CaSE News

Campaign for Science & Engineering in the UK

The Quarterly Update for CaSE Members

Number 58 December 2008

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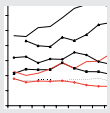

Is the Scottish Government for science?

It has been a couple of years in the making, but Scotland has a new science strategy: *Science for Scotland*. It was published in November by Fiona Hyslop MSP, Cabinet Secretary for Education and Lifelong Learning. *Science for Scotland* is the second Scottish science strategy post-devolution. The strategy is strong on the vision: "a nation of world-class scientific achievement, a magnet for talent and for investment, a powerhouse of technology innovation and enterprise, increasing sustainable economic growth". It is noticeably less strong on policy and budgetary commitments.

Unlike science strategies in most countries, including the UK's science and innovation framework, the Scottish strategy makes no commitment to sustained increased public investment in science and engineering. The only commitment for the research base is just confirmation that it will continue to be funded. The commitment for science in the Scottish Government is that there will be a cross-cutting efficiency review. Scientists and engineers within universities, research institutes and government agencies were hoping for more.

There has been an ongoing dispute over higher education funding in Scotland following the last Scottish budget settlement. The Future Thinking Task Force was set up to find a way forward. Its report, *New Horizons*, came out prior to the science strategy's launch and informed its development. The science strategy supported the conclusions of *New Horizons* that Scottish Funding Council grants should be better aligned with government priorities. The strategy also recommended that the importance of knowledge exchange be raised to become equal with the importance of research excellence. Scottish universities have been "pooling" resources in a successful approach to building up the capacity necessary in certain fields, one that is set to develop further in the future. The strategy also notes that the Scottish Government will consider increasing postgraduate numbers in-line with demand from students and employers.

The strategy repeats commitments to the development of the Curriculum for Excellence and Science Baccalaureate. Both of these initiatives are viewed as positive steps to make school science education more challenging and relevant. Hopefully a new Royal Society of Edinburgh education committee will help ensure that changes to the education system are properly thought through. There was no mention of increasing the number of specialist teachers, just a repeated commitment for funding of continuing professional development.

It is good that the *Science for Scotland* recognises the importance of policies at the UK level (e.g., research councils and R&D tax credits) and the EU level (e.g., framework programmes) as well as the need for the Scottish Government to engage with the development of these policies. However, for Scottish researchers to capitalise on UK and EU funding opportunities, they need to have the base funding to be competitive with English and other European universities. It does not seem that the Scottish Government has fully recognised this critical point.

The strategy has little in the way of policy initiatives to improve the state of science and engineering. It has nothing with respect to funding commitments. The only hope is that the strategy's vision for Scotland to be a "science nation" gives the science and engineering community stronger leverage in policy and budgetary decisions in the future.

CaSE responded to the Scottish Science Strategy consultation and produced Science and Engineering Policies for the Scottish Parliament to influence the strategy. CaSE's director, Nick Dusic, spoke at a conference on Scotland's Science Strategy in December.

Nick Dusic

CaSE News

The Quarterly Update for CaSE Members

Reprinted from CaSE News 58 with corrections

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The next issue will be published in March 2009. If you are interested in contributing, please contact the Editor at the CaSE office by February 1st.

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Comment

Is increased investment in science and engineering a luxury that can only be afforded during the good times? We are soon going to find out what politicians really think.

Looking at the figures over the last 10 years (CaSE feature, pages 8-9) one sees that during a time of economic growth the UK Government substantially increased its investment in the science base, although in real terms it did not yet double the science budget. The Government did not increase investment in its own evidence and innovation needs through departmental R&D spending. The UK has been very successful at attracting foreign investment in business R&D, but overall business investment has not grown. Overall the UK spends a similar percentage of its GDP on R&D now as it did 10 years ago, and this is still lower than most of our competitor countries.

The economic crisis is a game changer. The latest pre-budget report boosted public spending in the short-term, but said that in the medium term there will be cutbacks (see page 4). Science was included in the short-term stimulus package, which makes sense as it is a long-term investment. This investment was also seen as critical to the UK's long-term economic success. Achieving the Government's commitments in the 10 Year Science and Innovation Investment Framework 2004 – 2014 requires a good settlement for science and engineering in the next comprehensive spending review, which is no sure thing. Obviously the election to be held by 2010 will impact upon this.

Would the Conservatives make investing in science and engineering a priority? There was one signal that they might. During one of David Cameron's recent speeches on the economy, he said that science was a priority and that the economy needed to be rebalanced in a way that strengthened technological development. Although there is a strong understanding of the importance of science and engineering amongst members of the shadow front bench, there is a reluctance to make funding commitments at a time when the party wants to reign in public spending.

Although UK politics remain the most important level for science policy decision-making, both devolved and EU decisions are critical as well. In Scotland there is a new science strategy, but funding commitments have not been in-step with its vision (see page 1). In Northern Ireland, there is a lot of discussion on how best to build a strong knowledge-based economy. Over the next year the EU will be making decisions about its funding priorities, should more money go to research and away from farming? But research also benefits farming as the National Farmers' Union points out in its invited article (see page 10).

The US election will have a profound impact on science and engineering there. President-elect Barak Obama has made various commitments to supporting science and engineering, from doubling research funding to lifting federal restrictions on stem cell research. We will soon see if he follows through on his election commitments and their impact on science and engineering in the UK. Resurgent public support for science and engineering in the US is good for the world, but it means that the UK needs to keep pace if it wants to remain an internationally competitive place to do research.

CaSE has its work cut-out to keep science and engineering high on the political agenda at a time of political and economic uncertainty. In order to respond to these challenges CaSE has developed a new strategy, which will be launched at the AGM in January. CaSE is starting the New Year off with a bang by having a high-level Opinion Forum on arguably one of the most important topics for our members – the impact of the research base – and having Lord Drayson, the new science and innovation minister, speak to us about his priorities for the future at the Distinguished Lecture (see back page). By working with our members and engaging politicians across the UK, CaSE aims to get the support necessary for investing in science and engineering through the good times and the bad.

Nick Dusic

International Report Launched

CaSE launched its latest policy report, *International Excellence: Valuing International Scientists and Engineers*, in mid-November. The report developed out of a CaSE Opinion Forum on *Attracting, Education and Collaborating with International Scientists and Engineers*, held in July, both sponsored by the British Council. It has been circulated widely and Dr Brian Iddon, MP, referred to it in the Queens speech debate (day three) commenting that it "makes some very good recommendations about how to attract foreign students to study and do research and development work in British universities and how to get them to stay here in order to help British industry and commerce develop its exports. I hope that the Secretary of State will take some of those points into account."

The report describes the enormous range of benefits that the UK reaps from being able to attract, educate and collaborate with international scientists and engineers, as well as how this can help the global science effort. A series of policy recommendations were made that fall into three main themes.

First, the UK government and devolved administrations need to make the case in support of international scientists and engineers and be prepared to defend this position. All other areas of policy-making, should then be aligned with this strategy – at times policies developed by different departments contradict each other. The Science Minister should use his place in cabinet to ensure a new coherence to policy-making.

Second, the UK must not be complacent about its attractiveness to incoming science and engineering students and workers. It is essential to monitor factors that might decrease the UK's appeal, to guard against them if possible, but plan for their impact if not. Given that there are many factors that the UK has little control over, like policy-making in other countries, it is vital that the UK works to increase the appeal of the UK as a place to do science and engineering where it can.

For example, the new points based system for visas must enhance our attractiveness and international reputation. There is much about the system that could do so, with a recognition of academic skills as a basis for entry, new safe-guards on quality of provision for student learners, and straight-forward clearance for scientists and engineers with a job in a shortage occupation area. However, CaSE is really concerned that unless the new system is appropriately implemented, with properly tested and functioning IT and the right level of staff, the UK risks turning away or just turning-off potential science and engineering immigrants. The recently introduced security certificates for post-graduates were under-resourced and led to problematic delays. CaSE is also concerned that the administrative burden for institutions sponsoring international scientists and engineers is not proportional to their risk and that too few sponsors have registered throughout the system.

It took years for the US to recover its international student numbers after a more stringent migration system was introduced after 9/11. CaSE urges the Government to ensure that the migration of skilled scientists and engineers critical to the UK's economic or scientific prosperity is always supported and uncapped. The shortage worker list currently includes all secondary school science and mathematics teachers and this should also include primary school teachers with a science or mathematics background.

The third theme explored in the report is recognition that, at the same time as welcoming all that immigrants can offer, the UK must improve its own training and retention of scientists and engineers. CaSE would never suggest employing overseas workers as a substitute for training our own. The talent of UK nationals can be strengthened by spending time abroad, but many are reluctant to do so because of limited foreign language skills – these skills must be improved. Having more UK nationals participating in international "brain circulation" can benefit all the individuals and countries involved. Furthermore, the UK must invest sufficiently in its own universities so that they remain competitive and attractive and are not forced to bolster their incomes from overseas students, who should be valued for their own merit.

All member organisations should have received a copy of the report and it is available to download from the CaSE website at http://www.sciencecampaign.org.uk/documents/.

Hilary Leevers

Science & Parliament

CaSE's Director, Nick Dusic, participated in this year's Science and the Parliament in Edinburgh. The meeting was organised by the Royal Society of Chemistry and focused on science education. Nick was part of a Science Question Time panel, which discussed the changes to science education in Scotland brought in with the Curriculum for Excellence. The meeting also included a Parliamentary Question Time during which representatives from the main political parties were asked questions on topics ranging from higher education funding to improving diversity of the science community.

Toshiba Roundtable

CaSE Director, Nick Dusic, participating in a Toshiba industry roundtable on "How can the UK incubate the next generation of innovators?" See page 11 to read more.

How Academia & Government Can Work Together

Earlier in the year, the Secretary of State for the Department of Innovation, Universities and Skills, John Denham, commissioned a series of reports on higher education and its strategic direction. The Council for Science and Technology (CST) was asked to investigate how to improve the interaction between academia and public policy makers in Government (see page 5 to read about another of these reports). CaSE shares the CST's view that a healthy engagement between academics and policy makers is essential to develop informed, evidence based, world-class policies.

The report was published in November and found that recent improvements, such as the introduction of Departmental Chief Advisors and Scientific Advisory Councils, had strengthened engagement. Nevertheless, the relationship between academics and policy makers was not as strong as it could be, although this situation was not unique to the UK. Four key inhibitors to engagement were identified: less than professional working relationships, ignorance on both sides of what good engagement can deliver, a degree of mistrust between academics and policy makers, and a failure to value the relationship. The central message was that these barriers were cultural rather than structural, and that both sides needed to alter their behaviour in order to overcome them.

The report went on to recommend action in three key areas. First, a set of exchange mechanisms should be developed to enhance relationships and communication, such as world-class internship and secondment schemes. These have been successful in the US and do exist here in the UK, but they could be better publicised and are sometimes perceived to be career-damaging, due to an 'out of sight out of mind' attitude and inflexible work practices.

Second, the success of Departmental Chief Advisors and Advisory Councils as conduits between academia and government should be improved through better access to Ministers, closer working with other departmental senior analysts, and wider advertising within the academic community. The report also recommends that universities should professionalise their structures for engaging with Government.

Third, academic engagement with Government should be formally rated, valued and rewarded. Peer review bodies should be set-up to assess the quality of publishable and non-publishable academic engagement with Government. The results would then be rewarded either through monetary value or career progression, in the same way as traditional academic research excellence is rewarded. Such engagement could be included within the Research Excellence Framework currently under development. Although measuring the quality of engagement is complex, the report even suggests developing a 'gold standard' acknowledgement from Government for valued engagement.

CaSE agrees with many of the issues raised in the report, particularly the need to tackle the lack of scientific expertise across Government, through, for example, appointing robust and independent Advisory Councils and Chief Scientific Advisors.

The CST intends to conduct a further study in twelve to eighteen months time to investigate what progress has been made against these recommendations.

The full document can be downloaded from http://www.dius.gov.uk/policy/HE-debate.html.

Nick Hall

Pre-Budget Report

This year's Pre-Budget Report was focused on fiscal policy initiatives to respond to the economic crisis. Unlike recent budget speeches there was no mention of science. The Pre-Budget Report did announce that the £442 million of investment in research and education infrastructure would be accelerated. This was part of the Government's plan to increase public spending on infrastructure to boost economic activity.

At the same time, HM Treasury published a report on *The UK economy: addressing long-term strategic challenges*. It described government investment over the last ten years to rectify earlier under-investment and highlighted the importance of continuing the government's investment in scientific research and skills.

Both the Chancellor and opposition parties have stated that the UK's worsening economic situation and increased public spending in the short-term means that future public spending will need to be curtailed. There are disagreements between the parties about the degree of reduction needed and where it should be made. CaSE will continue to work with all parties to ensure that science and engineering are prioritized as a critical investment for the UK's long-term prosperity.

Nick Dusic

DIUS Annual Innovation Report

On the 4th December 2008 the Department for Innovation, Universities and Skills launched its first Annual Innovation Report. Lord Drayson, Minister for Science and Innovation, said that the report "presents a picture of a nation that is both good at innovation and getting better at it. However we need to maintain this progress to cope with the economic downturn and to emerge stronger from it. We must continue to invest in talent, science and innovation. Our future depends on it."

The Government committed to publishing an annual innovation report in its *Innovation Nation* white paper. The report includes information on the latest Innovation Survey and progress on implementing proposals within the *Innovation Nation* white paper, such as the Small Business Research Initiative. It also describes a large part of the UK government's policy and funding initiatives to support innovation, from higher education to regional development. The annual reporting process for science and innovation is an important reminder for the Government to follow through on previous commitments.

Also published was the annual progress report on the Ten-Year Science and Innovation Investment Framework. The Government set out the ambition of reaching 2.5% of GDP being spent on R&D by 2014 in the Framework. This year's progress report did not measure progress against meeting this headline target. The latest figure for 2006 puts the UK spending on R&D as 1.76% of GDP.

There were a few announcements that were made during the launch of the report. A new Innovation Research Centre was announced, which will be collaboration between Cambridge and Imperial Universities. There was also an outline of how government departments can set up Innovation Procurement Plans and regulate for innovation.

Nick Dusic

Developing Northern Ireland's Knowledge Economy

The first report of MATRIX, the Northern Ireland Science Industry Panel, was published in November. MATRIX is a business-led expert panel that advises the Department for Enterprise, Trade and Industry on how to maximise the economic return from the exploitation of science and technology.

A general conclusion of the report was that Northern Ireland's innovation system was fairly strong in terms of technological push from universities, but that private sector investment is too low to get the market pull. The review recommends that business takes more of a leadership role in the innovation agenda, universities continue to do high-quality research and education, and that government should help facilitate interactions.

Over the last two years, horizon scanning panels have looked at advanced engineering, advanced materials, agri-food, ICT, and life and health sciences. There were recommendations to support each sector, but overall MATRIX argued for a cross-sector approach as the innovations of the future would be inter-disciplinary.

The report also highlighted the importance of science, technology, engineering and mathematics skills, currently being reviewed by the Department of Education and Department for Employment and Learning. The report argued that there needed to be an alignment of the skills and training regime to produce higher value-added goods and services in the future.

The report also noted that as a small nation Northern Ireland would always be a net importer of knowledge and that more must be done to connect it within the UK, with the Irish Republic, and globally. This will require Northern Ireland's business to be more outward looking and for its universities to develop their international collaborations.

Enterprise Minister, Arlene Foster is now considering the report and how to develop an appropriate implementation plan. MATRIX is now looking at other sectors of the economy and how to move forward its recommendations with partners.

Nick Dusic

Mandelson on Manufacturing

On 25 November 2008 the new Secretary of State for Business, Enterprise and Regulatory Reform, Lord Mandelson, spoke at the CBI Annual Conference. Recognising the unique and challenging times which formed the backdrop of his speech, Lord Mandelson stated that "no British Secretary of State for Business has addressed senior British business leaders at a time of such economic disruption since the Second World War".

While first outlining the range of short and medium term measures which the Government was using to combat the financial crisis, Lord Mandelson then focused much of his speech on looking to the future, placing knowledge at the centre of any recovery.

The Business Secretary went on to praise the UK manufacturing sector in particular, for reinventing itself after the recession of the eighties and going on to seize global opportunities in cutting edge areas such as fuel cells, plastic electronics and Bluetooth technology, as well as retaining strength in sectors such as ICT and biosciences. The strength, value and global competitiveness of UK manufacturing adds more than £150 billion to the UK economy every year, makes up 75% of business UK R&D and accounts for half of UK exports.

Lord Mandelson insisted that "our most valuable assets are our skills and our capacity for innovation … the lifeblood of the UK's engineering and manufacturing base". He argued that without these skills, Britain risked failing to grasp some of the biggest economic opportunities on offer in the twenty first century, particularly through the harnessing of low-carbon and post-carbon technologies.

Stating that "If you really want to change the world - choose a career in engineering. And I mean real engineering", Lord Mandelson sought to highlight the work of the Manufacturing Insight Programme to help change perceptions of the sector, including campaigns to build enthusiasm in schools.

Referring to the renewed *Manufacturing Strategy* set out a few months ago, the Business Secretary touched on several key policy developments. These included the building of a new Manufacturing Technology Centre for applied research by 2010, a £100 million investment by the Technology Strategy Board and the Energy Technology Institute in low carbon vehicles, and a £24 million tender by the Technology Strategy Board in 2009 for high-value manufacturing.

Lord Mandelson concluded that, even before the credit crunch, it was clear that Britain faced a new generation of global economic challenges, but that these challenges also presented opportunities that could be seized if Britain is well prepared and placed to do so. Other speakers at the conference urged the Government to develop a clear industrial policy.

Nick Hall

University Enterprise Networks

November saw the launch of the first University Enterprise Networks (UEN), a government-led initiative intended to help over 100,000 students and graduates develop skills as entrepreneurs and business leaders. The UENs aim to establish a culture of enterprise in universities by providing training, advice, and encouragement to students and graduates who want to develop their business ideas or become innovative employers. The initial focus will be on three areas: STEM, innovation and the nuclear sector.

Of particular interest to CaSE has been the creation of the STEM UEN, led by the South East and the East of England Development Agencies. Sponsoring companies include Microsoft and its Head of Skills and Economic Affairs, Stephen Uden, commented that "We are looking at a long period of economic uncertainty. That doesn't mean that business doesn't go on … what it does mean is that those leaving university need to have the right skills to succeed. This announcement and the STEM network represent good progress".

Nick Hall

Linking Universities with Schools

In November CaSE's Assistant Director, Hilary Leevers, participated in a seminar on links between universities and schools. The event was organised by the Sutton Trust and centered around their report *Productive Partnerships? An examination of schools' links with higher education*, as well as the recent recommendations for higher education from National Council for Educational Excellence (NCEE).

There was much consideration of the roles that universities can play, including to widen participation and interest school students in further study. Issues of whether all students get fair access to the most selective universities have received much media and political attention. The Sutton Trust estimates that there are around 3,000 state school students qualified to attend the most selective universities, but who do not do so. However, the consensus wanted to move debate and action on to benefit those students from poorer socio-economic groups who drop out earlier in the system.

Socio-economic background has little impact once students are studying A levels, but a great deal of impact on who reaches that stage - around 360,000 students do not reach the standards to do so. Recommendations focused on raising aspirations and attainment of students a long time before they need to apply to university. In fact, universities are already collaborating with secondary and, to a lesser extent, primary schools to achieve these goals. And it is starting to be possible to evaluate which of these schemes are the most successful. Many of the recommendations from both the NCEE and Sutton Trust were based on improving the information available to students, and raising their aspirations, mostly through direct interactions with universities, particularly early in the school system.

It is gratifying that both reports had specifically considered promoting science and mathematics to students. The Sutton Trust suggested that pupils studying these subjects could receive financial incentives. They also suggested considering a scheme similar to one proposed by CaSE (see CaSE News 56) to target bursaries to low income students taking shortage subjects.

Thinking about Intellectual Property

As part of the series of reports on the strategic direction of Higher Education, Professor Paul Wellings, Vice-Chancellor of Lancaster University, was commissioned to consider the link between intellectual property (IP) and research benefits (see page 4 to read about another report in the series).

The report emphasises the crucial role that universities play in contributing to innovation through advancing knowledge and skills and training the next generation of researchers, business leaders, and policy makers. Over recent years, universities have also been asked to maximise the impact of new knowledge. Historically, knowledge transfer has not been an area of strength in the UK, although considerable advances have been made over the last decade, with impressive progress. Knowledge transfer includes publishing, presenting, teaching, consultancies etc. as well as the areas directly considered in the report, relating to the creation, management and use of IP.

Recommendations are made to a number of parties, some of which are outlined here. The Department of Innovation, Universities and Skills (DIUS) should clarify the purpose of research commercialisation for universities, businesses and funding agencies. It is recommended that the primary purpose for universities should be to create a wide range of social and economic benefits. Professor Wellings argues that pushing universities to maximise financial returns is "doomed to fail in the long run". Currently there are often time-consuming and obstructive debates about the ownership, recognition and return of IP for projects with many partners. If gain essentially benefits the UK as a whole it is unhelpful if involved parties spend time fighting their corners because they all believe that they must derive specifically financial benefit, for example. It is suggested that university Technology Transfer Offices (TTOs) are more effective above a certain size and models should be explored to use them to facilitate IP work in smaller centres.

HEFCE should seek annual reports from universities on how they are maximising economic, social and environmental benefits. This will be useful as funding for the sector increasingly demands illustration of impact and should also provide information on best practice. HEFCE and Research Councils UK should examine whether post-graduates can be provided with a broader range of skills and understanding of translational techniques, and how more numbers can be supported. They should also engage with DIUS to agree a way to fund such training for all post-graduates, including those from overseas.

Universities should clarify their IP policies and ensure that students and researchers are well-informed about them. All policies, including career development and promotion, should incentivise IP work.

The report also considers evidence that innovative excellence is facilitated by areas of concentrated research in universities with many PhD students and researchers within clusters of high-tech businesses. Such areas should be encouraged and also used to bolster regional development (e.g., in extending the reach of effective TTOs).

The report is dense with analysis of where the UK now stands and presents some clear if not sometimes controversial ideas on how to move forward. Well worth a read.

The full document can be downloaded from http://www.dius.gov.uk/policy/HE-debate.html.

Predicting Impact

The Russell Group are currently working on a report that summarises and presents select case studies of over 100 top licenses and spin-out companies. The report stresses the importance of basic research, arguing that, in this sample at least, curiosity-driven research has produced greater financial benefits than applied research. Notably, eight of the top ten projects identified, as judged by financial returns, resulted from basic rather than applied research.

Examples frequently emphasise serendipitous observations, such as when Professor Ferguson of Manchester noticed that the alligator embryos used in his research on cleft palates healed without scarring. This led to a major spin-out company for novel treatments for healing and scar reduction.

The report highlights how hard it would be to predict which research could yield the greatest financial returns let alone the wealth of societal gains that are not as easy to quantify. These are all issues that will be considered in our forthcoming Opinion Forum (see back page) and the resulting policy report.

Hilary Leevers

Getting Hard on Soft Subjects

The think tank Policy Exchange launched a report at the start of December entitled *The hard truth about 'soft' subjects*, which conveys its contents well. Based on some suggestive statistics and interviews with admissions tutors, Policy Exchange argues that research-intensive universities show a bias towards admitting students who have studied traditional rather than 'soft' subjects. While universities have the right to choose which subjects they prefer, they should be transparent about their preferences. Few universities have explicitly indicated which A levels choices they regard as less effective preparation for admissions although Cambridge and the LSE have published lists.

Although not mentioned in the report, Chester mathematics department credits Further Mathematics with double UCAS points indicating how highly it values the subject. CaSE has argued that increasing the allocation of UCAS points for the strategically important science, engineering and mathematics subjects, which are also typically judged to be the 'harder' subjects, is a way of expressing their value to students and should increase uptake (see CaSE News 56).

'Softer' A levels are less frequently taken in independent and grammar schools, for instance, while 75% of A levels are taken in non-selective schools, they account for 93% of media studies A levels. On the other hand, while physics, chemistry and mathematics A levels make up 15% of all entries, this rises to 22% in independent schools. These data do not just reflect student choice, but also what subjects they are offered, inhibiting efforts to widen participation.

The report urges universities to be clear about their preferred subjects, for UCAS to help relay this information, and for secondary schools to make sure that their lead teacher on careers and education is regularly trained to keep information current. All of these suggestions seem sensible and are similar to those made by other groups (see page 6), but CaSE would like to see further incentives to encourage students into taking the hard, high-value, and strategically-important subjects of science, engineering and mathematics.

Read the report at www.policyexchange.org.uk.

Hilary Leevers

Teacher Recruitment Rises

As hoped for (see CaSE News 56), the economic downturn has been accompanied by a rise in teacher recruitment, especially in the sciences and mathematics. The Training and Development Agency for Schools (TDA) had already turned to the City as a source of recruits in June, launching Transition to Teaching, to help those who wanted to move into teaching. The TDA quickly seized the initiative following redundancies at Lehman Brothers and other banks to run recruitment events in Canary Wharf and the City.

TDA projections, including employment-based routes into teaching, suggest that the number of trainee science teachers will reach 3,670, exceeding the Government's target by 2% for 2008-09. CaSE has emphasized the need for specialist rather than general science teachers urging the Government to set subject specific targets. In fact, the number of science teachers starting initial teacher training this year with a general science background fell 18% to 721, while subject specialists all rose: 7% in physics to 508, 10% in chemistry to 798 and 14% in biology to 1,087. In addition, the number of mathematics specialists rose 4% to 2,044.

These figures are obviously very encouraging, but it is vital that they do not lead to complacency. It will take many years of recruiting at above these levels to reverse the current shortages in secondary school specialist teachers. It has been estimated that about 3,000 mathematicians need to enter teacher training for several years to overcome current teaching shortages. Similarly, it is estimated that around 1,000 physics recruits are needed – current levels may be just enough to maintain the present workforce given retention and retirement rates.

It is also vital that teachers are retained better in the system, currently only about two fifths are still in the profession after 5 years. Mathematics and science teachers are often dissatisfied with workload (especially heads of department), pupil behaviour, and shortage of specialist support staff. Unfortunately, a Department for Education survey in 2006 found that technicians were among the least likely to feel appreciated and supported even though they had the most impact on decreasing workloads on teachers. Most teachers felt that support staff benefited pupil learning and behaviour.

The Government has not focused on retention issues to the same extent as recruitment. CaSE has argued that the most effective way to improve retention of science and mathematics teachers may be to provide more support staff and technicians who themselves experience improved remuneration and career prospects.

It is reasonable to assume that teachers entering the profession because of the economic downturn have a specific set of motives and it may be particularly necessary to work to retain them when the economy picks-up. If specialist teachers continue to be recruited and start to be retained at better rates then we can truly hope for a sustained increase in student interest, generating more science, engineering, and mathematics graduates, which, in turn, provide a larger pool to recruit future teachers from.

Hilary Leevers

Five-Decades of Chemistry Exams

The Royal Society of Chemistry (RSC) managed to entice 1,300 students to take an additional chemistry examination after their GCSEs this year. The paper consisted of questions selected from O level and GCSE chemistry examinations from 1960s to current. Students struggled more with the quantitative questions and those taken from earlier examinations, which may reflect changes in the syllabus as well as skill levels. The results, reported in the RSC report *The Five-Decade Challenge*, are being used as the basis for a campaign to raise school science examinations, including an online petition at http://petitions.number10.gov.uk/examstandards where you can also read more about the RSC's concerns.

Hilary Leevers

SET Statistics

The following analysis has been drawn from *SET Statistics* a document produced in 2008 by the Department for Innovation, Universities and Skills in collaboration with the National Office for Statistics. It summarises key science, engineering and technology (SET) indicators. This article will focus on the period 1995-96 to 2005-06 where possible, with all figures adjusted for inflation.

Gross R&D Expenditure

- Gross expenditure on R&D (GERD) in the UK shows a fairly smooth increase of 21% in real terms from £18.0 billion in 1995 to £21.8 billion by 2005. Table 1 shows the breakdown by source of funding and performing sector.

- **Source of funding:** While GERD funding from business enterprise rose from £8.7 billion to £9.2 billion and government funding rose from £5.9 billion to £7.1 billion during this period, the greatest rate of increase was shown by R&D funding from abroad, which rose from £0.7 billion in 1995 to £4.2 billion in 2005, at which point it accounted for 19% of total GERD funding.

- **Performing Sector:** The main beneficiary of the increased R&D expenditure has been the Higher Education sector, which has increased its R&D performance budget by 61% from £3.5 billion in 1995 to £5.6 billion in 2005. As a percentage of overall UK GERD during this period, the Higher Education sector increased its share from 19% to 26%.

Table 1. Breakdown of GERD by source of funding and performing sector in real terms (£ millions)

	YEAR	BUSINESS ENTERPRISE	GOVERNMENT	HIGHER EDUCATION	PRIVATE NON-PROFIT	ABROAD	TOTAL
BREAKDOWN BY SOURCE OF FUNDS	1995	8,684	5,916	152	2,605	656	18,015
	2005	9,174	7,126	266	1,022	4,184	21,772
BREAKDOWN PERFORMING BY SECTOR	1995	11,702	2,623	3,461	228	------	18,015
	2005	13,410	2,289	5,580	493	------	21,772

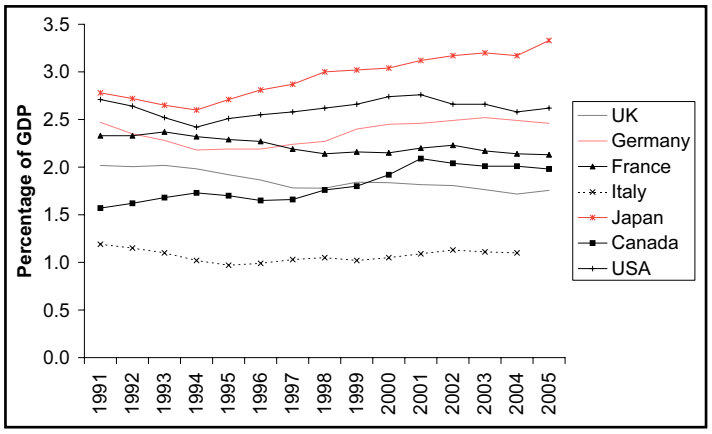
Note: Base year for breakdown by source of funds is 2004, for performing sector, 2005. Government includes departmental and research council spending.

- Despite the increase in gross expenditure on R&D in the UK over this period, it fell as a percentage of overall GDP as discussed below.

International Comparisons

- The UK's GERD fell as a percentage of GDP from 1.92% in 1995 to 1.76% in 2005. The UK performed badly when compared with other G7 countries over this period, with only Italy faring worse (see Figure 1).

Figure 1. Gross domestic expenditure on R&D in G7 countries as a percentage of GDP



- The UK performs particularly badly with regard to non-government GERD when compared to other G7 countries, especially in the business enterprise sector. Business Enterprise R&D (BERD) in the UK accounted for 62% of total GERD in 2005 down from 65% in 1995, while, over the same period, Germany increased its share from 66% to 69% and Japan increased its share 70% to 76%.

- This situation is exacerbated by the fact that Britain is more reliant on overseas R&D funding than any other G7 country. Although the data is incomplete, R&D funding from aboard in 2005 accounted for 9% of GERD in Canada, 6% in Italy, 0.4% in Japan and 19% in the UK.

Government funded R&D

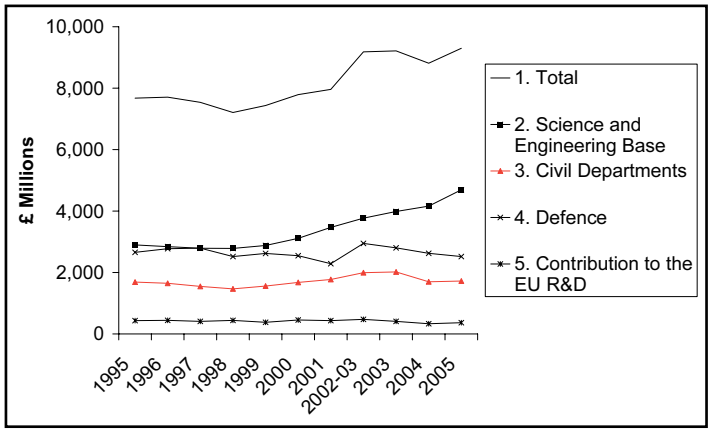
- Government expenditure on SET in 2005-06 was £9.6 billion in real terms, up from £7.9 billion in 1995-96. Of this, 96% is spent on R&D, with the other 4% focused on technology transfer and taught courses.

- Total government expenditure on R&D in real terms rose from £7.7 billion in 1995-96 to £9.3 billion in 2005-06; an increase of 21% over ten years. Grouped by socio-economic objectives, the biggest rise was seen in the field of 'advancement of knowledge', from 30% of net R&D expenditure in 1995-96 to 40% ten years later.

- Civil department R&D spending (including the NHS) rose slightly from £1.69 billion in 1995-96 to £1.72 billion in 2005-06, by which time it accounted for 19% of total

government R&D spending. Departments which increased their R&D spending notably over this period include the Department for International Development (£151 million to £265 million) and the Home Office (£22 million to £73 million). See Figure 2 for a breakdown.

Figure 2. Trends in government funded R&D expenditure in real terms (2005 baseline).

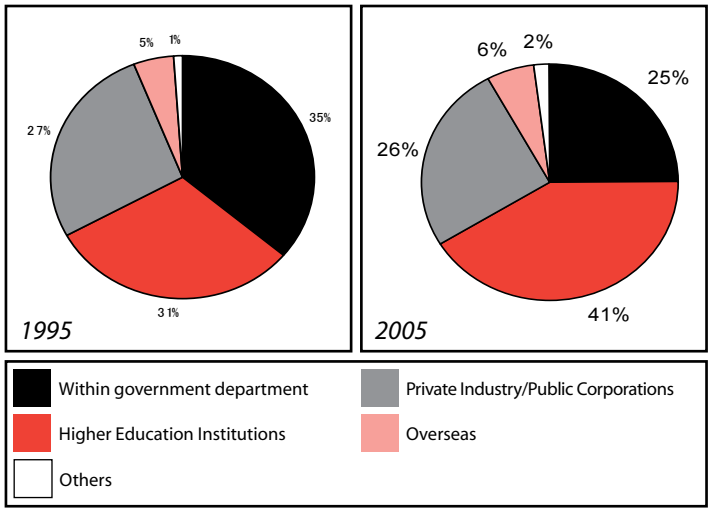


- The greatest beneficiary of government R&D expenditure has been the Science Budget which increased from £1.6 billion in 1995-96 to £2.8 billion in 2005-6, a rise of 74% in real terms (see Figure 3).

- By 2005-06 the Science and Engineering Base, consisting of the Science Budget (31%) and the Higher Education Funding Councils (22%), accounted for over half of total government R&D expenditure.

- The destination of total government R&D expenditure over this period saw the Higher Education Institutions increase their share from 31% to 41%, while government R&D spending within its own departments fell from 35% to 25%, and spending on private industry remained relatively constant.

Figure 3. Destination of Government R&D Expenditure in 1995 and 2005



- The Science and Engineering Base, which performs most of the basic and strategic research undertaken in the UK, received R&D funding totalling £5.9 billion in 2005: an increase from £3.6 billion in 1995. Of this 2005 figure, 71% came from government as shown above (in the science budget and HEFCE), while 15% came from charities, 8% from overseas (including 4% from the EU) and 5% from UK industry.

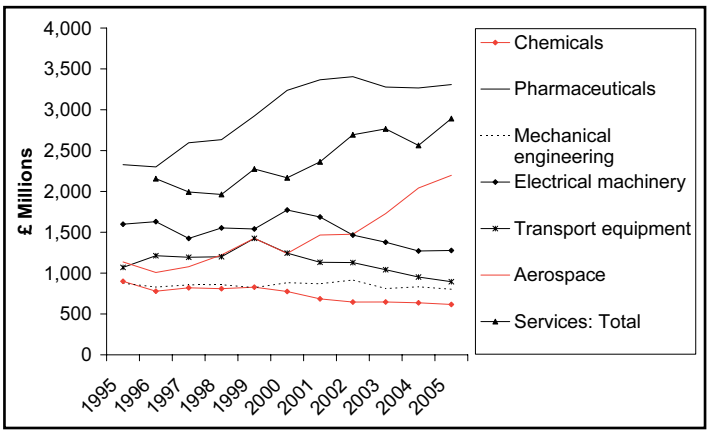
Business Enterprise R&D

- Total BERD expenditure in 2005 was £13.4 billion in real terms, up from £11.7 billion in 1995: an increase of 15% over ten years (See Figure 4). However, as a percentage of total GDP, BERD fell from 1.25% in 1995 to 1.08% by 2005, in the same period, overall GERD fell from 1.92% to 1.76%.

- **Source of funds:** Between 1995 and 2005, the share of BERD provided by business itself fell from 70% (£8.2 billion) to 64% (£8.6 billion), while the share from government fell from 10% (£1.2 billion) to 9% (£1.2 billion), and the share from overseas rose from 19% (£2.2 billion) to 27% (£3.6 billion).

- **Breakdown by sector:** More traditional industries within the manufacturing sector have seen a gradual but consistent decrease in BERD in real terms between 1995 and 2005, such as chemicals falling from £900 million in 1995 to £616 million in 2005, mechanical engineering falling from £877 million to £802 million, electrical machinery falling £1.6 billion to £1.3 billion and transport equipment falling from £1.1 billion to £895 million. However, the pharmaceuticals (£2.3 billion in 1995 to £3.3 billion in 2005) and aerospace industries (£1.1 to £2.2 billion) have seen increased growth. The service industry has also increased its BERD over this period, from £2.2 billion in 1996 to £2.9 billion in 2005. See Figure 4 to see these trends.

Figure 4. Expenditure on R&D performed in UK businesses in real terms, by broad product groups (2005 base line).



The full document can be found at http://www.berr.gov.uk/dius/science/science-funding/set-stats/

Nick Hall

Why Science Matters for Farming

The figures are now well known and widely quoted. The global population will reach 9 billion by 2050, with the highest rises in urban areas. At the same time poverty is falling. As earnings move from £1 to £5 per day, the demand for agricultural commodities increases, especially with the introduction of meat and dairy into the diet. Food production must increase by 50% by 2030 in response to these factors. But all this is happening in the context of climate change that impacts on where people live and farm, what crops and animals can be produced, the range and seriousness of pests and diseases, and the availability of fresh water. To feed all these extra people and animals, and to provide more of our energy from plants, production must be scaled up where it is possible, and sustainable, to do so.

Through the history of modern agriculture, there have been huge gains in productivity. Yields have been protected and food safety and quality improved through innovative practices, new technologies and the application of scientific research. Now, almost a decade into the 21st century, productivity and food security are being talked about as important issues for agriculture in the UK and the world. However, the current context is very different from when historic gains were achieved. The inputs needed to increase production, such as fertiliser, pesticides, feed, water, fuel, energy and labour, are increasingly expensive and limited in availability. As well as representing more cost to farmers, these inputs impact on the environment. There is limited new land available for cultivation. To increase productivity while reducing inputs, efficiency must be improved.

The National Farmers' Union (NFU) is convinced that science and technology are critical to delivering increased output per unit input. This is why we launched a campaign in October this year called *Why Science Matters for Farming*, with a report and meeting in the Houses of Parliament to present our case. Our primary audience is decision makers in government and the science community, but we also want to engage the next generation of agricultural scientists, particularly in applied research, as the pool of experts is diminishing at a worrying rate.

The NFU delivered three key messages. First, farming is a high-tech industry. This

Dr Helen Ferrier, National Farmers' Union Chief Science and Regulatory Affairs Adviser

needs to be communicated to students who are interested in studying science and engineering and want to work in an industry that will use their skills. Farming needs to compete strongly against automotive, pharmaceutical, energy or information technology, for the talent and enthusiasm to make a real difference. We give case studies in the report and online of the sorts of the research and technologies agriculture needs. A prime example is precision agriculture, which targets inputs to optimise production, using a range of technologies and analytical tools from soil sampling and sensors to GPS and yield mapping. Another is genetic improvement of plants and animals, through genomics and modern plant breeding, so that they can make better use of inputs and withstand pests, diseases and other factors. Research is also essential to understand, predict and mitigate changing patterns of pest and disease attack, which cause over 40% of crops to be lost worldwide and which can decimate livestock.

Second, we call for a reversal of the trend of under-investment in agricultural R&D over the past two decades. The cuts in funding, closure of research stations and redundancies are entirely inconsistent with the demands on production in the 21st century. They also threaten the UK's position as a world leader in many areas of science relevant to farming, such as plant genetics and animal health. Newly industrialising countries recognise the significant return on investment afforded by agricultural R&D. China is doubling its spending on agricultural biotechnology research to $800 billion over the next 5 years.

Acknowledging the current economic climate, our third message is a call for a genuine shift in government strategic objectives for food and farming towards efficiency and productivity, rather than being solely about environmental mitigation. Public spending on agricultural R&D can then reflect this policy priority. Of course, all funders of research, including industry, need to look at new ways to collaborate and to get more out of every pound spent. The structure of the agriculture industries and the competitive nature of its R&D can make it difficult for individual businesses to pay for or access the results of research. Major multinational companies spend $7.3 billion a year on agriculture-related R&D. Is it right to rely on this to feed the world? Government has to be a major stakeholder, considering not only the public good farming delivers but the critical importance of food security to the economy and to society.

For more information and to read our campaign document, please visit www.whyfarmingmatters.co.uk

Incubating the Next Generation of Innovators

In the Government's *Science and Innovation Investment Framework 2004-2014* it was stated that 'nations that can thrive in a highly competitive global economy will be those that can compete on high technology and intellectual strength.' How feasible is this in the economic downturn, and how can the UK follow these aims compared to the colossal R&D spend in emerging markets such as China and India?

Toshiba's recent industry roundtable, chaired by the award-winning science editor Lawrence McGinty, brought together leading figures from business, academia and the public sector to ask "how can the UK incubate the next generation of innovators?" The delegates (including myself) considered what government, business and academia can do to help foster innovation in the UK.

There was general consensus that the UK research base is strong, but that, compared to 20 years ago, industry has largely withdrawn from utilising large research centres and that academia has been left to fill the gap. International competition was judged to be affecting UK innovation, with many countries outside the EU investing far more in R&D than the UK. In addition, the UK uses a great deal of foreign talent, much of which is unlikely to stay in the UK in the long term.

The panel agreed that the onus to produce the innovators is not just on academia and industry. Students must change the way they approach their careers, both during and after their degrees. While the UK may have a great pool of talent, and graduates with in-depth technical knowledge, it is important that they are also well-rounded individuals. Graduates need a broader understanding and ability to successfully interact with cultural aspects of the workplace, to fully exploit their knowledge and experience, and increase their entrepreneurial confidence. More hands-on experience could help students gain these skills and recognise their value. Unfortunately, industry internships are scarce. In recent research funded by Toshiba, questioning 300 graduates, just over half (52%) felt that too few R&D opportunities were being supplied by the Government or public sector. Nick Dusic, CaSE Director, is all too familiar with this problem and stressed how vital it was that the Government continues to invest in science commenting "I hope the financial downturn will not dissuade the government from continuing to invest in skilled people and research."

Professor Roberto Cipolla, University of Cambridge and Managing Director of Toshiba's Cambridge Research Laboratory

The value of post-graduates gaining industrial experience abroad was highlighted by many delegates, including Dr Geoff Scott (Head of Strategic Development, BT Innovate) who commented "there is certainly a need for graduates to get a global perspective, or a view from the outside." The research mentioned above found that 76% of science post-graduates would consider going abroad to gain R&D experience. The point was pursued by Mr Nobuhiro Yoshida (Corporate Vice President & General Manager of Technology Planning Division, Toshiba Corporation) who stated that "multi-cultural exchange is very important in the research environment. Diversity in organisations is crucial to foster innovation; there is great value for post-graduates to experience international working cultures, they can see things from a different aspect."

The steps that industry can take to develop innovators were discussed at length. The delegates concurred that SMEs should have a greater role in fostering innovation. Many of the UK's leading science and technology graduates go into SMEs, which may be highly innovative companies but lack the finances to invest heavily in R&D. Professor Coton, (Dean of Engineering, University of Glasgow) said: "We have a very diverse technology base in the UK and in many cases the leading edge technology that is spinning out from universities is going into relatively small organisations. These organisations simply do not have the financial clout to sustain R&D on any scale."

The panel discussed methods in which SMEs could be encouraged to invest more, taking economic risks during the current downturn. They could be supported by venture capital or the Government. Professor Fabio Ciravegna (Department of Computer Science, University of Sheffield) added that "innovation comes from people who have ideas and find people to invest in them. I have lots of students with great ideas, but venture capitalists don't dare as much here as in the United States. Business needs to believe more in our graduate students; at the moment the fear of failure is too big."

The roundtable panel covered many ideas that could help the government, industry and academia to foster the next generation of UK innovators. They agreed on a need for greater government investment, for industry to take greater risks, and for individual students to become better suited to workplace needs. The main consensus was that these bodies should work together more closely. Only by greater collaboration and risk-taking can the UK compete on an international scale in R&D.

Professor Cipolla is a former fellow of The Toshiba Fellowship Programme that enables UK post-graduates to gain hands-on experience at Toshiba's Japanese laboratories (run in association with the EPSRC). As well as benefiting the fellows' careers, Toshiba's own personnel are exposed to fresh thinking and novel points of view.

Upcoming CaSE Events

Lord Drayson to give CaSE Distinguished Lecture

We are delighted that Lord Drayson, Minister for Science and Innovation, will be giving the CaSE Distinguished Lecture on **Wednesday 28 January 2009**. Lord Drayson, who took up his position in November and sits at Cabinet, will be speaking about his priorities for science and innovation in the UK. The lecture is kindly co-hosted with the Wellcome Trust.

The lecture will be preceded by this year's Annual General Meeting to which all CaSE members are invited. CaSE will also be launching its new five year strategy.

Please see the enclosed papers or contact CaSE for more details of these events. Anyone with an interest is welcome to attend the Distinguished Lecture, but it is necessary to contact the CaSE office to reserve a place. Please contact Nick Hall on 020 7679 4994 or NickH@sciencecampaign.org.uk to RSVP.

CaSE Opinion Forums

All of CaSE's organisational members should have now received their invitations to CaSE's next Opinion Forum on the *Impact of the Science and Engineering Research Base*. The Institute of Physics and IBM have kindly agreed to sponsor the meeting, which will be held on *12th January 2009* at IBM, South Bank, London. This meeting is particularly timely in these fiscally tight times and in the run-up to the next Comprehensive Spending Review. Increasing the impact of the research base has been prioritised by Government. The science and engineering community must engage in this process and clarify the case for spending.

The speakers include Professor Sir Chris Llewellyn Smith FRS (Chair ITER & SESAME Councils, Former Director General of CERN & UKAEA Culham), Dr Aileen Allsop (Vice President Science Policy, AstraZeneca), Dr Graeme Reid (The Department of Innovation, Universities and Skills), and Professor Philip Esler (Economic Impact Champion, Research Councils UK & AHRC Chief Executive) so we will be able to examine the issue from a broad range of perspectives. We have received a lot of interest so if you would like to attend, we recommend that you reply as soon as possible.

This Opinion Forum will bring CaSE organisational members from industry, charities and academia together with invited experts to discuss the various ways in which publicly funded scientific and engineering research makes a social and economic impact. We will examine recent policy developments and consider appropriate ways forward. Ideas raised at the meeting will be developed into a policy report to inform policy-makers, parliamentarians, funders and others. CaSE will then incorporate recommendations into its campaign work.

CaSE is planning the following Opinion Forum for Spring 2009 on how European Union Policy and budgetary decisions affect the state of science and engineering in the UK, in the run-up to the elections in June. If you have any suggestions for areas that might be considered or if your organisation is interested in sponsoring the event then please contact Hilary Leevers at CaSE.

IUSS committee

The Innovation, Universities, Science and Skills Committee has announced a new inquiry called *"Putting Science and Engineering at the Heart of Government Policy"*. They are inviting evidence on the following areas, all close to the heart of CaSE's work.

- Whether the Cabinet Sub-Committee on Science and Innovation and the Council for Science and Technology put science and engineering at the heart of policy-making and whether there should be a Department for Science.
- How Government formulates science and engineering policy (strengths and weaknesses of the current system).
- Whether the views of the science and engineering community are, or should be, central to the formulation of government policy, and how the success of any consultation is assessed.
- The case for a regional science policy (versus national science policy) and whether the Haldane principle needs updating.
- Engaging the public and increasing public confidence in science and engineering policy.
- The role of GO-Science, DIUS and other Government departments, charities, learned societies, Regional Development Agencies, industry and other stakeholders in determining UK science and engineering policy.
- How government science and engineering policy should be scrutinized.

CaSE is looking forward to making its submission and welcomes the input of all of our members, by the first week of January at the latest, but earlier than that if possible. Please call 020 7679 4995 or email Nick@sciencecampaign.org.uk if you would like to make any comments.