

## **Science and Innovation Strategy for Scotland**

The Royal Society of Edinburgh (RSE) is pleased to respond to the Scottish Executive's consultation on a science and innovation strategy for Scotland. These comments have been compiled with the assistance of a group of Fellows under the direction of one of the Society's Vice-Presidents, Professor John Mavor, and endorsed by its Council.

The Society recognises education, research and innovation as the main drivers of the knowledge economy. Enhancing the relations and synergies between these drivers is central to improving the competitiveness of Scottish business. We welcome, therefore, the Executive's intention to develop a new science strategy, and to address the important subject of innovation. We share the view expressed by the Deputy First Minister, in his foreword to the consultation document, as to the importance of science and innovation to Scotland's future, but are not convinced that the consultation paper adequately addresses the need to develop the integrated knowledge triangle of education, research and innovation.

In taking forward the strategy, we agree that "science" should not be defined in a narrow sense, and we endorse the description set out in paragraph 10 of the Introduction to the consultation paper. The Society also welcomes the recognition implicit in the same section that "innovation" is not restricted in terms of process or of outcome to science and technology, and that R&D is only one possible input to innovation. In many cases a new, highly-competitive product or service is dependent not on an invention or technology breakthrough, but on a new technique or channel to market development. It is also important to recognise that there can be other important benefits of innovation than the purely monetary.

At present Scotland is disadvantaged by the lack of coordination across its science base. Although the Office of Science and Innovation has a UK remit, we greatly welcome the establishment of the Chief Scientific Adviser (CSA) post within the Executive and the opportunity this creates for the coordination essential for the successful implementation of the proposed strategy. It will be important that the strategy identifies not only what requires to be done, but also by whom and on what timescale. The Scottish Executive and its agencies will clearly have central roles, but other players will also be important, including the UK Research Councils and the business community. It is, therefore, essential that the strategy to emerge from this consultation is written in terms that will inspire these other key stakeholders, and attract their support.

The seven themes identified in the consultation paper appear appropriate to the high-level strategy that is proposed. However, in her foreword to the consultation paper the Chief Scientific Adviser identifies the need to ensure that science and innovation are developed in a responsible and sustainable way. Given the central importance of sustainability, its absence from the rest of the consultation paper is an omission that requires to be addressed.

The Society does not dissent from any of the aspirations set out for each of the themes, or from the action points. However, many other countries throughout the world are developing science strategies with similar aspirations supported by significant investment, and the important question is how Scotland maintains, and builds on, its current strengths in the face

of this growing competition. The strategy and its associated delivery plans must set down clearly how it is proposed to address each of the themes to deliver the aspirations, and how success will be measured. In developing fully-costed proposals, it will be important to draw on wider commercial experience and expertise than exists in the current stakeholder group.

The Society recognises that the quality of Scotland's science base is a major strength that must be maintained in real terms. In general, universities are now much more commercially aware than in the past, and all are actively engaged in knowledge transfer activities. However, there remains the potential for tighter collaboration between university researchers and industry and commerce to facilitate technology transfer and develop initiatives in education and training. We return to these topics later in this paper.

### **Theme 1: Maintaining and developing the excellence of the science research base**

Scotland's science base is recognised as excellent in world terms and, relative to its population, ahead of the rest of the UK and many other countries including the USA. It is vital that this excellence is maintained in order that Scotland continues to attract the leading research workers in their fields. These key people help drive progress to the benefit of the Scottish economy, and Scotland must do more to attract and retain such talent from around the world. Related to this is the requirement for investment in modern facilities appropriate to the pursuit of world-class research.

The RSE runs several prestigious postdoctoral Research Fellowship Schemes that attract and retain exceptionally talented researchers in Scotland. One of these Schemes is funded by the Scottish Executive and is involved in subjects likely to enhance the transfer of ideas and technology from the research community into wealth creation and improvement of the quality of life. We encourage the Scottish Executive to increase its support for this Scheme as was recommended in the Enderby Review which it commissioned.

There are areas in which Scottish research is internationally competitive, and there will be others with the potential to achieve this status reasonably quickly. Support for these areas is vital. Although there is a need to focus finite resources, excellent research should always be considered for support wherever it occurs within the science base. Picking winners is a vulnerable strategy and it is important to maintain a broad capability across all subjects in order to be able to identify, and take advantage of, developing technologies.

The Society welcomes the Executive's increase in funding for science over the last two Spending Reviews. It is important that these funds continue to be used in such a way as to lever the maximum funding from other sources to support and develop the Scottish science base. Scottish institutions have to compete for funds from outside Scotland, not least from the Research Councils and from the EU. Within Scotland, the Scottish Funding Council's research pooling initiative has proved a success and should be developed, as should the Council's Strategic Research Development Grant scheme. One objective should be to encourage HEIs to adopt more diverse objectives and roles, providing wider opportunities for collaboration with business. The KT grant is one tool for the encouragement of such diversity.

The consultation paper rightly recognises the need to ensure the Scottish science base is fully connected to UK funding bodies, and valued by them. In addition to alignment with the rest of the UK, engagement with other European countries and particular regions should be a high priority.

### **Theme 2: Enhancing international connections and capturing overseas investment**

There are two aspects of international connections. In addition to attracting overseas investment into Scotland, there are potential benefits to be had from attracting top

researchers to work in Scotland. Both can be encouraged by raising the international profile of the Scottish science base and establishing Scotland as a world-class location for research.

At present, individual universities attract visiting academics because of their reputations, but there is scope for a more coordinated approach. We welcome the recent announcement by the Secretary of State for Trade & Industry of a new Royal Society of London scheme to attract the best researchers to the UK. However, we would like to see a separate scheme, backed by the Scottish Executive, which would provide full funding for world-class students from overseas to study for PhDs at Scottish universities. The RSE would welcome the opportunity to work with the Executive in developing and running such a scheme. Under the Fresh Talent initiative, these students would be encouraged to stay on in Scotland for up to two years after completing their degrees. Some would continue in academia, strengthening the research base, and others would find employment outside, transferring knowledge and expanding business innovation. On returning to their own countries they would help to enhance the international connections of Scottish academia and business.

### **Theme 3: Intensifying knowledge exchange between academia and business**

We agree that knowledge exchange between academia and business is essential to innovation, and that more requires to be done to encourage this. Although knowledge exchange takes place through many channels, research both here and in the USA points to short courses and direct contacts between academics and business as the most effective ways in which to build lasting and productive relationships.

We referred earlier to the success of the Scottish Funding Council's research pooling initiative. This provides the opportunity for the establishment of new inter-disciplinary research platforms and the creation of the types of multi-disciplinary team that can respond to the needs of industry both within the UK and internationally. However, within the university sector we consider that there is generally too little core support for the development of commercially oriented R&D. The level of the KT grant is less than 10% of QR. Increasing this to 25% of QR would serve to give greater impetus to more applied research, and should translate into a more structured planning of such activity. This greater focus, and more overt emphasis, on commercialisation within universities would be reflected in academic appointments.

We understand that the schemes that exist to encourage collaboration between HEIs and indigenous companies, in particular SCORE and SEEKIT, work well although opportunities to reduce the associated bureaucracy should be investigated. However, they influence only a small proportion of the business base. Moreover, although helpful in initiating contacts between SMEs and HEIs, there is little support to help consolidate the partnerships formed.

Universities and colleges should be encouraged to develop knowledge of, and links with, their local economies, and this is probably best achieved through participation in their Local Enterprise Companies. However, we recognise that the most appropriate links will not always be at a local level, and that companies will wish to work with those institutions best able to assist them, wherever based.

We consider that universities should be encouraged to place more weight on the exploitation of their IP than on protecting their rights. Even those American institutions that have concentrated on protecting their IP seldom generate more than a few percent of their income from patents. We propose that consideration be given to developing a common framework for the exploitation of IP that would become a condition of receiving KT grant.

One of the most effective methods of KT is the movement of people from university research into industry and commerce. Universities have large numbers of postdoctoral researchers, mostly in the sciences and mostly on short-term contracts looking for permanent contracts. Encouragement for these people to take their knowledge and skills into the business

environment could be better for the economy than the creation of more permanent posts within universities.

Where no obvious business partner exists to exploit the results of particular research, spin-out companies from universities can be highly successful. A highly successful scheme to encourage entrepreneurship by younger researchers is the Enterprise Fellowship Scheme run by the RSE and funded by Scottish Enterprise and various UK Research Councils. This Scheme has a proven record in increasing the commercialisation of the Scottish academic research base and in creating sustainable companies with high-value jobs. Pending the outcome of a Scottish Enterprise review, making new appointments is on hold in Scotland. The RSE is keen to continue this Scheme which is an important component of the programmes that exist to enhance innovation and knowledge transfer.

#### **Theme 4: Expanding business innovation**

The low levels of investment in R&D by Scottish business have been well-documented. The failure of Scottish business to exploit the excellence of the science base is a major failing and the Society welcomes the current study being undertaken by the Scottish Science Advisory Committee (SSAC) into the strengths of the business R&D base in Scotland with a view to developing recommendations on how it might be enhanced and better supported, including by the science base.

It is important that this work is taken forward in an independent and non-partisan way following the winding-up of the SSAC. One organisation that might be appropriate to lead on this is Technology Ventures Scotland which is a forum for the essential exchange of information between the business and academic communities, promoting mutual understanding of their different perspectives.

Although we welcome the contribution made to innovation in Scotland by Connect and by the Intermediary Technology Institutes, there is a need to engage the business community directly in collaborating with researchers in the development of new products and processes. A useful first step towards this would be the involvement of organisations such as the Confederation of British Industry and the Institute of Directors in implementation of the strategy.

We suggest that a study be undertaken into the investment climate in Scotland, and its impact on innovation. R&D Tax Credits, which apply throughout UK, can be helpful in encouraging companies to invest and we welcome the proposed widening of the definition of R&D which should serve to increase uptake. However, there is scope for further fiscal measures to encourage investment in R&D. The lower level of corporation tax in Ireland, coupled with significant tax breaks for the exploitation of IP, provides it with a considerable competitive advantage that has been rewarded by the establishment of new R&D operations. It has been suggested that a similar fiscal regime should be introduced in Northern Ireland and there is a strong argument that, if this should happen, it should also apply in Scotland where similar competitive pressures apply.

It has been demonstrated that public procurement can be a powerful driver of increased skills and enhanced innovation in the economy. The strength of the public sector in Scotland offers the opportunity for significant use of procurement policy and practice to stimulate innovation, particularly in SMEs. We see scope for a small science/technology unit within the Scottish Executive to advise on procurement across the public sector with the aim of realising this potential.

In considering ways to expand business innovation, the importance of the service sector should not be overlooked. Innovation does take place in the service industries, albeit in a very different form to the laboratory-based R&D required by, for example, the manufacturing sector.

## **Theme 5: Modernising science education and promoting science careers**

The Society considers this to be the most important of the themes identified in the consultation paper, and also the one in which the Scottish Executive is placed to make the biggest impact. Both the Deputy First Minister and the Chief Scientific Adviser have referred to the importance of co-ordination and integration. Nowhere is this more relevant than in tackling the neglect of school science over recent years. The state of science education in Scottish schools is a major concern that can only be addressed by SEED working jointly with other Departments, in particular SEETLLD. There may even be an argument for bringing school education within the remit of the Minister for Enterprise and Lifelong Learning. The failure to tackle the fact that traditional science taught in traditional ways does not engage pupils today represents a very real threat to the place of science in society.

The Society's programme of events held throughout Scotland for primary and secondary school students seeks to complement the science curriculum, and to encourage this engagement by stimulating young people's interest in science, society and culture. This is an area in which we see considerable scope for development, and would welcome the opportunity to explore possibilities with the Executive. The Science Teaching Fellowship Scheme, funded by the Executive, is also relevant. Teachers who have an improved knowledge and understanding of research, and of the application of science in commerce and industry, are better able to convey to their pupils the excitement of science, and its relevance to all areas of life.

Although promoting science education and encouraging the supply of science graduates and technicians must be a priority for the Scottish Executive, there is a need for all pupils to have the opportunity to develop an understanding of the methods of science, an appreciation of the value of science and an understanding of how science contributes to everyday life. The current review of the science curriculum is of great importance, and should be accompanied by a review by SQA of examination practice. The aim should be to develop people with the ability to tackle and solve problems.

One area that should be pursued is the development of schemes to facilitate interaction and joint projects between schools and universities. The whole of the science base must take some responsibility for influencing the future generation of scientists, and there exists a real willingness within universities to contribute to school science education.

## **Theme 6: Increasing public engagement with science**

It will be critical to engage the public at an early stage if similar problems to those that have arisen in respect of subjects such as GMOs are to be avoided in other developing areas. This theme relates strongly to theme 5. A public that has had the benefit of a good science education will be more able to engage constructively with scientific issues. More immediately, initiatives such as the network of Scottish Science Centres and the Edinburgh International Science Festival provide vehicles for engaging the public in a proper discussion of the role of science in developing Scotland as a forward-looking nation. The Science Centres suffer from the fact that there is a significant charge for entry which discourages some potential visitors, particularly children from lower-income households. This contrasts with free admission to public museums and their science collections. If the Science Centres are to fulfil their potential, this anomaly must be addressed by the Scottish Executive.

One difficulty is the number of activities in this area, some of which are amateurish, all competing for limited funds. The quality of public engagement is important, and only those initiatives that have credibility with the public and the support of scientific community should be supported.

The potential of the internet should also be explored. Not only does it offer a universal source of scientific information, it provides a means of spreading awareness of the importance of

science to the well-being of the country. A dedicated Scottish “science and society” website, funded by the Scottish Executive, might be worthy of further consideration. If this is to have the necessary credibility, there would be advantage in it being hosted by an organisation of the independence and standing of the RSE.

### **Theme 7: Developing better use of science by government**

The post of Chief Scientist, or more recently Chief Scientific Adviser, is long-established in Whitehall departments but is a recent innovation in Scotland. Since 2002 the SSAC has provided independent advice to Scottish Executive Ministers on strategic science issues. The establishment of the SSAC was a bold initiative that the Society considers to have successfully filled a gap in informing policy development. The fact that the SSAC is independent of the Scottish Executive has offered it the opportunity not only to inform, but also to challenge, Ministerial policy. The appointment of the CSA at the centre of the Executive, within the Office of the Permanent Secretary, is a welcome development that helps address the SSAC’s concerns about the lack of “connectedness” within the Executive on scientific matters.

The CSA is in a strong position to help co-ordinate not only the Executive’s policies across all Departments relative to the implementation of the science and innovation strategy, but also scientific input into policy, again across Departments. In pursuing the latter objective, the CSA will wish to develop mechanisms whereby the Executive as a whole can draw on robust external scientific advice. This may be advice on specific areas of developing policy, or longer-term horizon scanning activity to identify areas of future relevance to the Scottish economy.

In its recent report “Scientific Advice, Risk and Evidence Based Policy Making”, the House of Commons Select Committee on Science and Technology identified the importance of ensuring that any advisory committee set up to support the work of a CSA should be independent, and seen to be so. To help safeguard this independence, the Select Committee went on to recommend that the secretariat should include secondees from appropriate scientific establishments. This lends support to our view that the appointment of a CSA within the Executive does not remove the need for the type of robust, independent scientific advice provided by the SSAC. As the Select Committee identified, there is ample room for greater involvement of the learned societies and professional bodies in the provision of scientific advice.

If scientific evidence and advice is to play its proper role in informing policy development, those providing policy advice to Ministers must be receptive to the input that the CSA can provide. We endorse the Select Committee’s recommendation that all senior officials and policy makers should have a basic understanding of the scientific method, the role and importance of peer review, the relevance of different types of evidence and how it should be evaluated.

### **Conclusion**

The Royal Society of Edinburgh is Scotland’s National Academy, with a Fellowship that includes elected scholars and practitioners from the fields of science, engineering, technology, the social sciences, business and commerce. The Society is, therefore, well-placed to assist in taking forward many of the actions identified in the consultation paper. We should be pleased for the opportunity to explore with the Executive how best the Society might be able to assist in the developing the strategy, and in its implementation.

December 2006