <https://bit.ly/41hnwNj> (checked: 12/12/2023).

⁵⁷ ‘Maths to 18: Is maths A Level being made compulsory for 16 to 18-year-olds?’, *The Education Hub Blog*, 17/04/2023, <https://bit.ly/47SOMUV> (checked: 12/12/2023).

⁵⁸ ‘Crackdown on rip-off university degrees’, Department of Education, 17/07/2023, <https://bit.ly/3Ns0fT3> (checked: 12/12/2023).

⁵⁹ King Charles III, Speech: ‘The King’s Speech 2023’, 10 Downing Street, 07/11/2023, <https://bit.ly/4afus1t> (checked: 12/12/2023).

⁶⁰ ‘Prime Minister outlines his vision for Maths to 18’, 10 Downing Street, 17/04/2023, <https://bit.ly/3Rh9N4x> (checked: 12/12/2023).

⁶¹ William Schomberg, ‘Insight: UK employers feel the strain of missing skilled workers’, *Reuters*, 14/03/2023, <https://bit.ly/3Nmfggw> (checked: 12/12/2023).

⁶² *Ibid.*

⁶³ Lucy Colback, ‘Technology and the Skills Shortage’, 18/05/2023, <https://bit.ly/3Tlinle> (checked: 12/12/2023).

⁶⁴ Jeff Forshaw, ‘Why do physicists gravitate towards jobs in finance?’, *The Guardian*, 21/07/2013, <https://bit.ly/41jfzHs> (checked: 12/12/2023).

researchers and technicians by 2030 to capitalise on planned increases in R&D investment effectively.⁶⁵ The Institution of Engineering and Technology (IET) has estimated a shortfall of over 173,000 workers in the STEM sector, an average of 10 unfilled roles per business in Britain.⁶⁶

However, the UK's visa system is one of the most expensive in the world, and the upfront costs of visas are substantially higher in Britain compared to other research intensive countries.⁶⁷ This risks making the UK less attractive to global talent compared to competitors. Recently, the government announced a significant increase in the minimum salary that a skilled migrant must earn in order to qualify for a work visa, from £26,200 to £38,000. This increase means that the threshold is higher than the salary of most early career researchers, which could damage the UK's science ambitions.⁶⁸ At the same time, the UK's net migration figure for 2022 was at a record of around 745,000.⁶⁹ The gap between Britain's talent shortages and this figure indicate that migrants arriving in the UK do not have the right skills to ease labour shortages, and that Britain should be doing more to close the skills gap.⁷⁰

Conclusion

Charles Babbage was wrong about the decline of science in England in 1830. But nearly two hundred years on, those worried about the UK's scientific edge may be right. Although the UK is still home to some of the world's top universities, researchers, and facilities, it is not performing as well as it claims in areas of science and technology identified as priorities in the Science and Technology Framework. This has implications not just for British science, but for the UK's ability to tackle climate change and environmental degradation, and the other big challenges of the contemporary era. It also has implications for Britain's economic prosperity and productivity.

⁶⁵ 'Research and development (R&D) people and culture strategy', Department for Science, Innovation and Technology, 22/07/2021, <https://bit.ly/48xXwjh> (checked: 12/12/2023).

⁶⁶ 'Addressing the STEM skills shortage challenge', The Institution of Engineering and Technology, 19/05/2021, <https://bit.ly/4awcF6v> (checked: 12/12/2023).

⁶⁷ 'Summary of visa costs analysis (2021)', The Royal Society, 23/11/2022, <https://bit.ly/3uXV3Ao> (checked: 12/12/2023).

⁶⁸ Benjamin Plackett, 'UK scientists fear impact of new immigration rules', *Chemical Engineers News*, <https://bit.ly/3teWdqC> (checked: 12/12/2023).

⁶⁹ Marie Jackson, 'UK net migration in 2022 revised up to record 745,000', *BBC News*, 23/11/2023, <https://bit.ly/3GDBIH1> (checked: 12/12/2023).

⁷⁰ Lucy White, 'High Migration Failing to Ease Tight UK Labor Market, Says S&P', *Bloomberg*, <https://bit.ly/3t7yM2f> (checked: 12/12/2023).



If the UK wants to maintain its position as a global leader in science and regain the nation's position as a science superpower, HM Government ought to:

- Invest more in R&D so that the UK is closer to matching the spending of countries such as Israel, South Korea, Japan, Germany, and the US;
- Address the geographical imbalance in R&D spending, so that funding reaches places outside the South East of the UK;
- Foster a pro-science ethos and promote science as a career choice both in schools and at universities;
- Improve the quality of science teaching in schools and ensure that teachers are better qualified to be teaching their subjects (such as through CPD);
- Promote the development of soft skills;
- Increase the number of STEM graduates; and,
- Attract the world's brightest and best minds through a more appealing and competitive visa system, and who are better suited to meeting the UK's labour shortages.

Such recommendations are echoed by the Royal Society's manifesto for science and the UK government's own Science and Technology Framework.⁷¹ What now remains to be seen is how these recommendations are put into practice.

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⁷¹ 'A manifesto for science: building a more resilient and prosperous future', The Royal Society, 30/11/2023, <https://bit.ly/3tc4Ulh> (checked: 12/12/2023).



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