

Is the UK's science base performing?



Written by:

Pablo D'Este Cukierman, AIM Innovation and Productivity Grand Challenge Fellow, University of Sussex

Rachel Griffith, AIM Senior Fellow, Institute for Fiscal Studies and University College London

Julian Birkinshaw, AIM Senior Fellow, London Business School

Andy Neely, AIM Deputy Director, Cranfield School of Management

Tina C Ambos, AIM Research Fellow, University of Edinburgh and WU Wien

Kristiina Mäkelä, Hanken Swedish School of Economics

Laura Abramovsky, AIM Research Fellow, Institute for Fiscal Studies

Rupert Harrison, AIM Research Fellow, Institute for Fiscal Studies

Helen Simpson, Programme Director, Institute for Fiscal Studies

EPSRC

Engineering and Physical Sciences
Research Council

E · S · R · C
ECONOMIC
& SOCIAL
RESEARCH
COUNCIL

The Advanced Institute of Management Research (AIM) develops UK-based world-class management research. AIM seeks to identify ways to enhance the competitiveness of the UK economy and its infrastructure through research into management and organisational performance in both the private and public sectors.

Written by:

Pablo D’Este Cukierman, AIM Innovation and Productivity Grand Challenge Fellow, University of Sussex

Rachel Griffith, AIM Senior Fellow, Institute for Fiscal Studies and University College London

Julian Birkinshaw, AIM Senior Fellow, London Business School

Andy Neely, AIM Deputy Director, Cranfield School of Management

Tina C Ambos, AIM Research Fellow, University of Edinburgh and WU Wien

Kristiina Mäkelä, Hanken Swedish School of Economics

Laura Abramovsky, AIM Research Fellow, Institute for Fiscal Studies

Rupert Harrison, AIM Research Fellow, Institute for Fiscal Studies

Helen Simpson, Programme Director, Institute for Fiscal Studies

AIM consists of:

- Over 200 AIM Fellows and Scholars – all leading academics in their fields...
- Working in cooperation with leading international academics and specialists as well as UK policymakers and business leaders...
- Undertaking a wide range of collaborative research projects on management...
- Disseminating ideas and shared learning through publications, reports, workshops and events...
- Fostering new ways of working more effectively with managers and policymakers...
- To enhance UK competitiveness and productivity.

AIM's Objectives

Our mission is to significantly increase the contribution of and future capacity for world class UK management research.

Our more specific objectives are to:

- Conduct research that will identify actions to enhance the UK's international competitiveness
- Raise the quality and international standing of UK research on management
- Expand the size and capacity of the active UK research base on management
- Engage with practitioners and other users of research within and beyond the UK as co-producers of knowledge about management

contents	AIM – the UK's research initiative on management	2
	About AIM	3
	AIM research themes	4
	Executive review	5
	Introduction: the importance of the UK's science base	7
	Performance of the UK science base: science and technology indicators	8
	Internationalisation of R&D	14
	University research and the location of business R&D	17
	Commercialisation of EPSRC research	19
	Conclusions	21

Current AIM research projects focus on:

UK productivity and performance for the 21st century.

How can UK policymakers evaluate and address concerns surrounding the UK's performance in relation to other countries?

National productivity has been the concern of economists, government policymakers, and corporate decision-makers for some time. Further research by scholars from a range of disciplines is bringing new voices to the debates about how the productivity gap can be measured, and what the UK can do to improve the effectiveness of UK industry and its supporting public services.

Sustaining innovation to achieve competitive advantage and high quality public services.

How can UK managers capture the benefits of innovation while meeting other demands of a competitive and social environment?

Innovation is a key source of competitive advantage and public value through new strategies, products, services and organisational processes. The UK has outstanding exemplars of innovative private and public sector organisations and is investing significantly in its science and skills base to underpin future innovative capacity.

Adapting promising practices to enhance performance across varied organisational contexts.

How can UK managers disseminate their experience whilst learning from others?

Improved management practices are identified as important for enhancing productivity and performance. The main focus is on how evidence behind good or promising practices can be systematically assessed, creatively adapted, successfully implemented and knowledge diffused to other organisations that will benefit.

The ability to create a competitive and thriving economy is partly dependent on knowledge production and innovation. So how well is the UK performing in these important areas? To assess the UK's comparative performance, and gauge how it might perform in the future, it is a useful exercise to benchmark the performance of the UK in knowledge production and innovation, against its competitors.

The Advanced Institute of Management Research (AIM) is engaged in a variety of research which looks at the health of the UK's science base, an important element of knowledge production and innovation in the UK.

In particular, AIM research relating to the performance of the science base reveals a number of important findings in the areas of: science and technology indicators of performance; internationalisation of research and development (R&D); the commercialisation of research; and the relationship between the location of business R&D activity and university research. These findings reflect on the state of the UK's science base and thus on its knowledge production and capacity to innovate.

The ability to create a competitive and thriving economy is partly dependent on knowledge production and innovation.

1 Science and technology indicators

Certain indicators and measures can be used to assess performance of the science base. AIM research in this area reveals:

- The UK has to improve considerably if it wants to compete on a level playing ground with its competitors; both major western economies, smaller hi-tech countries in Scandinavia and the emerging economies.
- The UK invests comparatively less in public and private R&D than many other nations, and its investment has been on a downward trend since the early 1980s. A trend also reflected in the area of scientific productivity.
- In terms of research impact, the UK is losing ground in Chemistry, Physics and Engineering. The UK is falling behind Japan, Germany, the Nordic hi-tech countries like Sweden and Finland, and other nations in terms of both patents per capita and per unit of investment.

2 R&D location

Another feature of the UK's science base is revealed by trends in the location of R&D. AIM research reveals that:

- R&D conducted in the UK is increasingly funded by foreign multinationals. This has implications for the UK as R&D can be moved out of the UK should conditions in the UK or elsewhere favour such a move.
- The trend for UK funded R&D is to conduct it offshore.
- Further research is required to look at the extent to which firms in different countries locate their innovative activities offshore, where firms are moving these activities, what the determinants of firms' location decisions are, and whether innovative activities carried out in different geographical locations have a differential impact on productivity and performance of firms.

3 Location of UK based business R&D

When business R&D is located in the UK, is it located close to leading academic research centres? This important question is an indicator of the importance and relevance of academic, science based R&D in the UK, from a business perspective.

AIM research reveals that:

- Findings relating to R&D in the pharmaceutical sector appear to confirm the importance of world-class centres of research in attracting increasingly footloose R&D investment, although the picture is not entirely clear.
- The research also finds some instances of co-location with lower-rated research departments which raises the possibility that firms may benefit both from proximity to frontier basic university research as well as to more applied public sector research activity.

4 The commercialisation of research

Conducting research is one thing. But how much of this research has an impact on economic activity? AIM research in this area reveals that it is possible to identify factors that increase the prospects of research having a commercial impact.

Findings relating to R&D in the pharmaceutical sector appear to confirm the importance of world-class centres of research...



- The UK Research Assessment Exercise (RAE) ranking did not come out as a significant indicator of commercial output, suggesting that there are likely to be additional factors (such as individual level characteristics or motivations) driving commercial output.
- Younger researchers are more commercially oriented than more established researchers. Furthermore, individual motivation and perceived compatibility between academic and commercial activities are also significant drivers of commercialisation endeavours.
- Institutional level factors that have a positive impact include the scientific excellence of the department where the research is conducted and the existence of a technology transfer office.

introduction: the importance of the UK's science base

It is generally accepted that the key to creating a competitive and thriving economy, certainly in mature economies such as the UK, is knowledge production and innovation.

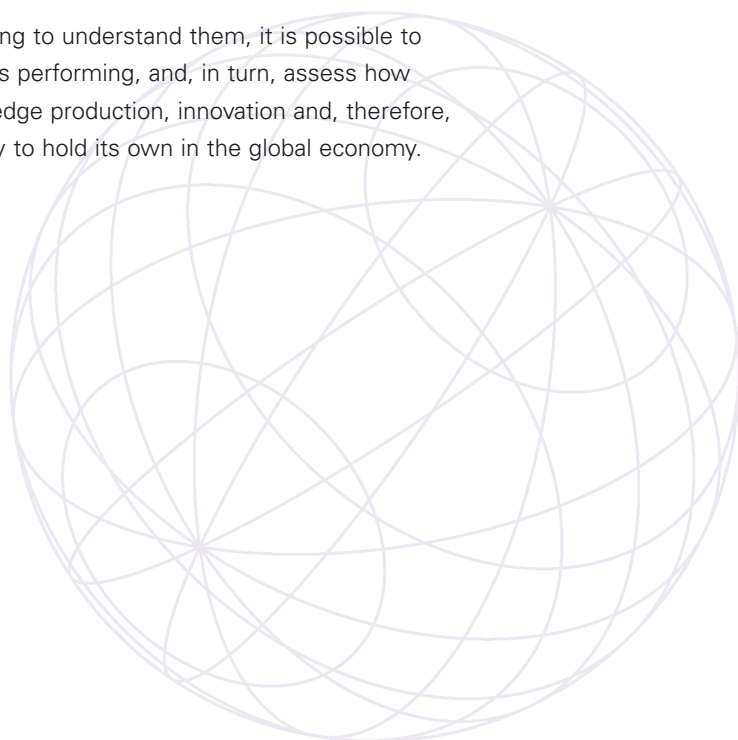
The UK is no longer the manufacturing engine of the world, as the Economic and Social Research Council (ESRC) notes in its manufacturing fact sheet: 'Britain's position as the 'workshop of the world' in the middle of the 19th century is long gone.' The UK's story is one of a steady decline in the numbers of companies and people engaged in manufacturing in the UK.

In a global economy, with the supply chain dispersed around the world, economic value is bound up with knowledge production and innovation. To assess the UK's comparative performance in this area, plus how well it is likely to fare in the future, it is necessary to benchmark knowledge production and innovation against a range of the UK's competitors.

Innovation and knowledge production are not easy things to measure. There is no universally accepted, easy to read innovation index, for example; although there are several attempts at such a measure. There are, however, a range of different measures and indicators, used by organisations such as the National Science Foundation in the US, the OECD, and the European Commission, which touch on this issue.

This briefing looks at a range of indicators and measures that reflect on the health or otherwise of the UK's science base; and thus on knowledge production and innovation. These indicators include: benchmarking UK research and development (R&D) performance against international competitors such as the US, France, Germany, the Nordic hi-tech countries and a number of emerging economies; the locations in which UK firms choose to conduct their R&D activities; the relationship between university research and business R&D; and the extent to which UK science research is commercialised.

By looking at these factors and attempting to understand them, it is possible to gauge how well the UK's science base is performing, and, in turn, assess how the UK is performing in terms of knowledge production, innovation and, therefore, its economic competitiveness and ability to hold its own in the global economy.



One way of assessing the performance of the UK's science base is to look at the inputs and outputs of R&D, and then benchmark those against the performance of other countries. While R&D and innovation can be difficult to measure, there are several useful indicators that attempt to capture R&D input and output. These include, for example, expenditure on R&D as a percentage of a country's Gross Domestic Product; the number of scientific publications published; and the number of patents filed.

Using these indicators it is possible to benchmark the UK's performance against various countries over a period of many years. In this case the benchmark countries are divided into three groups.

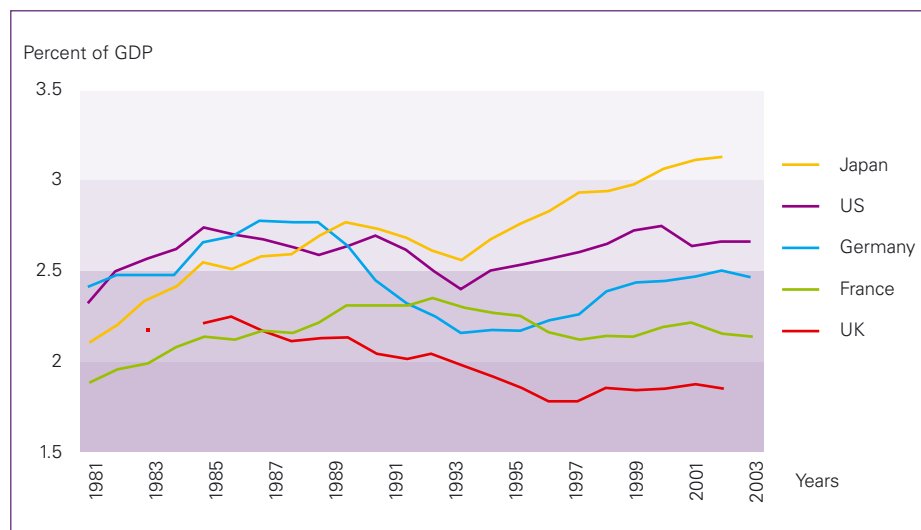
In group one are emerging economies, including some of the next economic superpowers, such as Brazil, China, India, Taiwan, Singapore and South Korea. Group two includes the Nordic high-tech countries of Denmark, Finland, and Sweden, and also Switzerland. Finally, group three comprises of mature Western economies that are, at present, the UK's major competitors: the US, Japan, Germany and France.

1 Gross Expenditures on R&D (GERD)

The measures used to compare R&D inputs on a national basis are Gross Domestic Expenditure on R&D expressed as a percentage of GDP, and also expressed on a per capita basis.

Figure 1 reinforces the popular perception that, when it comes to R&D investment, the UK lags behind its main competitors. Worryingly, since 1995 the gap between the UK and all its main rivals, has grown wider, dramatically so in the case of Japan.

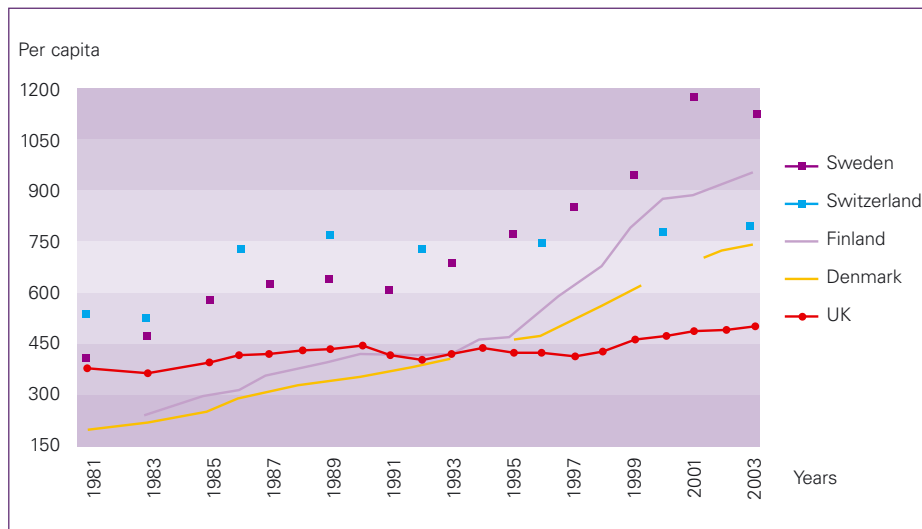
Figure 1: Government expenditures on R&D as percentage of GDP



The figures reflect long-term under-investment for the UK in R&D, with the long-term trend one of an ever smaller percentage of GDP being committed to R&D, and no signs of convergence with any of the major competitors.

Dismal picture that this is, it grows worse when other economies are taken into account. The UK's expenditure on R&D per capita is now falling further behind the levels of the small, high-tech countries – Sweden, Switzerland, Finland and Denmark (see Figure 2).

Figure 2: Government expenditures on R&D as percentage of GDP



Sweden, for example invested over \$1000 per person (US\$2000, PPP adjusted) in 2003, Finland over \$900 and Switzerland over \$750, compared to the UK's investment of a little under \$450 per capita. How long before the UK falls behind the R&D investment of the emerging economies?

The numbers are no more encouraging if you separate out business and Government expenditure on R&D. Figure 3 shows the Government expenditures Gross Domestic Expenditures on R&D per capita. Once again, in stark contrast to the majority of the UK's major competitors, since 1995 the trend is a downward one. A trend only mirrored, (out of Japan, the US, Germany and France) by France, and France started from a much higher position than the UK and, despite its downward trend, has widened the gap with the UK. It is a similar picture with business investments in R&D.

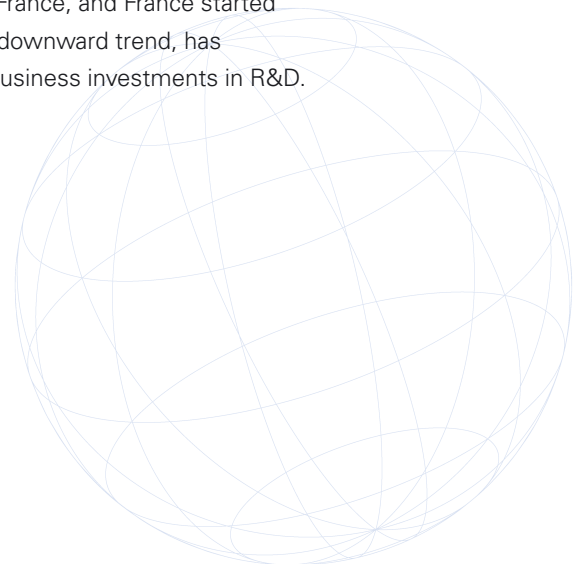
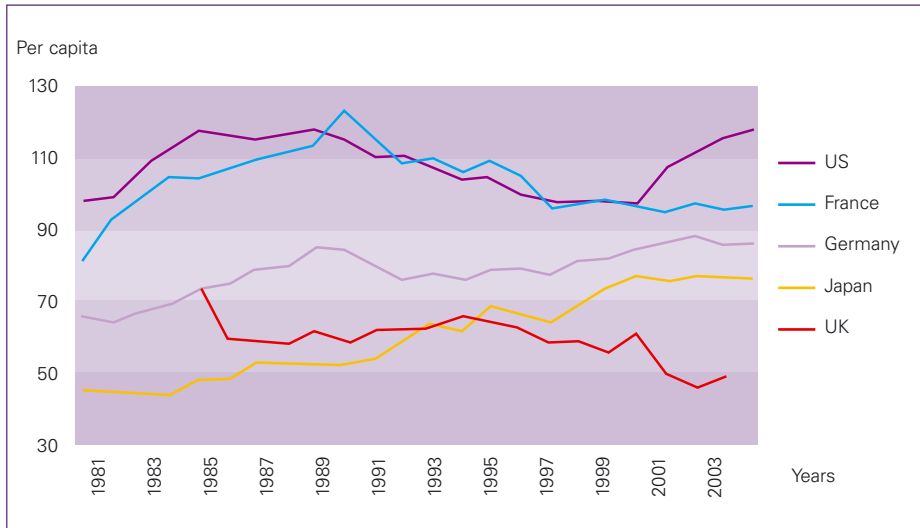


Figure 3: Government expenditures on R&D per capita



2 Published papers

Another measure of R&D is scientific publications. The trend across all countries is an increase in the number of publications; however, growth is not even. The emerging economies are publishing papers at a much faster rate than the developed economies, and this may reflect the emergence of new powers of scientific production. However, the publication of papers alone is not an effective R&D indicator. It is far better to consider these figures together with data for the scientific impact of the papers published, as determined by the number of citations per capita.

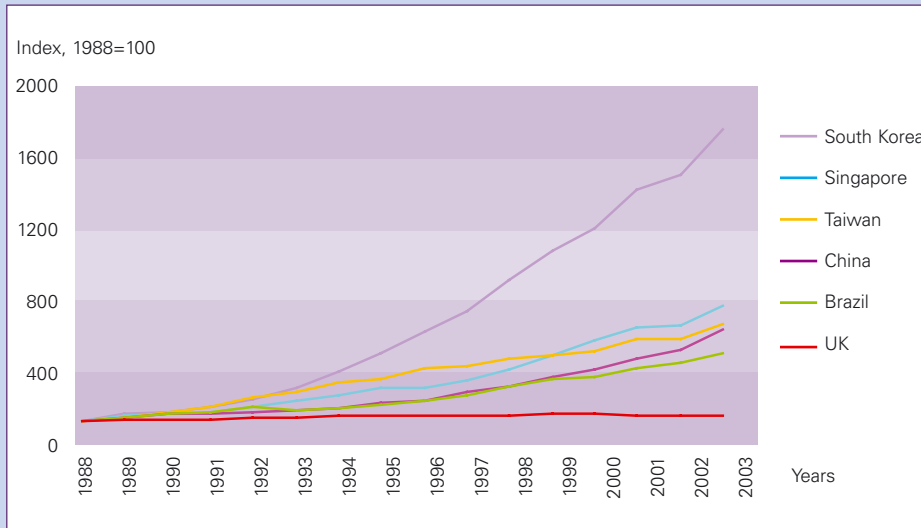
The trend across all countries is an increase in the number of publications; however, growth is not even.

On a subject by subject basis, in terms of publications per capita the UK is ahead of its competitors in fields such as biology, chemistry and the social sciences. In Engineering, the UK leads its major competitors, but competitors in the small, high-tech countries have moved ahead of the UK, while South Korea and Singapore have caught up to the UK.

In terms of scientific impact, the picture is not as encouraging. In terms of citations per thousand capita, the UK slipped from sixth to eighth position behind the hi-tech group of countries and also the US. In subjects like engineering and physics, the UK lags behind a host of economic competitors in groups two and three in terms of scientific impact. The one area where it has a significant advantage is in biology.

Another good indicator of what is likely to happen in terms of R&D strength is the trend in terms of international collaborations as measured by numbers of papers co-authored with researchers from other countries. In terms of collaboration with China, for example, the percentage of collaborations in 2003 was, surprisingly, down from the 1988 figure. Over that period the UK was still behind the US and Japan, and was overtaken by Germany and an East Asia group comprised of South Korea, Taiwan and Singapore.

Figure 4: Publications trends – UK versus emerging economies



In terms of publications per Higher Education expenditures on R&D (HERD), while the UK has a higher ratio of publications per HERD, the ratio has been decreasing over time. In terms of publications per expenditures on R&D, the UK has a higher ratio of publications per publicly performed R&D than its major competitors.

3 Patents

The number of patents granted is a measure of technology output. On this measure the UK is failing to keep pace with either its major competitors or the small, high-tech countries. Also, some newcomer countries are catching up with the UK in terms of patents per capita.

In terms of patents granted by the US Patent & Trademark Office, there is a similar pattern, with the UK among the lowest recipients of new patents per capita, when compared to major competitors and newcomer countries.

Figure 5: Number of triadic patents

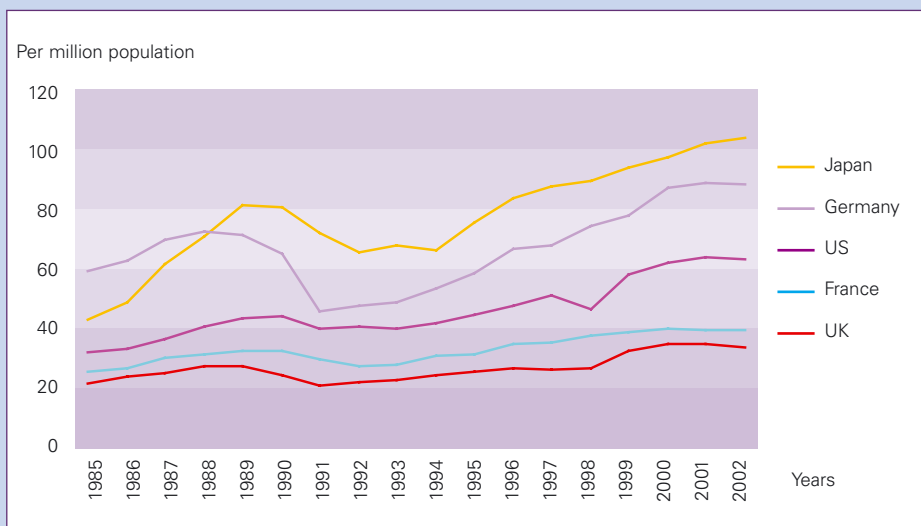
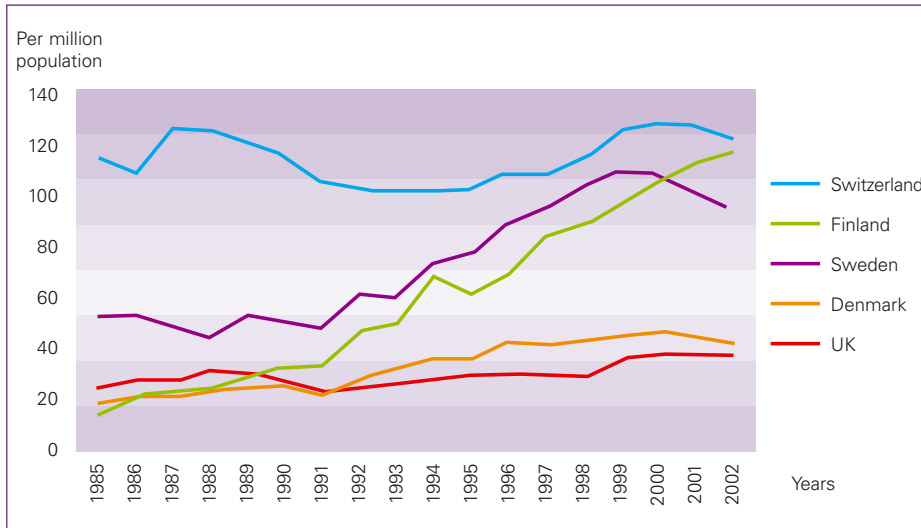


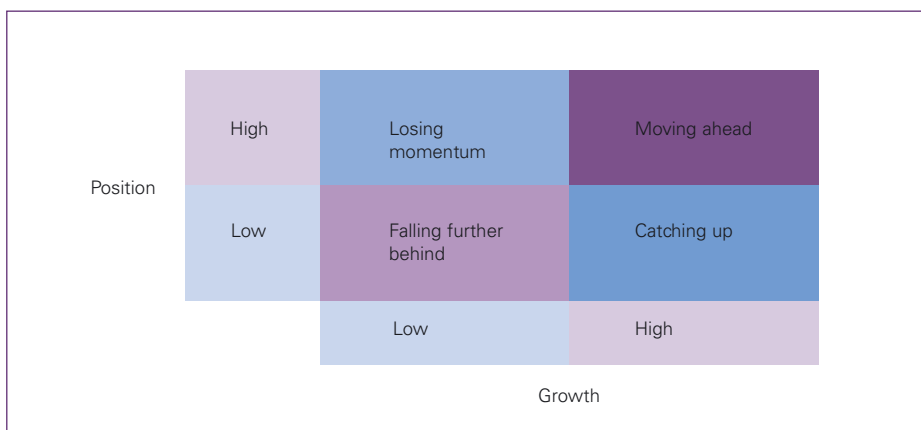
Figure 6: Number of triadic patents



Furthermore, when looking at where the UK patents originate from, more than a third of the patents relate to R&D conducted by their multinational affiliates abroad. In terms of triadic patents per business expenditures on R&D, Germany, Japan, Finland and Switzerland are performing better than the UK both per capita and per unit of investment.

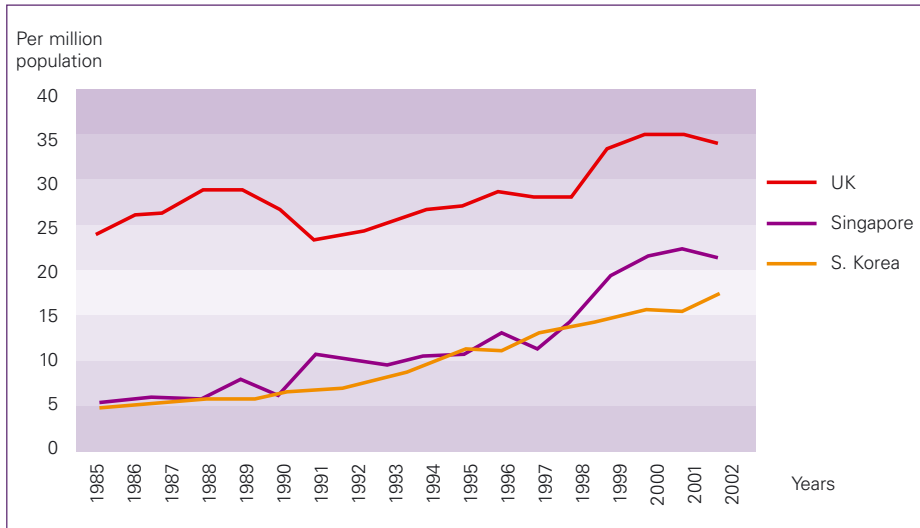
It is clear from the comparison charts below that, across a broad range of indicators, the UK is failing to match either its existing economic competitors, or many emerging economies.

Figure 7: Summary Tables



Notes
 High: above average (which includes UK and comparators)
 Low: below average (which includes UK and comparators)

Figure 8: Number of triadic patents



Source: OECD

Figure 9: Summary Table II – UK versus small high-tech

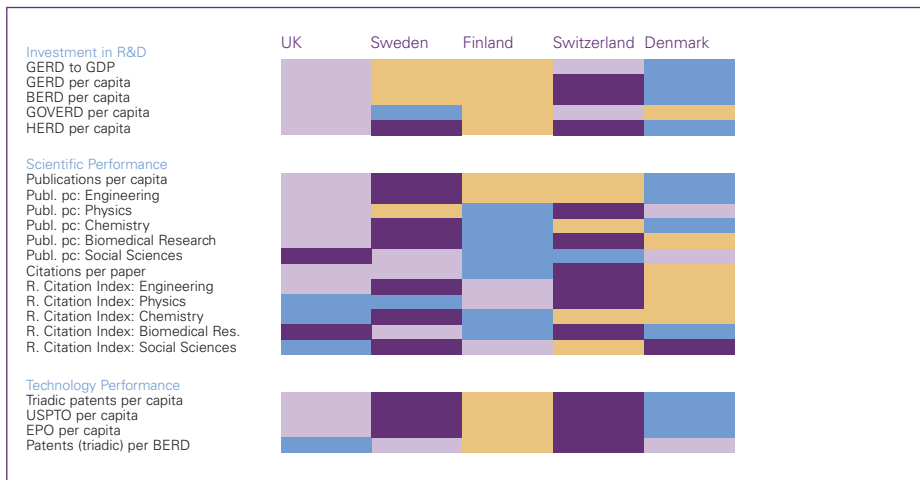
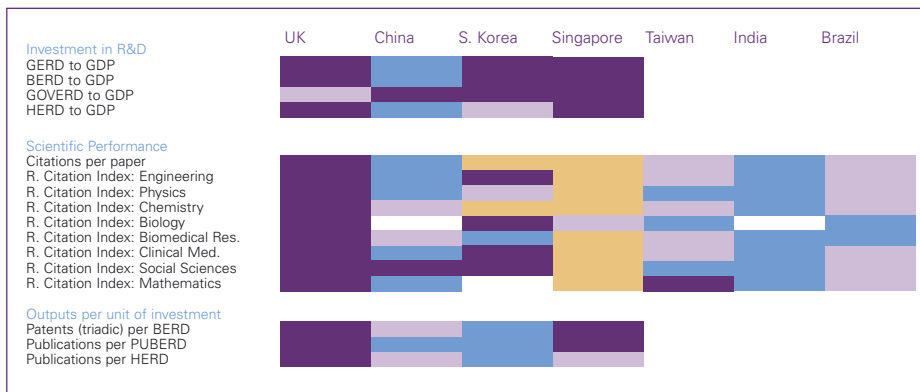


Figure 10: Summary Table III – UK versus newcomers



internationalisation of R&D

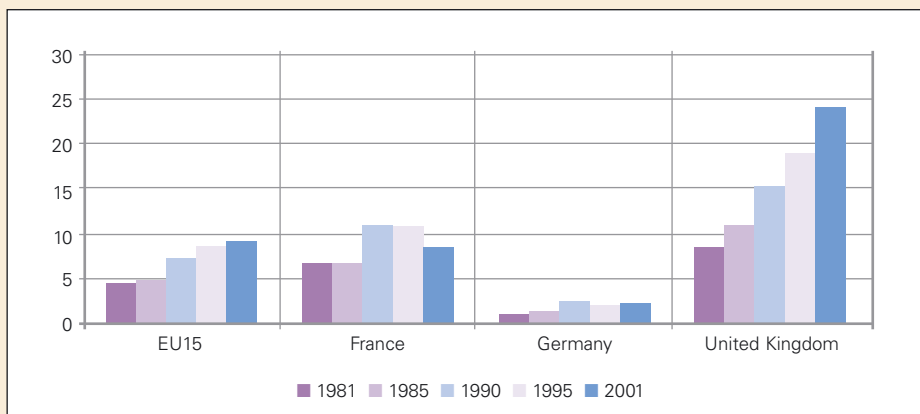
The figures for R&D investment show that the UK lags behind its major competitors, and is even being caught by emerging economies. But why has the UK's performance in R&D been so poor over the last decade?

1 R&D financed from abroad

One important factor is the increasing internationalisation of R&D activity. Multinational firms (both UK and foreign owned) account for 75 percent of all business R&D carried out in the UK. Over the past 20 years the share of business enterprise R&D undertaken in UK, but financed from abroad, has increased from 8 percent to 24 percent, shown in Figure 5, as have exports of R&D conducted in the UK.

This could have important policy implications. For example, should the conditions in which R&D is conducted in the UK become unfavourable, then R&D can easily be moved overseas. Equally, if conditions are more attractive elsewhere the same applies. Globalisation has seen widespread offshoring of various organisational activities and R&D, in theory, is no different.

Figure 11: Share of Business Enterprise R&D financed from abroad



Source: OECD Main Science and Technology Indicators, 2004

2 R&D moved abroad

At the same time as the percentage of R&D conducted in the UK but financed from abroad is increasing, so too is the amount of R&D that UK firms carry out abroad.

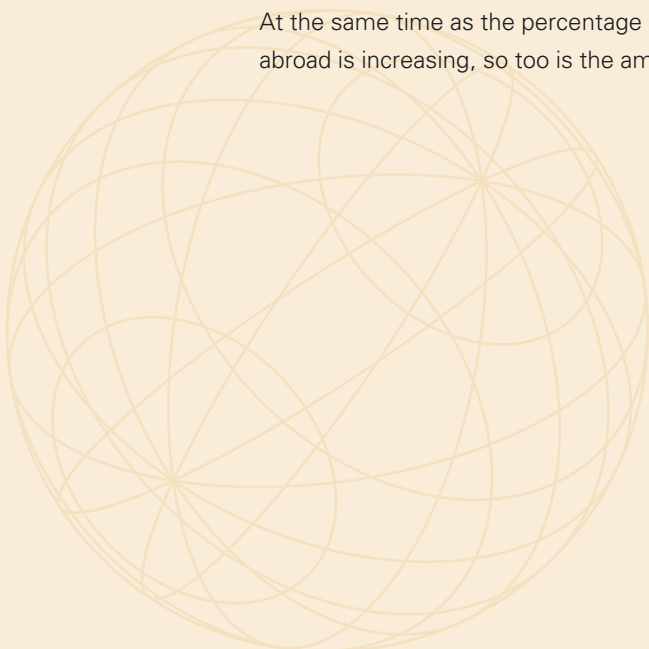
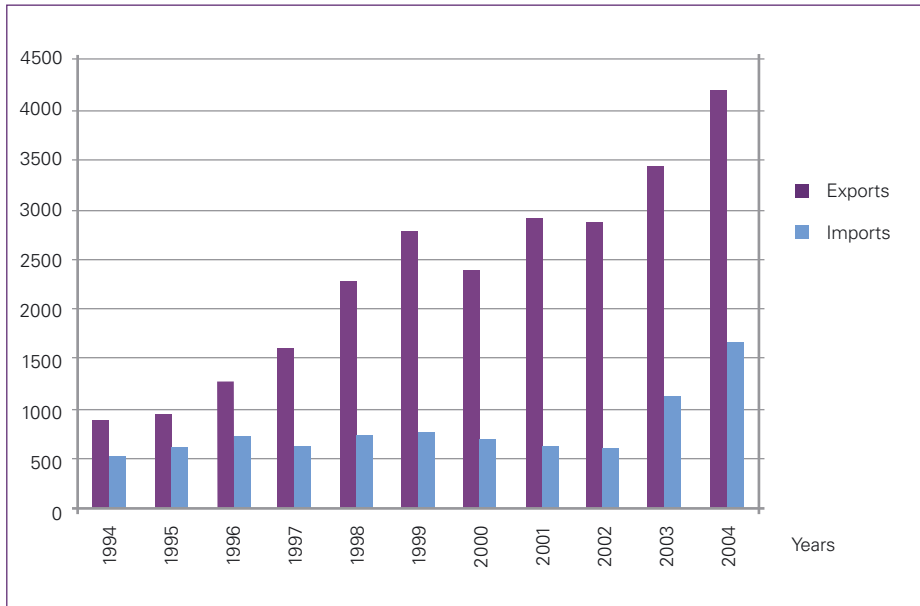
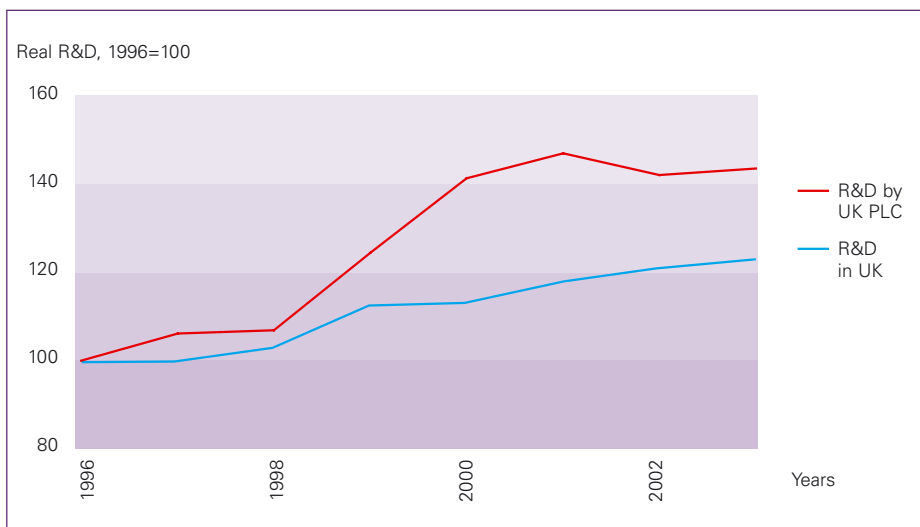


Figure 12: Trade in R&D – exports of R&D from the UK have risen rapidly



The main beneficiary is the US. There are several possible reasons for this trend. One reason for the increase in UK firms locating R&D in the US might be that R&D is more productive when it is located close to where the cutting-edge technology is already in place. So, for an ICT company, for example, it might make sense to move R&D to the technology cluster in Silicon Valley, where the tech base is firmly established and universities like Stanford are combining with businesses to keep the region at the leading edge of technology advances in ICT. If this is the case then it has policy implications for the subsidies the government currently provides for R&D in the UK.

Figure 13: Shows that the total amount of R&D carried out by UK firms has grown faster than the total amount of R&D carried out in the UK



3 Knowledge spillovers

Matters are further complicated by the issue of knowledge spillover. This is where organisations acquire knowledge via a mechanism whereby knowledge spills over from other firms in their networks. The effects of such knowledge spillovers on R&D productivity will, inevitably, impact on decisions about where R&D is best located.

AIM research suggests that UK firms benefit more from spillover from R&D in the US if they have inventors located there. And, as common sense might suggest, the benefits of 'technology sourcing' are also larger where the investing firm has 'more to learn': in other words, in those UK industries that have a larger productivity gap with the US. There appears to be less benefit for US firms conducting R&D in the UK, even though they also have inventors located in the UK.

Evidence suggests that multinational firms operating in the UK facilitate the transfer of new technologies and best practices into the UK, as do UK multinational firms operating elsewhere in the world. For policymakers there is always the risk that mechanisms designed to boost levels of R&D activity in the UK by UK firms, through tax credits for example, may as a consequence reduce international R&D activity, and this may come at a cost in terms of knowledge transfer.



Evidence suggests that multinational firms operating in the UK facilitate the transfer of new technologies and best practices into the UK...

Further assessment of the extent and quality of the science base in the UK is possible by looking at the extent to which business-sector R&D activity is located in the vicinity of university research departments. This is done by examining data on the location of R&D establishments in different industries, together with novel measures of the presence and quality of university research in relevant subject areas.

The research^{1,2} relates the location pattern of private sector R&D establishments and its relationship to the presence of relevant university research departments. Data from the UK Research Assessment Exercise (RAE) is used to separate departments into those rated 5 or 5*, which are deemed to perform world-class cutting-edge research, and those rated 4 or below.

Figures 14 and 15 illustrate the data underlying the research. Figure 14 shows the geographic distribution of R&D establishments for six industrial sectors in 2003, while Figure 15 shows the distribution of a group of related 5 and 5* university departments from the 2001 RAE. Areas with higher numbers of R&D establishments or 5 and 5* departments are represented by darker shading. Comparison of the figures shows a clear positive correlation between the locations of R&D establishments and high-rated university research departments.

1 Evidence of co-location

After controlling for other characteristics that may affect the location of R&D establishments – such as industrial structure, local labour force skills and the presence of science parks – there is evidence of co-location with university research departments in some sectors.

The most consistent evidence is for pharmaceuticals. Pharmaceuticals R&D labs locate near to both lower and high-rated chemistry departments. The relationship is strongest with respect to 5 and 5* rated chemistry departments, and is even stronger when looking only at the location of labs owned by foreign multinationals. This group of laboratories is likely to be highly geographically mobile, and hence the evidence could be interpreted as consistent with international technology sourcing.

In some industries, such as machinery and communications equipment, the research finds evidence of co-location near to relevant departments rated 4 or below.

The importance of proximity to university research may be driven by a number of underlying economic mechanisms, ranging from knowledge flows via informal networks or face-to-face interactions, to formal collaboration agreements, consultancy or university spin-outs.

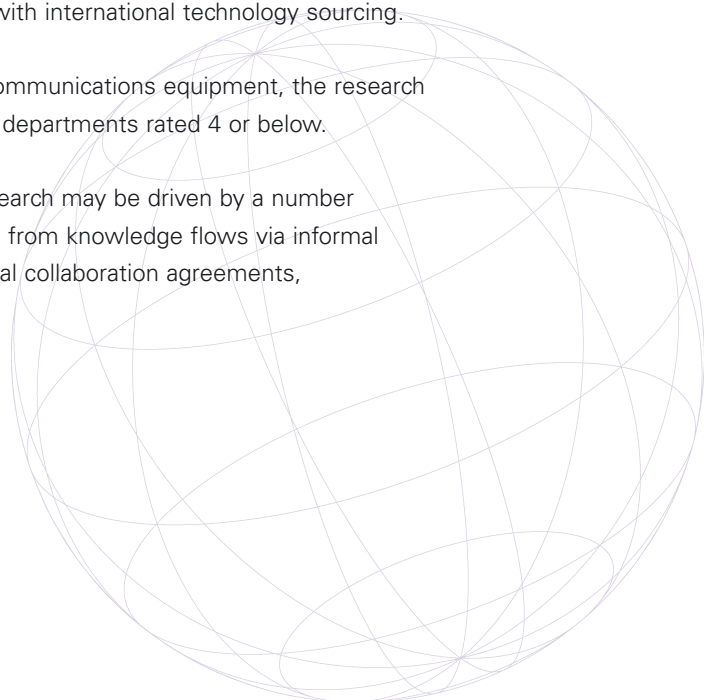
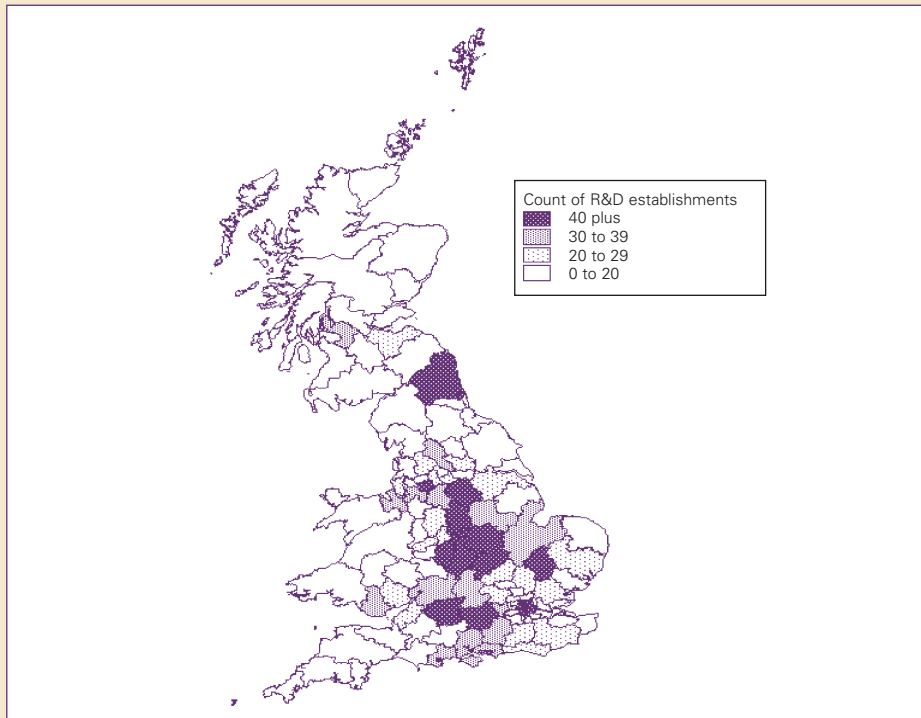


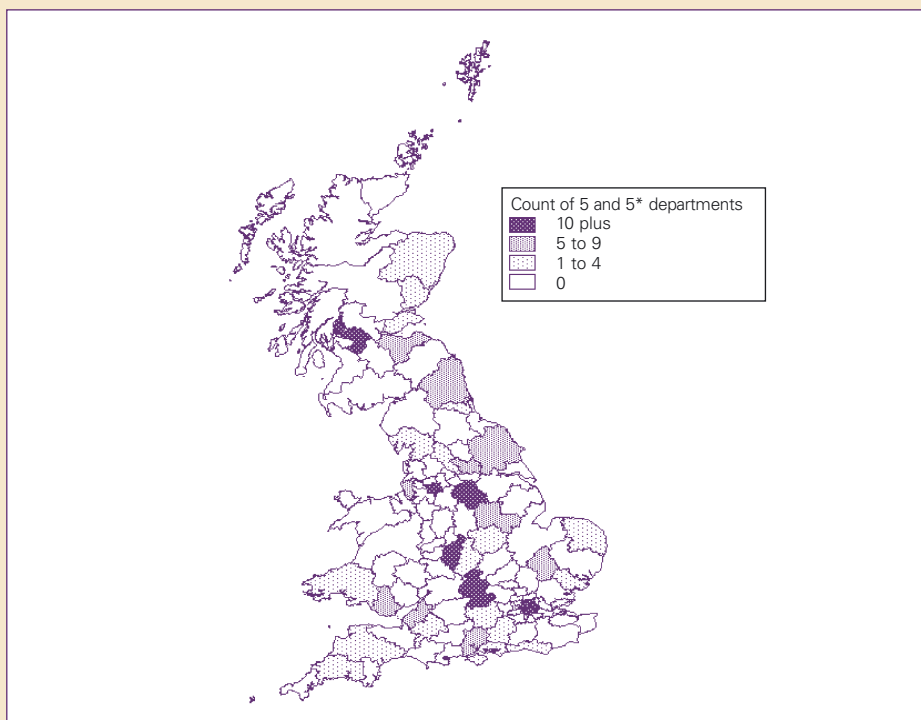
Figure 14: Distribution of R&D establishments across postcode areas, 2003



Source: Author's calculations using BERD (Source: ONS), Abramovsky et al. (2006).

Note: Product groups are pharmaceuticals, chemicals, machinery, electrical machinery, TV and radio equipment and motor vehicles.

Figure 15: Distribution of 5 and 5* relevant departments across postcode areas



Source: RAE 2001, authors' calculations, Abramovsky et al. (2006).

Note: Research departments are biology, chemistry, medical, materials science, mechanical engineering, electrical engineering and computer science.

Another facet of the science base is how useful the research is to business. This is important as it influences how research funding is, and should be, apportioned so as to maximise the funding of commercially useful projects.

One AIM study takes a focused look at the commercialisation of research by studying the outputs from research funded by the Engineering and Physical Sciences Research Council (EPSRC) between 2003 and 2005 using a combination of survey and archival data. Figure 16 below provides a simple descriptive analysis of the data – it shows the percentage of EPSRC funded projects that generated patents, licencing arrangements and spin-offs during this period of time. Figure 17 shows the extent to which the same group of projects involved collaboration – with international academics, domestic academics, industry and other institutions. In both charts, the overall impression is that most EPSRC projects do not involve large amounts of collaboration, nor are they likely to yield commercial outcomes. It is worth noting, however, that the data is collected from the ‘principal investigator’ in the project right at the end of the period of funding, so some potential commercial outputs may not yet have transpired when this data was collected.

Another facet of the science base is how useful the research is to business.

Figure 16: Commercial output from research funded by the EPSRC between 2003-2005

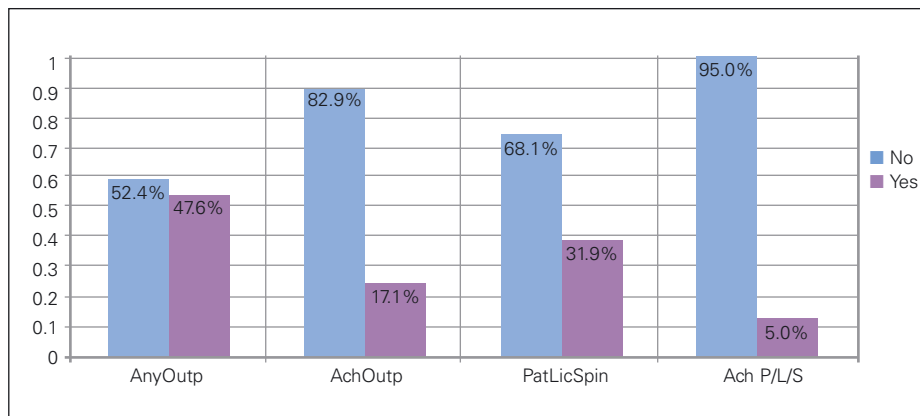
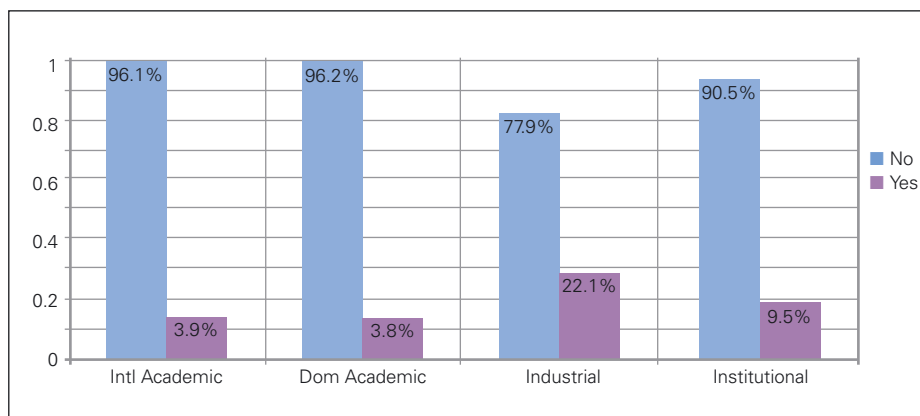


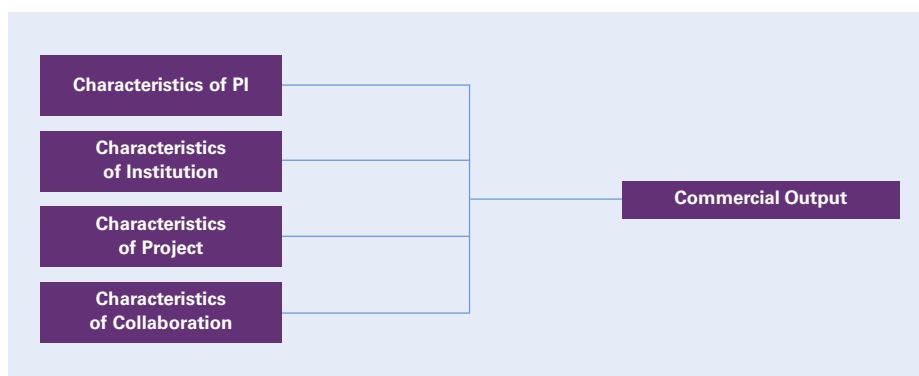
Figure 17: Collaborations per project



1 Factors influencing the likelihood of commercial outputs

The research went on to suggest a number of different factors that might explain why some research projects achieved commercial outputs while others did not. As figure 18 indicates, these factors were grouped initially into four categories – aspects of the individual investigator, aspects of his/her research institution, aspects of the project itself, and aspects of the collaborative arrangements (if any) with other institutions. As we undertook the analysis, we homed in on the first two sets of factors.

Figure 18: Initial research model



2 Key Findings

The final analysis focused on a subset of 207 projects that all involved some level of collaboration, and for which we had detailed data from both archival and questionnaire sources. This analysis indicated two important findings.

First, projects were more likely to have commercial outcomes (a) where the research institution they were located in had a Technology Transfer Office, (b) where there were clear efforts being made to remove the constraints that got in the way of industrial collaboration, and (c) where the institution was known for research excellence (i.e. it had a high RAE rating). These findings were all expected.

Second, projects were more likely to have commercial outcomes where the principal investigator: (a) was relatively young (in terms of years since getting his/her PhD), (b) had relatively few previous EPSRC grants, and (c) was not a full professor. In comparison to the institutional factors above, these results were relatively surprising. They suggest that individual faculty often face some tension between the need to publish academic research and the opportunity to commercialise the outputs from their research, and that many of the more senior or experienced academics lack the motivation and/or the capability to turn their attention towards commercial outcomes.

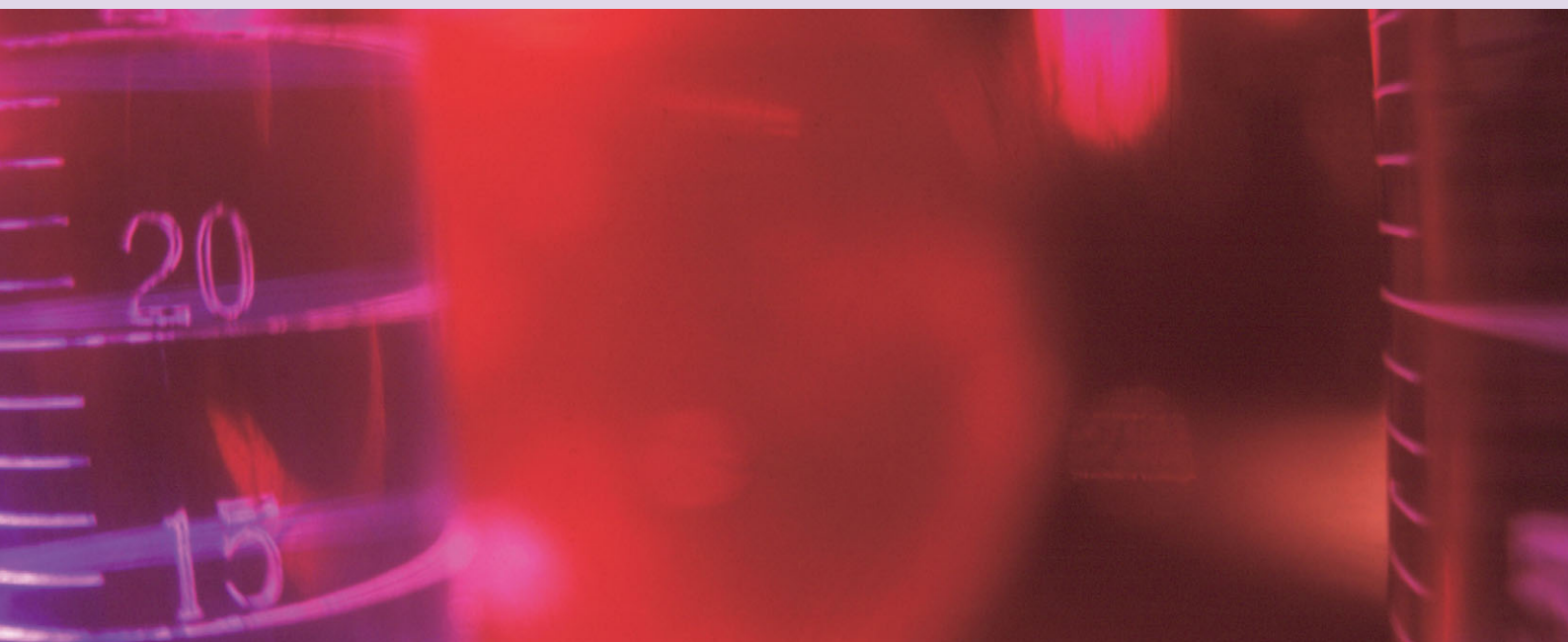
In sum, the research shows that there are, not surprisingly, some inherent tensions in the UK university sector between meeting the traditional demands for high academic quality and meeting the emerging demands for commercial outputs. Most individual faculty struggle to reconcile these tensions, but the evidence suggests that universities are for the most part able to deliver on both sets of outputs.

AIM research on the performance of the science base reveals a number of important findings in the areas of: science and technology indicators; internationalisation of R&D; the commercialisation of research; and the relationship between the location of business R&D activity and university research. These findings reflect on the state of the UK's science base and thus on its knowledge production and capacity to innovate.

1 Science and technology indicators

Looking across the various indicators of science base performance, in terms of science and technology inputs and outputs, it is clear that the UK has to improve considerably if it wants to compete on a level playing ground with its competitors; both major western economies, the smaller hi-tech countries and the emerging economies. If knowledge production and innovation really are major drivers of economic prosperity the evidence suggests that the UK must do better.

The UK invests comparatively less in public and private R&D than many other nations, and its investment has been on a downward trend since the early 1980s. A trend also reflected in the area of scientific productivity.



In terms of research impact, the UK is losing ground in chemistry, physics and engineering. The UK is falling behind Japan, Germany, the Nordic hi-tech countries like Sweden and Finland, and other nations in terms of both patents per capita and per unit of investment.

These findings lead us to question the traditional strength of the UK science base. Policymakers should consider how the UK can boost the current science base. There are some important questions to be answered. What explains the UK's success in biomedical related fields? What lessons can we learn from other countries in terms of their approach to R&D investment?

2 R&D location

Another feature of the UK's science base is revealed by the trends in the location of R&D, both in the UK and funded by UK business and governments.

In the case of R&D investment in the UK the trend seems to be that, increasingly, R&D conducted in the UK is funded externally by foreign multinationals. This has implications for the UK as, in a global R&D market, R&D can be moved out of the UK should conditions in the UK or elsewhere favour such a move. Indeed the trend for UK funded R&D seems to favour locating it offshore. Policymakers should consider what factors are driving R&D location decisions.

Further research is required to look at the extent to which firms in different countries locate their innovative activities offshore, where firms are moving these activities, what the determinants of firms' location decisions are, and whether innovative activities carried out in different geographical locations have a differential impact on productivity and performance of firms.

3 Location of UK based business R&D

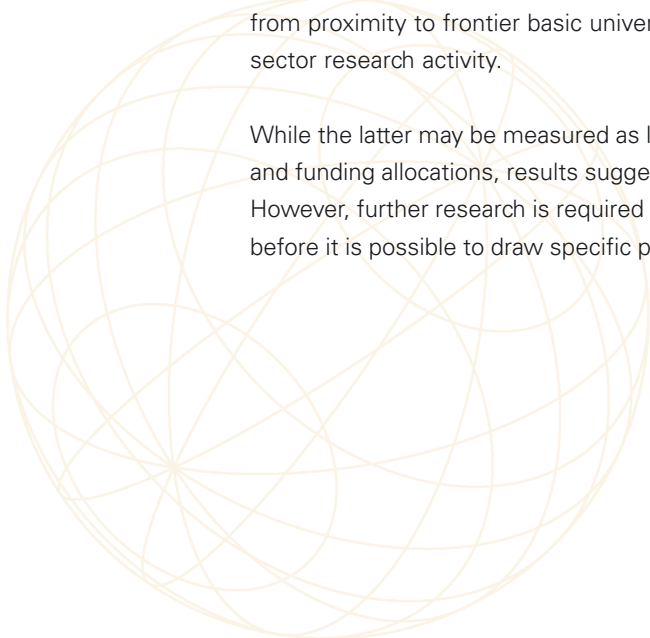
When business R&D is located in the UK, is it located close to leading academic research centres? This is an important question as it relates to the importance and relevance of academic, science based R&D in the UK, from a business perspective.

The findings shed new light on the links between public research and business R&D and the role of geographic proximity in public-private sector interactions, which are topical policy issues in the UK and elsewhere.

While the findings relating to R&D in pharmaceuticals appear to confirm the importance of world-class centres of research in attracting increasingly footloose R&D investment, the picture is not entirely clear.

For example, the fact that the research also finds some instances of co-location with lower-rated research departments raises the possibility that firms may benefit both from proximity to frontier basic university research as well as to more applied public sector research activity.

While the latter may be measured as lower quality for the purposes of the RAE and funding allocations, results suggest that it may play a role in technology transfer. However, further research is required to establish the underlying mechanisms at work, before it is possible to draw specific policy recommendations from the evidence.



4 The commercialisation of research

Conducting research is one thing. But how much of this research has an impact on economic activity? AIM research in this area reveals that it is possible to identify factors that increase the prospects of research having a commercial impact.

Our research highlights some of the specific things universities can do if they want to increase the volume of commercial outputs from their research projects. Most obviously, they can develop TTOs and other mechanisms for promoting and supporting collaboration with industry. More subtly, they can make it clear that the development of commercial outputs is a legitimate activity, and that it does not compromise a researcher's ability to further his or her academic career.

From a policy perspective, the study raises some interesting questions about the sort of researchers and institutions that might be targeted by research councils for support. For example, it is often tempting to view a track record of prior funding as a good sign when considering a new proposal, but our results shows that this negatively affects the likelihood of a commercial output.

¹ The research was funded by the Gatsby Charitable Foundation, the ESRC Centre for the Microeconomic Analysis of Public Policy at the IFS and AIM.

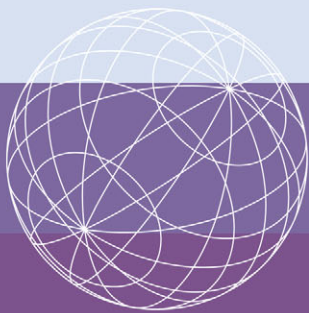
² Abramovsky, L., Harrison, R. and Simpson, H. (2006) University Research and the Location of Business R&D, *The Economic Journal*, forthcoming.

AIM – The UK's research initiative on management

If you are interested in working with AIM Research, require further information or to access the following:

- Full UK programme of AIM workshops, conferences and event listings
- Fellows' profiles and full research project details
- AIM quarterly Newsletter and press releases
- Research papers and AIM publications available as downloads
- Information for the media

please visit AIM's website **www.aimresearch.org**



For all enquiries please contact:

Advanced Institute of Management Research (AIM)
4th Floor, Stewart House
32 Russell Square
London WC1B 5DN

Tel: +44 (0)870 734 3000

Fax: +44 (0)870 734 3001

Email: aim@wbs.ac.uk

Web: www.aimresearch.org

The Advanced Institute of Management Research (AIM) was founded in October 2002. It is a multi council initiative of the UK's Economic and Social Research Council (ESRC) and Engineering and Physical Sciences Research Council (EPSRC) – with activities at over 110 institutions in the UK and overseas.

ISBN 978-1-906087-07-4