

Long-term fundamental research

The case for investing in UK research
and development

Introduction

Long-term research conducted at UK universities is the backbone of our world-leading science and technology ecosystem. To maintain this strength, and continue to yield its benefits, the UK needs long-term, stable funding and strategy from government.

Universities conduct long-term, fundamental research that yields groundbreaking discoveries and solutions. These discoveries have changed the world, saved millions of lives, and created new markets and areas of economic activity. Universities commercialise this research through partnerships with businesses and industries.

A lack of long-term investment and planning in research and development (R&D) means that we can no longer take universities' R&D activities for granted. UK universities incur an annual £5 billion loss in their delivery of research, and without changes to our research funding system the UK is at risk of losing its strategic and economic edge.

This is against a backdrop of increasing competition from international innovation superpowers. The UK's share of world-leading research has stagnated, while the research share and R&D investment of countries such as China, India, and South Korea has grown significantly. The UK spends only 20% of its tertiary education expenditure on R&D, which is notably lower than the OECD average of 29%.

To ensure universities can continue to unearth discoveries and develop solutions, universities need long-term, stable funding and strategy from the UK Government. Without this, UK universities' capability for world-leading research and innovation will suffer, impacting our ability to drive growth and prosperity across the country. In our Manifesto for Opportunity and Growth, we call on political parties to commit to:

- Setting a target for GDP invested in R&D by 2030 which matches the most innovative and competitive economies around the world.
- Treating R&D as long-term capital investment through 10-year funding cycles to maximise the ability to secure private investment through increased certainty.

The importance of long-term, fundamental research

Every day, university researchers are expanding our knowledge, solving today's biggest challenges and preparing us for what tomorrow brings.

From making groundbreaking scientific and medical discoveries to creating the products and jobs of the future, university research makes a real difference to people's lives. Research that is happening in every part of the UK is among the best in the world – over 80% of research in the latest national assessment was classified as 'world-leading' or 'internationally excellent'.

Universities conduct long-term fundamental research. Often referred to as just 'fundamental' or 'basic' research, this is research that is conducted to further our understanding of how the world works. By nature, it is experimental, bold, and risk-taking in a way that corporate research cannot afford to be.

Examples of discoveries emerging from fundamental research include the following:

- **The Oxford-AstraZeneca Covid-19 vaccine** was based on fundamental research into exotic diseases such as Middle East respiratory syndrome (MERS), a coronavirus closely related to Covid-19. The research team at Oxford were able to leverage their research experience MERS into a rapid development and deployment of a Covid-19 vaccine. The vaccine was rolled out quickly thanks to years of prior research and access to the university's world-leading R&D talent and expertise. It saved 6.3 million lives in the first year of the global vaccine rollout – the most out of all the vaccines in circulation at the time.
- **AlphaFold** is a sophisticated AI tool that can predict the 3D structures of proteins. AlphaFold was developed in the UK to solve purely hypothetical research problems in computer science until its practical applications were recognised. AlphaFold has managed to predict the 3D structures for 98.5% of human proteins, greatly aiding drug discovery.

Fundamental research is often unhelpfully contrasted with 'applied' research. But as Oxford-AstraZeneca Covid-19 vaccine and AlphaFold demonstrate, they are two sides of the same coin: fundamental research is the key that enables applied research and commercialisation.

The unique role of universities in the R&D ecosystem

Universities research activity supports societal and economic goals in a unique way through:

- **Cutting-edge research:** universities' fundamental research is more experimental, bold, and can afford to take more risks than business R&D. They undertake groundbreaking research across a range of disciplines, leading to new discoveries, products, and services.
- **Skills development:** ensuring the future workforce is equipped to lead scientific and technological developments. Universities also train the researchers at businesses and PSREs.
- **Infrastructure:** universities have expertise to use and manage the most sophisticated physical and digital infrastructure through which groundbreaking research and innovation happens. Businesses such as Rolls Royce collaborate with the University of Edinburgh to design new jet engines with the ARCHER2 supercomputer.
- **Connectivity:** creating local and international connections for sharing knowledge and expertise.
- **Multidisciplinary:** universities bring together world-class experts from a whole range of fields, from biomedical science to AI and social research to design and the creative sector in a way other institutions are unable to.
- **Driving innovation and investment:** producing and supporting new businesses that drive innovation and leverage investment.
- **Public trust:** university R&D is perceived to be more altruistic than R&D by business or government, and the public trust universities to be more honest about the national need for R&D.

Universities' multidisciplinary research will be crucial to supporting priority areas in the UK Science and Technology Framework, including artificial intelligence, engineering biology, future telecommunications, semiconductors and quantum, alongside Net Zero.

Research and innovation brings billions of pounds in investment into towns, cities and regions all over the UK and plays a huge role in generating economic growth by

supporting jobs and prosperity, boosting skills and opportunities, and building pride in place and local communities. The University of Sunderland's Sustainable Advanced Manufacturing Project, which helps businesses become more productive and sustainable, has produced £47.1 million gross value added (GVA) to businesses, and growth in employment by 25.1%.

Public funding for university research and innovation helps bring in private investment, allowing universities to maximise their impact and support long-term economic growth and prosperity across the UK. It also delivers value for money, with proven returns on investment for public funding – every £1 of public R&D spending stimulates between £1.96 and £2.34 of private spending.

The benefits of investing early and a first-mover advantage

Leaning into the experimentation, higher risk appetites, and the blue skies horizon-scanning that are inherent in long-term fundamental research comes with great opportunities.

- **Artificial Intelligence:** it is estimated that AI will contribute more than \$15 trillion to the global economy by 2030, and global revenue associated with AI software, hardware, service and sales will likely reach \$900 billion by 2026, compared with \$318 billion in 2020. AI can help identify molecules with particular properties in drug discovery, aid in modelling the effects of drugs on large populations, and give the UK life sciences industry a critical edge in R&D and drug development. It can also help the development of materials with the characteristics needed in batteries or solar cells.
- **Quantum technologies:** global investment into quantum computing is estimated to be reaching \$35.5 billion globally. The UK ranks globally 4th in quantum research, and according to the CBI, the UK quantum sector has grown 81% since 2013, and now contributes an estimated £1.7bn to the UK economy. More than half are start-ups, and the number of active companies has increased 81% since 2013.
- **The NHS and healthcare:** the NHS is suffering under severe financial pressures, patient backlogs and an ageing population. AI can help the NHS deliver faster and more accurate diagnosis, reduce errors caused by human fatigue, automate repetitive tasks, decrease costs, and reduce mortality rates. Israel, one of the R&D superpowers, is already using AI and cutting-edge technology to supercharge its healthcare system.

However, these successes only emerge from the fact that UK is a world-leading expert in these fields – and this expertise comes from long-term, fundamental research conducted at universities which translate into commercial success.

Recommendations

To cement the UK's position as a lead innovator in developing and harnessing key technologies of the future, we call on long-term, stable funding and strategy from government.

We recently launched a manifesto for an incoming government which are all aimed at increasing the contribution that universities make to individual and national opportunities and growth:

- Setting a target for GDP invested in research and development (R&D) by 2030 which matches the most innovative and competitive economies around the world.
- Treating R&D as long-term capital investment through 10-year funding cycles to maximise the ability to secure private investment through increased certainty.

Universities UK is the collective voice of 142 universities in England, Scotland, Wales and Northern Ireland.

Our mission is to create the conditions for UK universities to be the best in the world; maximising their positive impact locally, nationally and globally.

Universities UK acts on behalf of universities, represented by their heads of institution.



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