

Review of Science and Innovation Policies of Government

The Royal Society of Chemistry (RSC) welcomes the opportunity to submit evidence to the *Review of Science and Innovation Policies of Government*.

The RSC is the largest organisation in Europe for advancing the chemical sciences. Supported by a network of 43,000 members worldwide and an internationally acclaimed publishing business, our activities span education and training, conferences and science policy, and the promotion of the chemical sciences to the public.

This document represents the views of the RSC. The RSC's Royal Charter obliges it to serve the public interest by acting in an independent advisory capacity, and the RSC is happy for this submission to be put into the public domain.

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Industry R&D and investment in innovation

Industry investment by UK industry in R&D remains mixed. As a whole expenditure and R&D intensity in the UK remains close to the average across the OECD countries. A particular strength in the UK is the pharmaceutical sector, and it is essential that the economic, political and scientific environment that allows this industry to flourish in the UK is maintained.

The RSC welcomes some of the measures being put into place as a result of the March 2007 Budget. Specifically improved tax credits for research in SMEs and the establishment of a £100 million collaboration research competition.

A significant strength of the science and technology sector in the UK is the increasing number of high-tech SMEs and university spin-out companies. Despite these successes some remaining concerns are:

- A lack of suitably qualified and experienced managers to develop and grow these enterprises, particularly in Scotland.
- The concentration of chemistry departments in fewer universities will decrease the likelihood of chemistry spin-outs and high tech SMEs being established in certain areas of the country.

The RSC has recently conducted an overview study of the UK Chemical Science Small Business Sector, which will be available 3Q 2007. Key findings from the report include:

- More accessible funding features as the support businesses most need in order to meet business objectives, and is the area in which businesses would be most interested in having access to advice and support. More of this funding would be used for research than for any other business area.
- The issue most likely to affect the growth of the business over the next two years was perceived to be new regulations and legislation; an even larger barrier to growth than market competition.
- In agreement with previous observations, finding skilled staff also ranked highly as a barrier to business growth.

Full economic costing has recently been introduced across UK universities. Although there has been no clear change in industry funded academic research, it is now only approximately 18 months since it was introduced and any effects may not become apparent until a greater time period has elapsed. It is likely that some industrial schemes, such as EPSRC CASE awards, will be relatively unaffected because they require only a small financial contribution from the industrial partner, but other funding mechanisms could potentially suffer in the future. The RSC recommends that this situation is monitored so as to ensure continued collaboration between industry and academic researchers.

The Royal Society of Chemistry is concerned that REACH could impact on innovation due to a possible reduction in chemical diversity. A particular concern is that REACH may lead to useful chemicals being withdrawn unnecessarily due to the high cost of testing. Any chemicals that are withdrawn should be those that are least desirable for health, safety or environmental reasons and not withdrawn on the basis that they generate insufficient profit to cover the cost of testing. A similar situation has already resulted in a loss of around 60% active substances in plant protection products and probably an even larger proportion of active substances in biocidal products.

There is also some concern that if undue emphasis is placed on 'substitution' as a means of driving innovation, it is unlikely to lead to truly innovative products. Although, 'Authorisation' provides a sensible mechanism to exert control on hazardous substances and 'substitution' is a desirable endpoint, decisions on substitution need to be taken in a holistic manner.

Publicly funded R&D (including government departments) and investment in innovation

Publicly funded science is essential to the future prosperity of the UK, leading to the creation of a highly creative scientific base, highly trained scientists. It is widely accepted that the UK research base performs above expectations with respect to the level of funding available. This has been highlighted in several reports over recent years,¹ and the 2007 DTI report *PSA target metrics for the UK research*² stated that the UK's share of world citations currently stands at 11.9%. The UK was also found to stand second only to the US in research outcomes in 7 of the 10 major fields; it ranks fourth in the physical sciences.

The Council for Science and Technology (CST) review of Government policies and progress of Nanosciences and Nanotechnologies, published in March 2007,³ highlighted the danger of the UK losing its leading edge in engagement of nanosciences. The RSC endorses the CST's view that Government must implement a programme of strategic research spending, and highlights the crucial role that the chemical sciences plays in the development of new nanotechnologies and in the evaluation of their health and environmental impacts. It is essential to the future economic success of the UK that innovation in nanotechnology is fully embraced.

There have been several recent consultations regarding the public funding of science which the RSC has responded to.⁴ In its October 2006 report, the RCUK looked into methods for improving the efficiency and effectiveness of the peer review responsive mode funding stream across all the research councils. Some of the key points that arose from the RSC's response include:

- The excellent science research base in the UK must be maintained.
- Responsive mode funding is crucial to the long term success of the UK's scientific research.
- Targeted research programmes are beneficial, both socially and economically, but must only be used at an appropriate level.
- The economic success of publicly funded research must be judged in the long term; any drives towards judging short term, applied science, should be avoided.

Knowledge exchange between universities and business, including examining progress made since the Lambert review

There is concern that industry is finding it increasingly difficult to collaborate with University researchers as a result of the drive towards increasing the number of spin-outs and the rising costs of licensing technologies. This could potentially become a significant barrier to the transfer of knowledge between research institutes and industrial partners. This problem can become even more acute if industry requires technology from more than one institute; currently there is not consistency among research institutes as to how they handle intellectual property (IP).

University researchers should also be encouraged to consider the alternative option to patenting and spinning-out, which could be to embark upon collaborations with appropriate industries. This may bring about a more consistent stream of funding and improved knowledge transfer over a greater number of years and therefore be of greater benefit to all parties concerned, including the public. The balance between more accessible science and protecting IP needs to be considered and evaluated.

It is also worth considering the economic burden that an increased patent portfolio may impose upon research institutes. The drive to patent an ever increasing number of scientific discoveries will increase costs, as will effectively maintaining a large patent portfolio over a number of years.

The RSC has recently commented on the EPSRC's Knowledge Transfer and Economic Impact strategy.⁵ Although the EPSRC, as a provider of public funds for scientific research across the UK, is in a position to play a crucial role in improving economic returns from

investment, it is essential that funding good science remains its top priority and that it firmly defines and understands its role in the knowledge transfer process.

There are a number of other organisations, such as the DTI funded Knowledge Transfer Networks (KTNs), Regional Development Agencies, devolved administrations, technology transfer offices, and venture capital organisations that already form a range of knowledge transfer facilitators. The KTNs run on a variety of different models, but the RSC fully endorses that adopted by the Chemistry Innovation KTN. The KTNs need to be strategically focused, primarily led by industry, and given greater financial resources. The total number and potential overlap of KTNs needs to be looked at and evaluated.

Finally, despite the large number of schemes and initiatives, potentially the most effective means of achieving knowledge transfer is through the mobility of people. As expertise resides within individuals, it is essential that employment and social policies aid, rather than constrain, mobility.

The supply of skilled people

The supply of skilled people presents concerns across all levels of education with potential impacts in both the academic and industrial sectors. The RSC would like to raise the following issues:

- In 2006 a Department for Education and Skills (DfES) study found that only 25% of secondary science teachers were chemistry specialists, whereas 44% were biologists. This imbalance can lead to the teaching of chemistry by those without the correct background, and there are obvious problems associated with this. The RSC is attempting to address this problem through its '*Chemistry for non-specialists*' programme.⁶ It is essential that teachers in need of this training be allowed release from teaching duties when necessary to complete the training.
- In 2004 an RSC study found that 65% of science laboratories were basic, uninspiring or unsafe. It is estimated that a £1.5 billion investment will be needed to bring school laboratories up to an acceptable standard for science teaching.⁷
- There is currently little provision in the FE sector for vocational and technician-level science based training.⁸ This has an impact on industrial laboratories and manufacturing plants as there is a shortage of skilled technicians. Regionally this is being addressed by apprenticeship schemes in the North West (Chemicol) and in the Yorkshire and Humber region (CATCH). These schemes are best done in partnership with industry and more of these schemes should be made available to FE students and those in employment.
- Despite the additional £75 million provide by government for teaching chemistry and physics at HE level over the next 3 years (starting 07/08) a funding gap does remain.⁹ It is also noteworthy that this additional funding is available in England only.
- Closure of certain departments can have significant impact on accessibility. Introduction of tuition fees has been accompanied by an increase in the number of students staying at home during their degree; therefore in some regions a student's choice to study chemistry may not be possible. The closure of single honours chemistry courses at QMC has had a significant impact on ethnic minorities in London.
- Since the decision to retain teaching of chemistry degrees at the University of Sussex, the number of departments seems to have stabilised, at least for the time being. Single honours chemistry provision has also returned at Universities that have previously abandoned it, including Queen Mary, University of London, the University of Central Lancashire, in Preston, and the University of Hertfordshire.
- Involvement of industry in undergraduate and postgraduate training is to be encouraged to enable graduates to be better prepared for employment after completion of their degrees. The benefits of sandwich degrees, in which undergraduate students industry placements, should be made more aware as they considerably enhance a graduate's employability in industry.
- There is currently an increase in the proportion of females in chemistry due to a decrease in the number of male chemists. Women, however, tend to stay in this

profession for a shorter period of time than male colleagues. The impact of this on the long term supply of trained scientists needs to be assessed.

The supply of Venture Capital

In its 2005 document '*Chemical Science Spin-outs from UK Universities: Review of Critical Success Factors*', the RSC highlighted the current situation with regards to Venture Capital (VC) funding and Chemical Science spin out companies:

- Chemistry and Materials related start-ups are not favoured by the VC community, primarily as they are viewed as being too remote from the end-market to allow strong control by the venture over its destiny.
- Exceptions to this statement are bio-related chemistry spin-outs and, more recently, 'green' chemistry spin-outs.

The British Venture Capital Association (BVCA) assessed the role of Venture Capital funding in relation to University spin-out companies in its 2005 report '*Creating Success from University Spin-outs*'. Some key findings in agreement with those of the RSC, include:

- *"a lack of appropriate quality management was the single most important inhibitor"*
- Venture capitalists would ideally prefer spin-outs companies to attract experienced entrepreneurs and managers.

International science and technology collaboration

The RSC is involved in the European Technology Platform for Sustainable Chemistry (SusChem) which is being financed under FP6. This platform has defined a Strategic Research Agenda and an Implementation Action Plan. Headlines from these documents have been taken up in the first calls under FP7. The RSC is concerned by the UK's relative lack of engagement in SusChem compared to other countries and recommends that UK companies pay attention to the advantages of cooperation in research, especially in applied areas, which are promoted by the European Research Area. If the UK is to remain competitive it is important that we cooperate with our European partners to reduce duplication and therefore the RSC believes that the UK should become a full member of ERA-NETS.

In order to help form research partnerships between European countries it is important that any double jeopardy issues are removed whereby partners in different countries are required to have their proposal reviewed by research councils in more than one country.

The RSC supports the formation of the European Research Council (ERC) and is pleased that proposals will be funded on the basis of excellence. The RSC also feels strongly that national research programmes should not be top sliced to fund the ERC

The RSC also work with bodies like the EPSRC in fostering international cooperation. Working with the EPSRC we have run workshops for leading younger chemists in the US, India and China. We believe that fostering this kind of cooperation through the research councils and the British Council is extremely important and is a good way of enriching the UK's science base.

One other area of cooperation is in national security. The RSC recently hosted an UK-US conference and workshop on Sensors. Again it is important that we encourage cooperation in order to meet some of the current security challenges that we face.

China and India are rapidly emerging as future science and technology heavyweights, and are of particular concern to the UK Government and Treasury.

The Royal Society of Chemistry (RSC) has been at the forefront of collaboration between UK scientists and those from a range of other countries. To-date it has signed international cooperation agreements with the Chinese Chemical Society (October 2006), the Chemical Research Society of India (February 2007), the Singapore national Institute of Chemistry (February 2007) and the South African Chemical Institute (February 2007). Under these agreements members of the societies automatically become partners in the RSC and a range

of international conferences and workshops have taken place to promote the exchange of ideas and to provide a forum in which collaborations can begin.

In March 2007 Japanese delegates visited the RSC with regard to the problems of falling numbers of students choosing to study the physical sciences and engineering subjects.

¹ <http://www.dti.gov.uk/files/file11959.pdf>

² http://www.dti.gov.uk/science/science-funding/budget/uk_research_base/page29207.html

³ http://www2.cst.gov.uk/cst/news/Files/nano_review.pdf

⁴ <http://www.rsc.org/ScienceAndTechnology/Policy/Documents/RSCresponsetoRCUK.asp>

⁵ <http://www.rsc.org/ScienceAndTechnology/Policy/Documents/KTandEIstrategy.asp>

⁶ <http://www.rsc.org/Education/Teachers/INSET/ChemNonSpec/index.asp>

⁷ <http://www.rsc.org/Education/Policy/Improving.asp>

⁸ <http://www.rsc.org/Education/Policy/Post16SkillsTraining.asp>

⁹ <http://www.rsc.org/Education/Policy/FutureSustainabilityHESector.asp>