A close-up photograph of a laboratory experiment. A pipette tip is shown dispensing a vibrant pink liquid into one of the wells of a clear plastic multi-well plate. The plate is filled with many other wells, some of which contain a light blue liquid. The background is dark and out of focus, emphasizing the action in the foreground.

**A manifesto for science:**  
building a more resilient  
and prosperous future

THE  
ROYAL  
SOCIETY

***A manifesto for science: building a  
more resilient and prosperous future***

Issued: December 2023 DES8700

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This report can be viewed online at:

**[royalsociety.org/2023/manifesto-for-science](https://royalsociety.org/2023/manifesto-for-science)**

# Foreword

## An open letter to all parties from the President of the Royal Society



Dear Party Leaders,

UK science produces enormous value for our society. We led the world in developing an effective COVID-19 vaccine, building on a strong base in biological sciences that had been cultivated over decades. From the steam engine to artificial intelligence, science and innovation have fuelled productivity, created countless jobs and turbocharged our economy in every part of the country.

It's been a turbulent few years since the last general election, and we continue to face a raft of increasingly disruptive global challenges. These include an ageing population, climate change, biodiversity loss and the unsafe exploitation of rapidly emerging new technologies.

Today, it is clearer than ever that science is central to the solutions. Although these challenges are great, they also create opportunity: there is enormous innovation and growth potential created by technological advancement that delivers a low carbon, sustainable planet. As we set out on this new path, the next government must make long-term decisions that ensure the UK has a science and technology ecosystem in which fundamental research discoveries can provide the foundations to a more resilient and prosperous future.

The Royal Society is a Fellowship of the world's most distinguished science leaders working across a broad range of disciplines from astrophysics to zoonotic infections. We stand ready to convene our global network to provide the next government with the cutting-edge expertise necessary to put the clear proposals set out in this manifesto into action.

A handwritten signature in black ink, appearing to be 'Adrian Smith', written in a cursive style.

**Sir Adrian Smith,  
President of the Royal Society**

# What the next government can achieve

## FOR THE LONG-TERM FUTURE OF THE NATION

- **To build a R&D landscape in which world-class science can thrive**  
Implement a long-term plan for UK science, with an effective international science strategy to drive innovation and an ambition to lead the G7 in R&D intensity.
- **To provide young people with the skills fit for a future economy**  
Restructure the secondary education system, introducing a broader and more balanced range of study that includes an opportunity to combine technical education and academic options.

## IN ONE PARLIAMENTARY TERM

- **To secure a net zero future**  
Develop an evidence-led technology roadmap to send clear signals to international net zero investors and support Britain's renewable energy generation with the construction of energy storage infrastructure.
- **To equip young people with real world mathematical knowledge and skills**  
Reform mathematical and data education and ensure schools across the country have the funding and trained teachers necessary to offer Core Maths Qualifications.

## IN THE FIRST 100 DAYS

- **To attract top global research talent**  
Create a visa system that enables the world's brightest scientists of all career levels to reside in the UK by reducing the expensive upfront cost of long-term researcher visas.
- **To aid teacher shortfalls**  
Commit to attracting and retaining more teachers, including through guaranteeing 35 hours of subject related professional learning/ CPD annually for STEM teachers.



# Building a thriving R&D landscape fit for the future

## The unique value of science and innovation

Science is a long-term endeavour that delivers health, resilience and prosperity. Many of the innovations that saved lives and rescued economies during the COVID-19 pandemic were built on fundamental research discoveries made decades ago.

## The next government should create an R&D environment in which world-class science can thrive

### Developing a long-term vision for science

Currently our ability to stay at the forefront of critical scientific fields is hampered by the general prevalence of short-termism and stop-start investment in science. The next government has a critical opportunity to produce a long-term strategy for science of at least 10 years that creates the stable conditions valued by researchers, innovators and the investors the UK is seeking to attract.

The UK is not alone in seeking to grow its domestic R&D capabilities. In an increasingly unstable geopolitical landscape, the UK should lead the G7 on R&D intensity and seek to be among the top science nations globally. The next government should also develop an effective international science strategy. After securing association to Horizon Europe and Copernicus, the UK should ensure it shapes the development of the next round of European framework programmes, which are scheduled to launch in 2028.

## Reducing barriers to international collaboration and research mobility

Researchers who want to bring their skills to the UK face upfront visa costs up to ten times higher than the average fees of other leading science nations, with fees set to rise even further next year. The proposed increase in fees means that the Global Talent Visa could have an upfront cost of almost £5,891 per applicant. The upfront cost of bringing a family of four here for five years will rise to almost £21,000.

This is a punitive tax on talent for UK business and public/non-profit research organisations that hampers innovation and ultimately reduces the UK's share of its economic and societal benefits. If the UK is to really be a world leader in the competitive global research environment, we need urgent action to remove these barriers to international scientific collaboration.

### FOR THE LONG-TERM FUTURE OF THE NATION

- 1 Develop a long-term plan for UK science.
- 2 Strive to lead the G7 in R&D intensity.
- 3 Develop an effective international science strategy.

### IN THE FIRST 100 DAYS

- 4 Reduce upfront visa costs for researchers in line with other leading science nations.

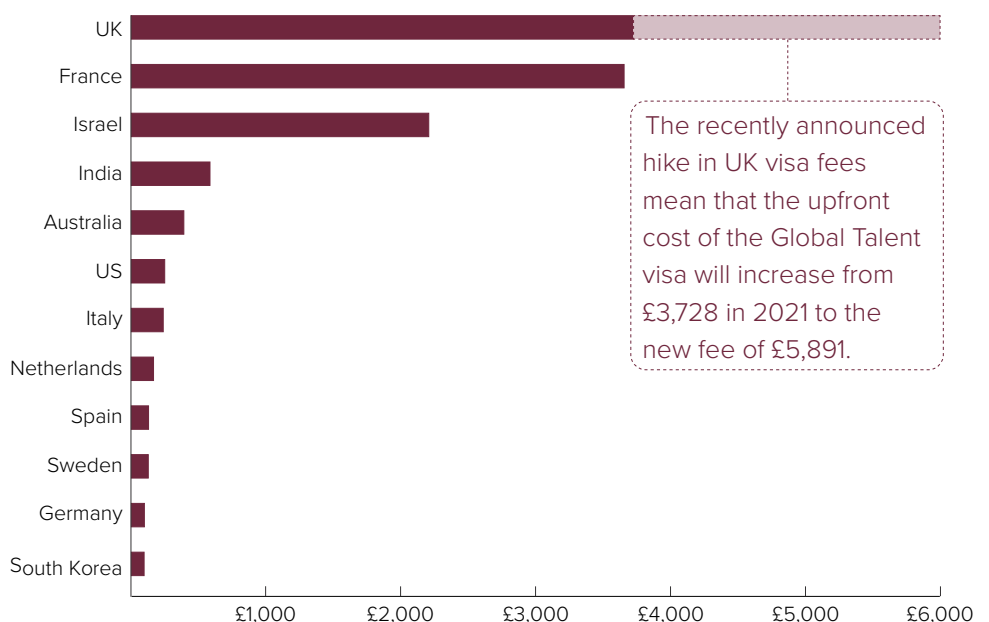
## Comparison of gross domestic expenditure on R&D (as percentage of GDP) in G7, 2021

Country	%	Rank
USA	3.46	1
Japan	3.30	2
Germany	3.13	3
UK	2.91*	4
France	2.22	5
Canada	1.70	6
Italy	1.45	7
<b>G7 average</b>	<b>2.60</b>	

\* The ONS have outlined these are the current best estimates but they are currently improving their methodology.

G7 average uses the straight mean of the seven nations (not weighted). OECD data used in USD. Source: OECD (2023). Gross domestic spending on R&D (indicator). doi: 10.1787/d8b068b4-en (accessed on 10 November 2023).

## Cost for UK Global Talent compared to visa routes in other leading science nations, 2021



# Securing a path to a net zero future

## The benefits of climate investment

There is a need for rapid and determined action on damaging climate change from decision makers in all levels of government that prioritises the long-term benefit of humanity as well as making economic sense for the UK. The UK is well placed to demonstrate global leadership on reversing climate change. Protecting the biodiversity of our planet also makes clear economic sense and will benefit countries around the world, with an estimated £10 trillion benefit to taking early action.

## The next government should develop a clear pathway to reach net zero by 2050

### Constructing a net zero technology roadmap

Science-led solutions must be placed at the forefront of our net zero response.

To fulfil our net zero commitments, the next government should develop an evidence-based technology roadmap that is informed and continuously updated by bringing together scientists, economists, social and behavioural scientists and industry. The roadmap should send signals to internationally mobile investment through recommending the technologies to deploy, develop or research.

## Averting an energy crisis through investing in energy sovereignty and security

Achieving the net zero target will require transport, industry, commerce and households to make a huge transition from fossil fuels towards renewable electricity as the primary energy source. New methods will also need to be developed to use renewable energy in sectors difficult to decarbonise such as aviation, steel and cement manufacture.

As one example, as we transition to increased levels of renewable supply, large-scale electricity storage will be essential to mitigate variations in wind and sunshine.

### IN ONE PARLIAMENTARY TERM

- 5 Develop an evidence-led technology roadmap to guide net zero investment.
- 6 Enable immediate construction of energy storage infrastructure.



Image credit: unsplash.com/@mrdoherthy.

# Developing skills fit for the future economy

## Empowering young people through education

Education is the most powerful policy lever a government has at its disposal to improve society. It provides future skills for the economy, offers fulfilling job opportunities for all young people and strengthens engagement with wider society. Yet with technology and society rapidly changing, our education system is playing catch-up.

## The next government should explore opportunities to reform our education system

### Broadening the curriculum

The problem-solvers of tomorrow will need a foundation in science, digital and data skills alongside knowledge of the humanities and creative arts. Currently students are presented with an ‘illusion of choice’, where many are forced to abandon studying for a wide range of skills post-16. The next government should introduce a broader range of study that would offer educational experience equivalent to counterparts in other high-performing economies. That would provide learners with a broad range of skills valued by employers.

To aid recruitment and retention, the next government should also guarantee that STEM teachers will have 35 hours of subject-specific continuing professional development (CPD) annually. An independent expert body should also be established to oversee the dispersal and coordination of funding.

### Embarking on a new approach to mathematics education

Government data show that 49% of the labour force in England has a level of numeracy equivalent to that of children when they leave primary school. This level of numeracy is significantly below other high-income ‘countries and has created an entrenched culture in which it is socially acceptable to be seen to be bad at mathematics.

We need a society in which everyone has the knowledge and skills to thrive in this fast-moving world; We will need mathematically educated people who are equipped to deal with the opportunities and challenges of varied and everchanging work roles. Similarly, all citizens need to be able to manage their day-to-day lives.

In a changing world, the nature of the mathematical education that is needed is shifting from ‘mathematics’ to a fusion of mathematics, statistics, data science and computer science. The next government should implement a shift towards a more fulfilling mathematics and data education, while providing funding to ensure that schools across the country can offer Core Maths Qualifications. Core Maths uses real-world data and explores mathematical concepts in authentic contexts that are relevant to everyday life, business, or social issues but only around 7% of eligible students are taking the qualification.

.....

**“They [students] don’t necessarily see the relevance of what they’re doing mathematically in GCSE and how it links into other things. That’s why, when we get them into Core Maths, we start with the finance straight away so they can start seeing the relevance.”**

Alasdair Staines, Course Leader for Core and GCSE Mathematics at Bolton Sixth Form College.

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## FOR THE LONG-TERM FUTURE OF THE NATION

**7** Restructure the secondary education system, introducing a broader and more balanced range of study.

## IN ONE PARLIAMENTARY TERM

- 8** Reform study of mathematical and data education.
- 9** Ensure schools across the country have the funding necessary to offer Core Maths Qualifications, which provide important, everyday skills.

## IN THE FIRST 100 DAYS

**10** Guarantee that STEM teachers will have 35 hours of subject-specific CPD annually.



The Royal Society is a self-governing Fellowship of many of the world's most distinguished scientists drawn from all areas of science, engineering, and medicine. The Society's fundamental purpose, as it has been since its foundation in 1660, is to recognise, promote, and support excellence in science and to encourage the development and use of science for the benefit of humanity.

The Society's strategic priorities emphasise its commitment to the highest quality science, to curiosity-driven research, and to the development and use of science for the benefit of society. These priorities are:

- The Fellowship, Foreign Membership and beyond
- Influencing
- Research system and culture
- Science and society
- Corporate and governance

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