Securing our Economic Future with Science & Engineering

Campaign for Science & Engineering in the UK

www.sciencecampaign.org.uk

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Introduction

Investment in science and engineering skills and research gives broad and historically proven economic returns over the short- and long-term. Such investment, if made now, could drive the growth needed to secure a strong economic recovery.

The Government is keen to boost confidence in the UK by making decisive cuts. But making cuts in the science and engineering sectors would have the opposite effect, damaging investor confidence and reducing levels of investment.

The total investment in research and development (R&D), and the public contribution to that sum, are important signals to investors and researchers and must be increased, or at least maintained.

The UK and its competitors

Over 30% of the UK's Gross Domestic Product (GDP), is produced by sectors intensive in science, technology, engineering and mathematics.[1] Yet the Government spent only 0.55% of GDP on R&D to support these sectors in 2007; of the G7 countries, only the Italian government spent a lower proportion, with Germany at 0.71%, France at 0.81% and the USA at 0.77%.[2]

The Government supports science and engineering in various ways including: funding projects through research councils; investing in general university research; government departmental research; and supporting private and charity investment. It also pays for education and training. Factors affecting where private companies choose to invest include a countries' growth potential and the quality of the workforce and the research base.[3]

"We've been losing manufacturing industry faster than the 1980s. It's been a complete tragedy. We've got to rebuild... Let's start with investing in our science base."
David Cameron, April 2010.[4]

The Government needs to develop a long-term and stable policy framework to make the UK a country where people and companies want to do science and engineering, enabling researchers to innovate, and encouraging private investment.[5,6,7]

The UK invested 1.8% of its GDP in R&D in 2007. This is short of the UK's own target of 2.5%, and further behind the EU target of 3%.[8] To reach the UK target, public investment must increase, for its direct benefit and because it stimulates private-sector investment.

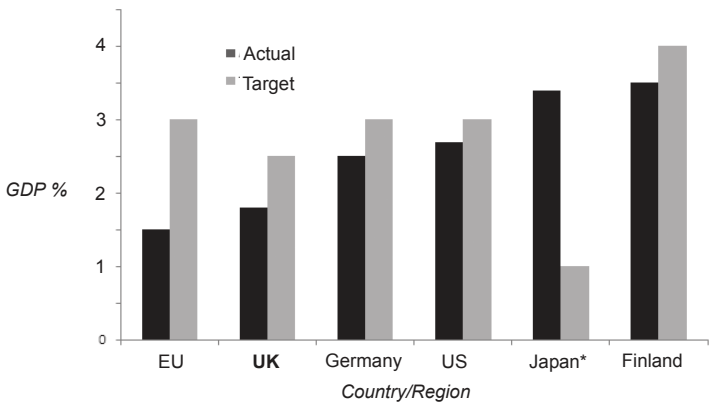
R&D is an economically important sector. In 2007, the UK had an overall current account deficit of £37.7bn, but foreign businesses invested £1.7bn more in R&D here than UK companies spent on it abroad.[9] Further public investment could increase the level of this gain.

The UK ranked 15th for level of investment in R&D in 2007. Since then, the economic downturn prompted many countries to invest more in R&D, in line with a good historical precedent. Finland and Korea responded to their economic crises in the 1990s by investing heavily in R&D while severely constraining public spending; these investments helped their strong re-growth in knowledge-based economies.[10] The UK has not yet seized the opportunity, still available, to invest in science and engineering to accelerate the recovery.

The new Government needs to commit to the challenging goal of at least 2.5% of GDP to be spent on R&D from all sources by 2014.

"My department will be the department for growth. We need to develop a stronger, more balanced economy that is less dependent on the City by building on the strengths of our manufacturing and other knowledge industries."
Vince Cable, May 2010.[11]

International spending on R&D as a percentage of GDP in 2007



*Japan target for public spending only (Source: CaSE News 62)

Returns on Investment

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Immediate returns

- To attract and retain private-sector investment, the UK must be perceived to offer a strong and stable environment for research.[12] This gives immediate gains through tax revenues and employment.
- By showing a strong and sustained commitment to science and engineering the UK can attract and retain excellent and internationally mobile scientists and engineers and the industries that seek to employ them.
- The UK's economic climate, funding, and the reputations of its universities, all help to attract more and more overseas students - 250,000 in 2008/09, who contributed about £5bn to the UK economy.
- 180,000 people gain from working in R&D.[13]

"The decisions we make about the science base today are not just impacting the research of tomorrow, they are impacting the investment decisions of today."
Iain Gray, Chief Executive, Technology Strategy Board, February 2010.[14]

Economic returns building over time

Public and private R&D have independent effects on growth:

- Multifactor productivity (MFP) reflects the extent to which an economy can derive GDP growth from a certain level of labour and capital. R&D raises MFP in various ways, like improving workforce productivity and skills. A 2004 OECD analysis estimated that a 1% increase in business R&D increases MFP by 0.13% and a 1% increase in public R&D increases MFP by 0.17%.[15]
- A recent literature review estimated that every £1 spent on public or charitably funded research gave a return of 30p a year in perpetuity from direct or indirect GDP gains, on top of the direct gains of the research.[16]
- Corporate investment in R&D brings a return of around 50% to the public. This compares to a private return of around 20% captured by investors themselves.[17]

Evidence shows that public R&D investment helps generate private R&D investment, and vice versa:[18]

- A study of the pharmaceutical sector found that a 1% increase in public basic research led to a 1.7% increase in industry R&D after eight years. And a 1% increase in public clinical research led to a 0.4% increase in industry R&D after just three years. Given that industry spending in the study was five times greater than public spending, this multiplied up to over 8%.[19] Basic ('blue skies') research may lead to greater returns than other types of research, but more slowly, underlining the importance of a portfolio approach to R&D investment.

Research findings give direct economic benefits:

- From 2003 to 2007, 31 university spin outs were floated on stock exchanges with an IPO value of £1.5 bn and 10 spin outs were bought for a total of £1.9 bn.
- It is estimated that cardio-vascular research gave a continuing annual benefit of 39p for every £1 of public or charity money spent and mental health research gave a continuing benefit of 37p per year.[20]

The UK will only be able to benefit fully from other countries' R&D spending, including their stimulus packages, if UK researchers have developed their own skills and knowledge by conducting comparable research themselves, building up an 'absorptive capacity'.[21] Evidence shows that countries with higher R&D intensity gain more from R&D performed overseas.

Science, engineering & society

- A broad research base is essential for the multidisciplinary work needed to tackle national and global challenges like climate change, energy security, and health challenges. Breadth also gives us security to respond to the unexpected, from declining bee populations to volcanic ash clouds.[22]
- A scientific understanding is essential for modern life, from individuals choosing their health care, to MPs evaluating the evidence for the best public policies.

"...research and innovation policy has moved up in terms of EU priorities and become widely recognised as a key enabler of competitiveness, productivity growth and sustainability and to tackle global and societal challenges"
Council of the European Union, May 2010.[23]

The Effects of Cuts

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Short-term risks

- If the UK is not perceived to support R&D, then individuals and investors will relocate to more favourable countries. The current uncertainty of long-term funding, and the regular reprioritization of limited funds occuring in some areas, is destabilising and hinders long-term research. It also impacts upon the desirability of the UK as a partner in international collaborations. The UK currently receives a very high proportion of its R&D funds from foreign owned firms (17%) which may be even more responsive to market conditions than UK-based companies.[24]

- Excellent scientists and engineers are most creative when they have stable funding. Less stability will reduce the ability of these individuals to do their most high-impact and valuable work.[25,26]

- The UK's reputation in science and engineering has already been damaged (e.g. physics funding crisis, and cuts already announced).[27] We can recover with prompt action, but if not done soon, it will be hard to regain our previously enviable reputation.

- Reduced funding for higher education teaching and research has already resulted in job losses. As the teaching of high cost science and engineering courses is already under-resourced, and some universities have accepted unfunded places, further financial pressure is likely to lead to departmental closures.

- Many years of hard work and investment have improved the uptake of science and mathematics in secondary education. It would be tragic if students could not pursue their interests in higher education. If graduate numbers fall, it may perpetuate the downward spiral of having too few entrants into teaching to inspire the next generation of students, a spiral which had shown signs of being broken.

- Universities increasingly bolster their finances by recruiting overseas students, who bring with them high levels of fees. If the UK becomes less desirable, then this income will fall.

"If support for research councils was cut by £1 billion from its current £3 billion, GDP would fall by around £10 billion."
Jonathan Haskell, Imperial College Business School, March 2010[28]

Longer term dangers

- If the capacity and quality of the higher education system is reduced, a generation of less-skilled graduates is the result. It is difficult to retrain these individuals. This deprives people the opportunity to make the most of their potential. If university funding is lowered, universities will scale back on renewing and upgrading their teaching and research facilities, reducing the value of the skills of new graduates.

- Without enough people trained in science, technology, engineering, and maths, it will be difficult to retain industrial investment in the UK.

- Reducing investment in R&D would reduce the potential for economic growth (see page 2). There will be fewer breakthroughs, and less development of them into beneficial products. The general public will notice falling productivity, given the level of media interest in and coverage of scientific and medical discoveries, as well as new (including green) technologies. And if research projects are cut short, this wastes money that has already been spent.

"Cuts in spending on science and universities are likely to have important long-term consequences. They would lead not only to direct falls in innovative outputs, but also to indirect falls to the extent that the UK would become a less desirable place for firms to conduct research."
Institute for Fiscal Studies, February 2010.[29]

Threats

Limited research expertise could leave the UK unable to tackle issues that specifically affect it.

- The UK may be unable to conduct preventative research and mitigate against local problems, such as the outbreak of BSE. For instance, research refining the use of the Thames Barrier has been estimated to save £30 bn.[30]

- The UK may waste opportunities to capitalise in areas where we have a natural or historic advantage, like wave power and stem cell technologies.

The Imperative to Invest

"Investment in science cannot be turned on and off on a political whim - we must have long-term investment. If we cut science now, just as the benefits of nearly twenty years of consistent policy are really beginning to bear fruit, we will seriously damage our economic prospects."
Lord Waldegrave, former Science Minister & Chief Secretary to the Treasury, March 2010.

The UK has an excellent track record, with four of the world's top 30 research universities.[31] But this excellence is threatened by rapidly increasing investment overseas, particularly in countries such as Brazil, Russia, India and China, that could grow into research giants. Indeed, the UK's share of scientific publications fell over the last decade, while China's quadrupled.[32] The advantages that the UK built upon – including an early scientific and industrial base, the English language, and openness to international investors and workers – will not sustain our excellence without a strong new commitment to the future.

The economic recovery is fragile, and resources are limited. Stakeholders in skills, research, and development need to identify efficiencies and new ways to communicate and collaborate. Industry has established new collaborative ways of working pre-competitively, including with universities and research charities. Better collaborative structures and faster mechanisms of translating research into marketable discoveries have aided this.

Government departments spend over £3bn on R&D. This should not be seen as an 'easy cut', particularly as such funds are used to evaluate cost-effectiveness in other programmes. The largest budgets are in Health and Defence; any cuts here could have severe consequences.

The total budget for R&D is an important signal to investors and researchers. It must be increased, to be aligned with international competitors, or at the very least maintained at current levels. Efficiency savings in R&D need to be made but must be reinvested in science and engineering.

Public investment is even more important during the recession as R&D funds from charities and industry have fallen. Further cuts cannot be made to public investment in science and engineering training and research. Some direct and knock-on effects would be rapid; others would damage the UK's research capacity and international standing for years, if not decades.

"The Government faces a strategic choice: invest in areas with the greatest potential to influence and improve other areas of public spending, or make cuts of little significance now, but that will have a devastating effect upon British science and the economy in the years to come."
House of Commons Science & Technology Committee, March 2010.[33]

References

1 *Engineering: Turning ideas into reality.* IUSS Select Committee, 2009.
2,8,9,13,24 *SET Statistics*, BIS, November, 2009.
3,12 *Research and Development: Going Global.* OECD, 2008
4 BBC Pre-Election Debate, 29th April, 2010
5 *A Vision for UK Research,* Council for Science & Technology, March 2010.
6,26,32 *The scientific century: securing our future prosperity.* The Royal Society, March 2010.
7 *Setting priorities for publicly funded research,* House of Lords Science and Technology Committee, April 2010
10 *Policy responses to the economic crisis: Investing for long-term growth.* OECD, 2009.
11 Speech to Cass Business School, 3rd June 2010
14,25,27,28,33 *The impact of spending cuts on science and scientific research.* Science and Technology Committee, March 2010.
15,21 *R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries*, OECD Science, Technology and Industry Working Papers, 2001
16,17,20 *Medical Research: What's it worth? Estimating the economic benefits from medical research in the UK.* MRC, Wellcome Trust & the Academy of Medical Sciences, November 2008.
18 *Work on Innovation - A stocktaking of Existing Work*, OECD, 2009
19 Toole (2007). *Does public scientific research complement private investment in R&D in the pharmaceutical industry?* Journal of Law and Economics, 2007, 50, 81-104.
22 *Impacts of Investment in the Science & Engineering Research Base,* Case Policy Report, September 2009.
23 *Conclusions on creating an innovative Europe, 3016th competitiveness council meeting*, Council of The EU, May 2010
29 *The IFS Green Budget:* Institute for Fiscal Studies, February 2010
30 *Excellence with Impact*, RCUK, 2007.
31 *Academic Ranking of World Universities,* Shanghai Jiao Tong university 2009

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