UK-INNOVATION
RESEARCH CENTRE

INNOVATION POLICY AND THE UK ECONOMY

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EVIDENCE FROM THE UK INNOVATION RESEARCH CENTRE

What can public policy do to promote the innovation that drives economic growth?

How can the UK make the most of its research base in both the private and public sectors?

And how should policy-makers access the evidence base to formulate policy?

These questions are at the heart of the work of the UK Innovation Research Centre (UK~IRC).

They have been the particular focus of a sequence of research reports published by the Enhancing Value Task Force. This joint project with the Council for Industry and Higher Education was established in 2012 with the aim of ensuring that government policies and business and university activities are aligned to achieve maximum economic impact for the UK globally and to keep the country at the forefront of research.

The Task Force set itself four principal goals: to place UK public and private sector research in a European and global context; to explore the similarities and synergies between public and private sector research; to isolate the characteristics of different business sectors and explore appropriate sectoral systems of innovation; and to identify and prioritise a small set of key actions for change that will enhance the value of publicly funded research and collaboration with business.

THE GLOBAL CONTEXT FOR NATIONAL INNOVATION POLICY

The fourth and final Task Force report noted that research is a competitive global activity and developing countries are capturing market share. The UK needs to compete for a greater share of supply chains – from research through to wide-scale deployment of new concepts and products – to support the country's economic prosperity and sustained investment in the higher education and research base (Docherty et al, 2012).

So how does the research base look in an international perspective? The first Task Force report explored the UK R&D landscape through an analysis of official statistical sources on R&D activities (Hughes and Mina, 2012). This shows that despite increases in investment in higher education research, there is an R&D funding gap between the UK and its major industrial competitors.

In terms of two key measures – overall gross domestic expenditure on R&D relative to GDP (see Figure 1) and researchers per 1,000 employees – the UK ranks relatively low in the OECD, especially when the focus is narrowed to manufacturing. Furthermore, R&D is highly concentrated in the UK's biggest firms with only 3.5% of R&D being conducted by independent small and medium-sized enterprises in 2011.

A UK~IRC study commissioned by the Department for Business, Innovation and Skills (BIS) looks at other ways of tracking the internationalisation of innovation in the UK. These include 'rest of the world' ownership of UK-quoted company shares and the impact of foreign direct investment, the extent to which UK R&D expenditures are generated by foreign controlled affiliates and the share of R&D funded from abroad. In all cases, there is strong evidence of internationalisation (Hughes, 2012).

The extent of internationalisation and the dependence of the UK on foreign direct investment in increasingly vertically integrated value chains set the context for policy. This should not be framed by picking winners, the report argues, but by 'choosing races and placing bets'. This means first assessing whether the UK possesses distinctive and outstanding scientific and technological competence in a particular area, then analysing market potential and national capability to deliver. Foresight and mapping have a key role to play.

There also needs to be an evaluation of the wider social implications of placing a particular bet and a risk assessment of policy failure. Only when all this is done should policy-makers turn to consider intervention. Following this approach requires discipline; it also has significant data requirements and needs special analytical capabilities.

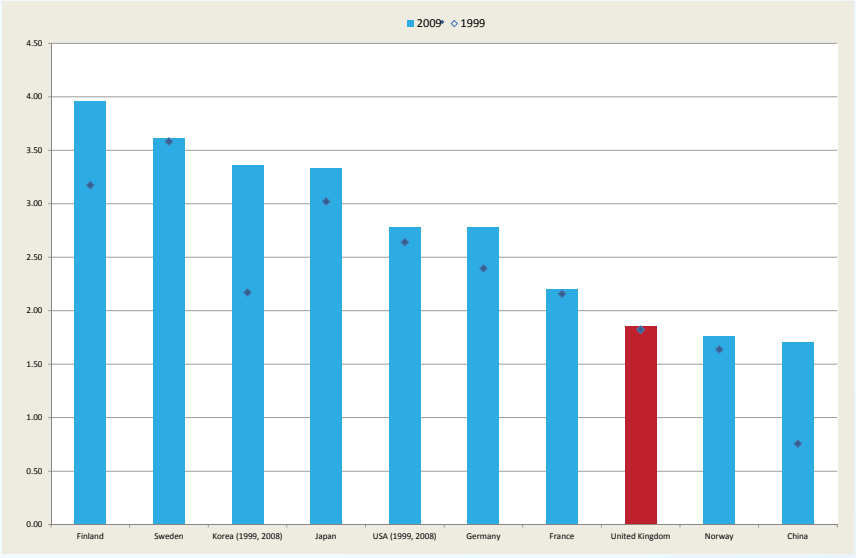


Figure 1: GERD: Gross Domestic Expenditure on R&D, 1999 and 2009 (as % of GDP)
Source: Hughes and Mina, 2012

THE VALUE OF PUBLIC SECTOR R&D

What is the impact of publicly funded research on innovation and economic growth in the UK? The second Task Force report, which reviews evidence on this question, establishes that quantification is exceptionally difficult and attempts to reduce multiple inputs to a single rate of return often require heroic assumptions. So it may be a serious policy mistake to rely on rate of return calculations as evidence of the health of UK innovation (Hughes and Martin, 2012).

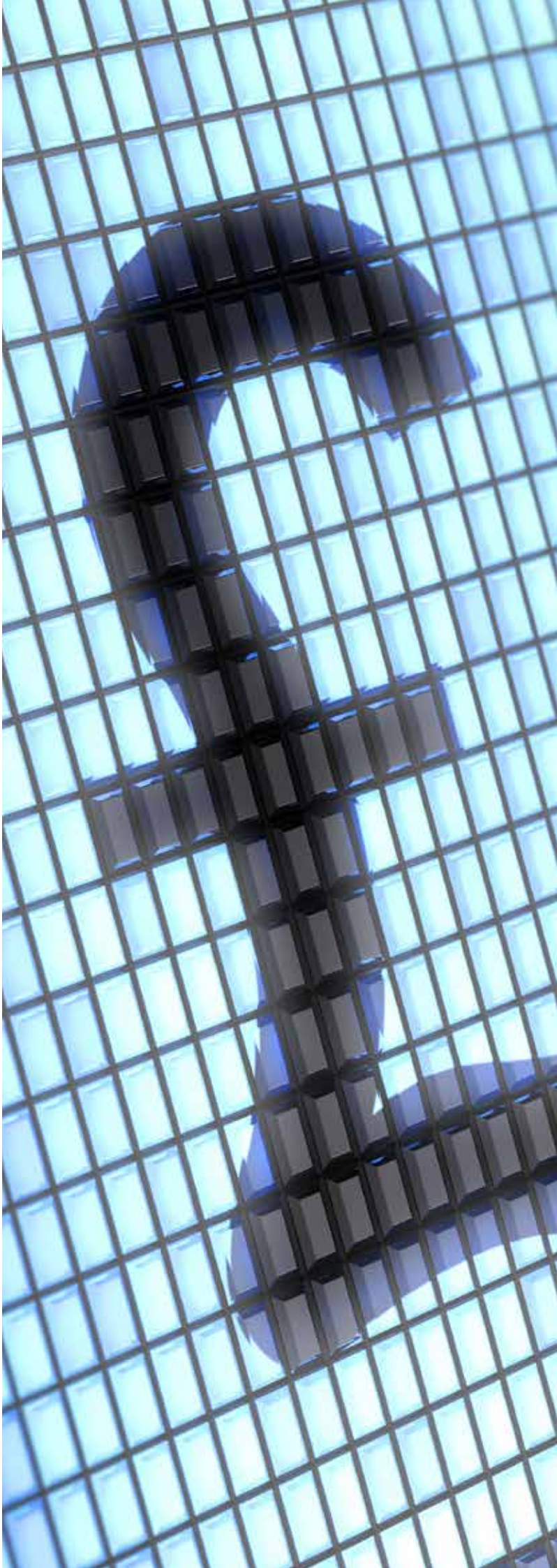
Nevertheless, public sector research investment is consistently assessed as strongly positive, with estimated rates of return ranging between 10% and 25% over a long time period. But the impact of public sector research investment depends critically on the private sector and charitable organisations investing alongside. And as with all innovation-related investment, a small number of successes account for the bulk of the return.

The Task Force calls for more sophisticated methods of impact measurement than rates of return calculations to be adopted across the research collaboration and innovation landscape as a guide to guide policy development. But its overall assessment and the very first of its four key policy recommendations is to maintain the excellence of the UK research base through long-term strategic commitments from government.

THE UK'S INNOVATION SYSTEM

Enhancing the impact of the UK's higher education and research base requires a joined-up or systems-based approach, which recognises the linkages from research through to deployment, and from start-up companies through to major multinationals, as well as the importance of infrastructure and finance in achieving growth.

There is a global trend towards greater openness in research and collaboration between companies and research institutions. These dynamics are particularly notable in the UK, with some institutions being leading practitioners. Indeed, the openness and excellence of the UK research base is reflected in its attractiveness to overseas firms: the UK has the world's highest percentage of R&D coming from foreign subsidiaries.



But this extreme openness carries risks, making the country potentially vulnerable to strategic investment decisions made outside the UK. This investment could go elsewhere as developing countries provide incentives for inward investment. Alternatively, the UK could increasingly be viewed as providing a higher education and research service 'at cost' to the world. This would profit other countries' innovation systems with little or no follow-on benefit to the UK.

Large international companies account for the majority of the UK's business research and have the capacity to interact effectively with UK universities and funding organisations. These same companies choose to invest where they can find the best people, leveraging national research expenditures and infrastructure. Smaller companies account for a small fraction of R&D, and those seeking to innovate often struggle to leverage the university and funding systems, due to a lack of resources and relevant 'bridging' skills, both in the companies and in universities.

The commercialisation of research is one of many ways in which value is created and it is inherently risky. Large companies are practised at this and have the ability to manage the whole innovation pipeline and portfolio. Failures occur regularly and are to be expected. Smaller companies have fewer resources and a narrower portfolio, making failure terminal, but success also more dramatic.

The Task Force's second and third key policy recommendations are: to prioritise and finance collaboration, and the sharing of best practice in innovation, between UK universities and businesses, local and global; and to promote entrepreneurship and entrepreneurial corporate management in universities to enhance risk-taking and innovation in business.

The absence of an industrial strategy has arguably resulted in offshoring of manufacturing, fewer opportunities for local leverage of the research base and a lack of strategic prioritisation of public research funding. And, because of the less than patient approach of UK capital to long-term investment UK inventions often end up being funded by overseas businesses, and their value is not captured in the UK.

SECTOR STRATEGIES FOR INNOVATION

The fourth and final policy recommendation of the Task Force is to develop consistent differentiated sector strategies to provide incentives for university-business interactions designed to match specific sectoral systems of innovation. The recognition that innovation pathways vary by sector is crucial to policy discussions. Each sector has a particular set of strategic requirements and particular growth trajectories, and requires specific policy support.

The third and fourth Task Force reports provide a wealth of evidence on the innovation value chains of four sectors of the economy (Mina and Probert, 2012). The pharmaceutical, energy, creative-digital-information technology (CDIT) and construction sectors are characterised by very different patterns of R&D and innovation, depending, for example, on their 'clock-speed', industry structure, maturity and the significance of intellectual property.

It is essential to recognise that there is no single 'silver bullet' solution to enhancing the value and impact of university inventiveness that would work across all sectors. Equally, many technologies have multiple applications across many sectors.

Pharmaceuticals and Biotech

A key issue for pharmaceutical companies is the renewal of the industry's research and business models. The sector is increasingly externalising R&D that was previously done in-house. A higher level of outsourcing and collaboration brings greater opportunities for independent R&D providers, smaller firms and universities. The complementary challenge is to the growth of a dynamic and well-supported biotech community in the UK, with potential for strong contributions from entrepreneurial academic teams.

Much of the government's life science strategy is predicated on the role of small and medium-sized enterprises. As drugs become more specialised, those smaller businesses – even if they are privately funded – are more likely to be inside the supply and value chains of the major pharmaceutical companies. It is crucial to join up this strategy, adding collaboration with the NHS, private healthcare providers and insurance companies.

The metrics of successful university-business collaboration for bio-pharma in an open innovation environment are likely to show increases in joint problem-solving activities, such as informal advice, participation in research consortia, joint papers, prototyping, physical plant co-location and contract research.

Creative, Digital and IT

The CDIT sector is emerging like a thousand archipelagos slowly becoming a continent. Its birth has been so rapid, and its growing pains so racked by booms and busts, that government systems can barely describe it, let alone measure it. The sector comprises tens of thousands of small businesses, hundreds of thousands of freelancers and a smattering of UK-originated platform companies, such as ARM.

The CDIT sector also encompasses the UK branches of global IT and internet companies, such as Google, Oracle, IBM and Cisco, world-leading creative companies, such as the WPP network, and a colossus in the BBC. The platforms built by the major IT and software companies provide the development space for shoals of smaller companies to build value, which in turn push those platforms to the point where they are rebuilt and create yet more value.

In the CDIT sector, there is a growing recognition of the need to engage with universities. Many companies, large and small, now realise that they do not have access to all the science they require if they are to develop an outward-facing approach to the digital economy. The core issue for most of the companies is their lack of intellectual property or other exploitable assets that will enable the businesses to grow from small and medium-sized enterprises into larger businesses.

INNOVATION POLICY AND THE UK ECONOMY

Energy

There are two key challenges for the UK's energy sector. The first is the need to (re)develop the skills base needed to manage the transition to a more sustainable energy system. The second is to invent new energy technologies that can compete with fossil fuels without subsidies and prevent the UK from becoming disadvantaged against other countries. The sums at stake are huge – perhaps 1% of GDP over the period to 2050 – but on the flipside, the UK has an opportunity to leverage any innovations into the global energy system.

There are many energy innovation coordinating bodies at the interface with government – for example, the Committee on Climate Change, the Office for Renewable Energy Development, the Low Carbon Innovation Coordination Group and the Energy Research Partnership. There is also growing capacity for quality analysis, for example, in the UK Energy Technologies Institute (ETI) and the Department of Energy and Climate Change itself.

The government's response to the innovation and R&D needs of UK energy businesses – and of the UK energy system as a whole – has to balance the threats of climate change against the possible offshoring of manufacturing to places where there is no price on carbon. It is crucial that government has access on a systematic basis to senior energy leaders and academics to ensure long-term consistent policy-making.

Knowledge exchange between the energy industry and the public research base is well established, through groupings such as the ETI, where applied research and demonstrations are carried out, as well as through bilateral arrangements between companies and universities. Industry involvement ensures communication to the academic community of the sector's needs, but contact between academia and policy-makers still appears more limited than it might be.

Construction

Innovation within the construction industry is generally not associated with R&D activity. Patenting by construction firms is relatively infrequent. Yet significant innovation by product suppliers and manufacturers leads to substitute products that offer benefits, such as lower cost, greater durability or lower carbon emissions. Mass production techniques, such as modularisation and pre-fabrication, are being adopted slowly.

There are significant barriers to collaboration with universities in both the clients of the construction industry and the constructors themselves. These include management, leadership and culture. But these attitudes are changing under the combined impact of climate change and financial pressures.

The increasing desire and need for the construction industry to increase its engagement with universities should lead to increases in the whole range of problem-solving trajectory measures, such as informal advice, research contracts, external secondments, consultancy services and shared physical space. The measures would include rises in pre-competitive collaboration between companies and universities, secure research environments to enable cooperation on clusters of problems, and 'sandpits' and advice to open up the innovation challenges. Vitally, R&D collaborations must be part of the procurement process for major government infrastructure projects.

EUROPEAN INDICATORS OF INNOVATION

How does the UK's innovation system perform compared with other European Union (EU) countries? A new indicator, to whose development UK~IRC Research Director Ammon Salter contributed, was launched by the European Commission in the autumn of 2013 (see Figure 2). The novelty of the indicator is that it focuses on innovation output.

The indicator is based on four components chosen for their policy relevance: technological innovation as measured by patents; employment in knowledge-intensive activities as a percentage of total employment; competitiveness of knowledge-intensive goods and services (which is based on both the contribution of the trade balance of high-tech and medium-tech products to the total trade balance, and knowledge-intensive services as a share of the total services exports); and employment in fast-growing firms of innovative sectors.

The top performers in the EU owe their ranking to doing well on several or all of the following factors: an economy with a high share of knowledge-intensive sectors, fast-growing innovative firms, high levels of patenting and competitive exports. A comparison with some non-EU countries shows that the EU as a whole does well: Switzerland and Japan have a clear performance lead, but the EU is more or less even with the United States on innovation output.

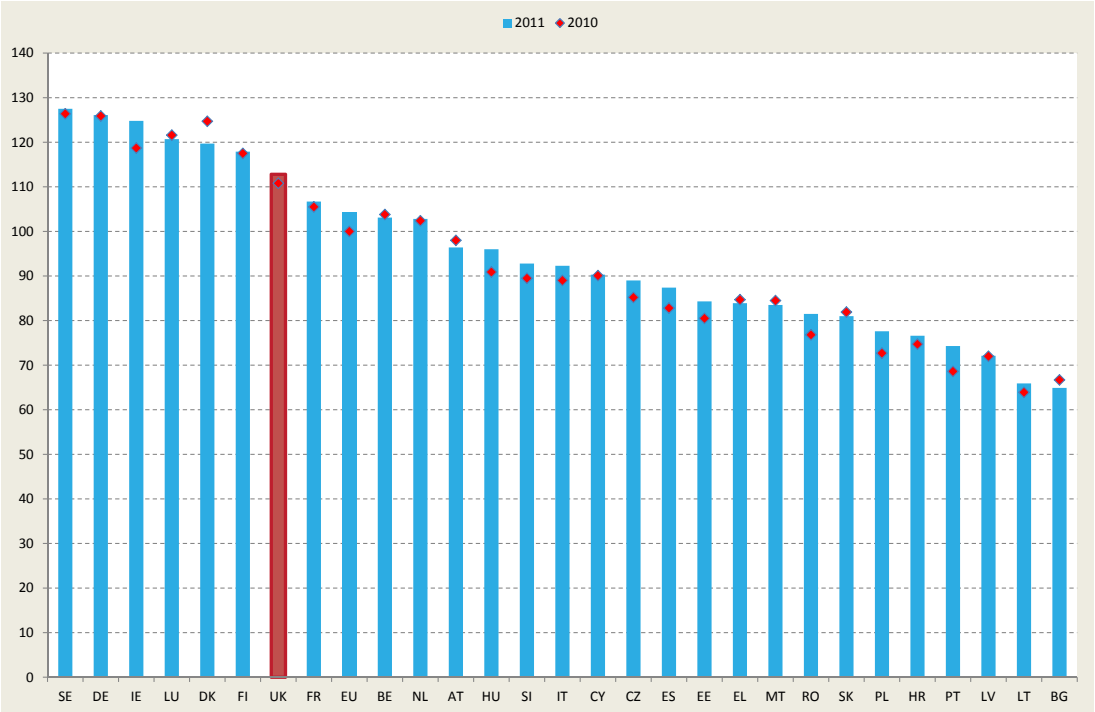


Figure 2: Innovation System Performance in 2010 and 2011
Source: European Commission, 2013

FURTHER READING

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