

Engineering and Physical Sciences Research Council

Driving research impact

Insights from the Research Excellence Framework 2014



EPSRC – driving research impact

Insights from REF 2014

The 2014 Research Excellence Framework (REF), which assessed the quality of research in UK higher education institutions, has revealed comprehensive evidence of the **sustained economic and social impact** of EPSRC's investments in engineering and physical sciences (EPS) research over the last 20 years – in a way that has not previously been possible.

REF 2014 drew submissions from 154 leading universities and other education institutions, including 6,975 impact case studies.

Of the **1,226** case studies directly relevant to EPSRC's remit, over **85 per cent** involved EPSRC-funded research and/or researchers and 44 per cent involved industrial collaboration; **333** recorded international collaboration with academic researchers in other countries.

Taken as a whole, the case studies show that EPSRC's investments have helped drive over **£60 billion of economic activity**. They have also led to over **£16 billion in cost savings, £5.9 billion** of which were made in the public sector.

Driving growth: 400 new businesses creating 50,000 jobs and £4 billion annual turnover

Economic growth has been supported by the creation of **400 new businesses** set up to take EPSRC-supported research to market. These firms employ some **50,000 people** and have contributed an estimated **£4 billion in revenue to the economy**.

EPSRC investments are particularly evident in key areas such as healthcare, aerospace and defence, information technologies, the automotive sector, energy and manufacturing.

The REF case studies cited over **£1 billion** of EPSRC investments in research; this was matched in the studies by £1 billion from other sources, including industry, the EU

Driving investment: over £6 billion additional investment from the public and private sectors

and government plus a further **£5 billion** in industrial funding for next-stage development.

These figures reinforce the key role of EPSRC as a major broker of R&D collaborations between academia and the public and private sectors; currently EPSRC **leverages over £900 million** from industry and other sources on its grant portfolio of around £4 billion.

Driving impact: over 85% of the 1226 REF case studies analysed involved EPSRC-funded research/researchers

The REF analysis also reinforces the central role of public sector investment in university-based engineering and physical sciences research: **44 per cent of external income to university departments** in these subjects stems from the UK research councils, the majority coming from EPSRC.

This study has also confirmed the effectiveness of EPSRC's provision of **long-term sustained funding for all types of research**, and

highlighted that impacts are delivered over a broad range of time frames, ranging, for example, from two to twenty years.

The case studies provide clear evidence of how EPSRC works effectively in partnership with others, including the other research councils and Innovate UK, enabling the initial discoveries which can then be taken forward with support from others. In fact, **90 per cent** of the case studies which refer specifically to support from **Innovate UK** and its predecessors were **supported by EPSRC investments**.

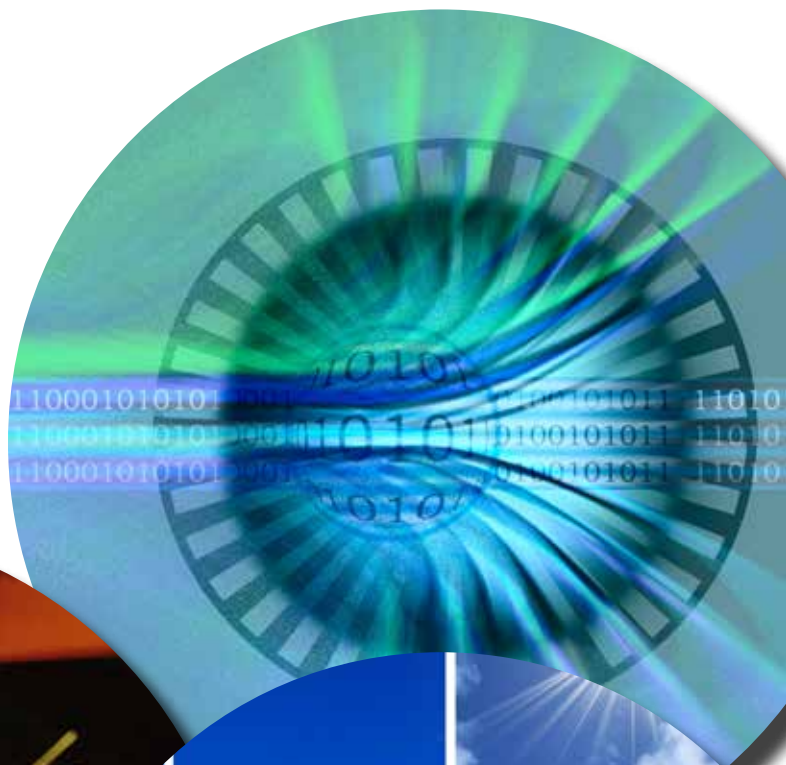
Driving innovation: 90% of the REF case studies citing support from Innovate UK also involved EPSRC

However, the REF impact material also demonstrates EPSRC's strong track record in partnering directly with business, accelerating the impact of R&D that benefits the UK economy.

It is not just the private sector which is benefitting: of the 1,226 case studies within EPSRC's remit, **198 feature support from government departments** such as the Department for Transport; the Ministry of Defence (and

related agencies such as the Defence Science and Technology Laboratory – Dstl); and the Department of Health. Of these, **171 involve EPSRC-supported research** or researchers; providing compelling evidence of the extent to which engineering and physical sciences contributes across many areas of government activity and offers real opportunities for the public sector to achieve significant levels of efficiency savings.

Driving efficiencies: over £16 billion in cost savings across public and private sectors



REF impact case study highlights



Smart TV catches more criminals

The UK's six million cameras generate oceans of data. Trawling through footage is virtually impossible. Royal Holloway University start-up Kinesense Ltd, formed to commercialise EPSRC-funded research, has developed a radical automated analysis technique based on how the human eye tracks moving objects.

Officers investigating a break-in can use the system to pinpoint a period on a CCTV tape that is of interest rather than watching through the entire tape.

Used by 20 per cent of UK police forces, and in around 20 countries, the system is helping to solve hundreds of serious crimes, the system slashes the time needed to analyse CCTV footage by up to 95 per cent – cutting costs and bringing criminals to justice more quickly.

Fuel cells drive exports

Intelligent Energy, the world's largest independent fuel cell company, was valued at £639 million when it was floated on the London Stock Exchange in 2014.

Spun out from Loughborough University, the company's R&D is led by a core team of EPSRC-funded researchers, part of a 350-strong workforce worldwide.

The company's collaborations with high profile partners including Boeing, Airbus, Citroën and Lotus have led to the world's first purpose-built motorbike with a fuel cell power source, fuel cell aircraft and zero emission road vehicles.

In October 2015 Intelligent Energy announced a milestone £1.2 billion deal to provide efficient, economical and clean power to over 27,400 telecom towers in India.



Maths saves lives

Lifesaving improvements to UK healthcare systems were made using mathematical models developed with EPSRC support at Cardiff University. Benefits included boosting hospital capacity planning tools in use across the UK.

The enhanced systems led to a 54 per cent reduction in mortality rates of trauma patients across South London through informing patient flows and resourcing levels in a major new trauma centre. They also reduced patient

waiting time and delivered better levels of patient care through improved resource management and greater efficiency.

The creation of a new stroke unit based on the research findings reduced the mortality rate of stroke patients across South London by 60 per cent. The emergency department at the University Hospital of Wales achieved net efficiency gains of £1.6 million per year thanks to the Cardiff team's research.

REF impact case study highlights



EPSRC centre generates £100m

The EPSRC-supported Optoelectronics Research Centre (ORC) at the University of Southampton is an acknowledged world leader in photonics, optical telecommunication and high-power lasers.

Ideas generated at the ORC help power the global internet, navigate airliners, cut steel, mark iPads, and manufacture life-saving medical devices.

The centre has spawned a cluster of photonics companies to commercialise its research, which EPSRC has supported for over 20 years, generating revenues in excess of £100 million and creating more than 500 jobs. It has also produced over 700 doctoral-level alumni holding senior positions in industry and academia worldwide. The centre has licensed over 30 key patents and files 20 patents a year.

Resilient rail track saves £50m

Technology for enhancing strength, stiffness and resilience in rail track, developed by EPSRC-supported researchers at Heriot-Watt and Edinburgh universities, has led to estimated cost savings of at least £50 million in the UK and overseas.

The XiTrack technology has reduced track maintenance costs by a factor of up to 40 and increased maintenance intervals from three-monthly to 10 years. Track speeds have also increased up to 125 mph in critical sections of the UK, Italy and Hong Kong rail networks.

The technology, developed with further support from the Natural Environment Research Council (NERC) and the Technology Strategy Board (now Innovate UK), has been applied at many important sites across the UK and was used to stabilise the track bed at Clapham Junction – one of the most highly used railway junctions in Europe with over 2,500 trains passing through it every day.



New wave, future-proof wireless

Award-winning UCL (University College London) start-up, Zinwave, has developed future-proof systems for wireless communications in large buildings such as stadiums and airports – where conventional wi-fi and cell phone systems can break down due to the signal's absorption by building material.

Zinwave's systems support reliable coverage throughout buildings, even underground coverage, and have been implemented globally.

The company's clients range from hospitals and airports to sports stadia, power stations and conference centres.

With 25 employees, Zinwave's revenue has grown tenfold since 2008; annual revenue from sales stands at £3.5 million.

REF impact case study highlights



Million dollar cells

Research at Loughborough University has led to innovative methods for the large scale culture of human stem cells key to regenerative therapies in areas such as blood replacement, stroke, degenerative diseases and tissue repair.

With long-term investment from EPSRC, the Medical Research Council, the Biotechnology and Biological Sciences Research Council and Innovate UK, the research led to the development of an automated cell culture system launched

by TAP Biosystems, a leading supplier of innovative cell culture and fermentation systems for life science.

By 2014, 47 of the systems, worth over £20 million, had been sold, 40 per cent in Europe and 60 per cent in the USA. Leading stem cell therapy company ReNeuron will be using the system to help produce clinical and commercial stem cell therapies at a new manufacturing facility in Wales.

Software saves NHS millions

Pioneering artificial intelligence techniques developed with EPSRC support at Goldsmiths, University of London and the University of Reading, have led to ground-breaking software which pinpoints potential savings by combining and mining purchasing data across systems and formats.

The SpendInsight software, developed in partnership with @UK PLC, was used in an analysis for the National Audit Office, which showed that the NHS could save over £0.5 billion in consumables expenditure through simple changes to purchasing practice. One Trust has already saved £320,000.

The National Audit Office has stated: "If the procurement system were utilised across all NHS Trusts in England they could make overall savings of at least £500 million, around 10 per cent of the total NHS consumables expenditure of £4.6 billion."



Optimising flood defences

Mathematics research on modelling extreme events has been fundamental to optimising the design of the UK's flood defences.

The Lancaster University team's EPSRC-supported research into 'extreme value methods' has enabled the optimisation of the design of coastal and river infrastructure to protect against extreme events without jeopardising the level of accepted risk.

The research has led to strong financial and societal benefits. For example, the UK has around 600 miles of walls, and one metre of extra height costs on average £150,000 per 100-metre length of wall. Calculating the optimal height of sea-walls has led to a reduction in unnecessary building costs – saving £22.5 million on 450 schemes. The research also resulted in the development of software to help the insurance industry accurately estimate annual flood loss for insured properties. It also led to less reliance on outsourced consultancies – with estimated savings of £6 million since 2010.

REF impact case study highlights



Spin-out company worth £130m

Data2Text, a company formed to commercialise artificial intelligence technology developed with EPSRC support at the University of Aberdeen, was valued at £130 million when it was floated on the Alternative Investment Market in 2013.

The company's goal is to build 'articulate machines' which communicate with people in the same way that people do. Its Natural Language Generation system automatically

generates written reports which would otherwise take expert analysts many hours to complete.

The technology is being used by the Met Office to generate high quality text for weather forecasts. A global oil and gas company is also using it to process vast amounts of data from production platforms in deepwater Gulf of Mexico and convert it in real time to the language that an operator or engineer speaks.

Electric research saves £0.5bn

An EPSRC-supported team of electrical engineers at Imperial College London have made pivotal contributions in the design of power transmission networks, the equipment within these networks, and non-conventional electricity systems.

Since 2008, the team have assisted the National Grid in defining new investment affecting £3 billion worth of network assets now approved by the regulator. They also provided tools to develop the first offshore networks design standards in 2008, saving an estimated £500 million by 2013, and a projected overall saving of £1-2 billion by 2020.

The research has also enabled the UK Power Network to plan network investment of £1.18 billion and make savings of £130 million and influenced government policies. Spin-out company, BBOX, has partnered with Brighterlite Kenya and Rural Development Solutions to help provide 2.5 million off-grid customers in Kenya with an on-grid experience by 2018.



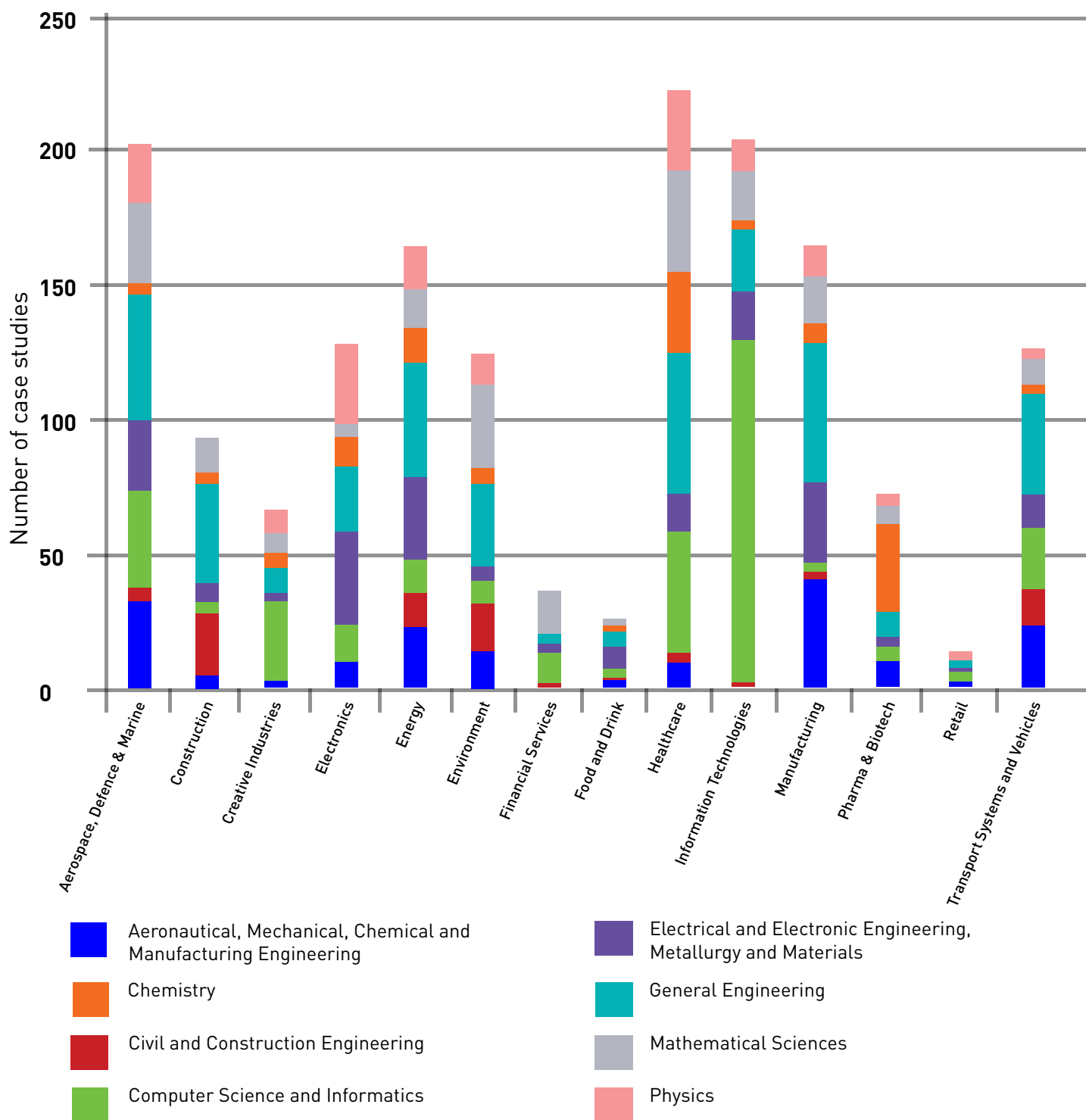
Hi-tech scanner for safer airports

A high-tech radar scanner which automatically detects hidden bombs and guns on people is set to revolutionise security at airports, shopping centres, stadia and transport hubs.

The scanner, developed by scientists at Manchester Metropolitan University, works in real time using radar waves and complex computer programs and can work at a distance of up to 25 metres.

Unlike current airport scanners, the device does not produce an image of the subject but only analyses radar signals reflected from the person – without compromising people's privacy or health.

Engineering and physical sciences produce impacts across all areas of UK economy and society



Impact across the UK: The chart above shows the distribution of REF impact case studies mapped against sectors.

The key findings featured in this publication were drawn from *Investing in excellence, delivering impact for the UK – Insights from the Research Excellence Framework 2014*. This report, compiled by EPSRC, presents the findings of an analysis of the REF impact case studies relevant to the EPSRC remit, and explains the methodology used in the study. It is available on the EPSRC website.

Engineering and Physical Sciences Research Council (EPSRC)

As the main funding agency for engineering and physical sciences research, our vision is for the UK to be the best place in the world to Research, Discover and Innovate. By investing £800 million a year in research and postgraduate training, we are building the knowledge and skills base needed to address the scientific and technological challenges facing the nation.

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