Response to the *Next steps* consultation on *Maximising the impact of science on innovation*

Summary of key points

From its inception, the Royal Society has been concerned and involved with the exploitation of science and technology, and has a range of schemes designed to encourage knowledge transfer from the science base set out on Annex A. Our plans for 2010, our 350th anniversary, include a significant increase in innovation support activities. The Society welcomes the major increase in funding made available to the science base in recent years, including major improvements to the research capital infrastructure, and the plans for future growth. This additional funding is an investment in the future, and the science base must respond by playing its full part in developing the UK economy. However, to exploit this investment fully, action by the science base will not be sufficient, it will also require effort by others elsewhere in the economy: in Government, in business and the in the financial sector.

While the Society's constituency is science and technology, including mathematics and the medical and engineering sciences, it wishes to emphasise the growing need to integrate fundamental research across all disciplines including the social sciences, and the arts and humanities in order to maximise the impact of publicly funded research on innovation.

The Lambert Review (Lambert 2003) and other commentators have confirmed that on most broad brush metrics the UK university sector is at least as engaged with business and exploitation as the US university sector. However, differences between the US economy and the situation in the UK and elsewhere in Europe mean that our universities are even more crucial to some aspects of innovation than are those in the US.

The critical aspects of academic/industrial interactions are not the transfer of single pieces of intellectual property but rather continuous interaction involving the development of networks and collaborations. These allow the incremental exchange of information and materials, both from academic institutions to business and in the opposite direction. The latter is an important aspect of research development and the implications of this need to be recognised and explored further

The Society has consistently stressed that the key feature of the science base is the people within it. It is therefore crucial to attract and retain the very best faculty within our universities – from leading-edge internationally renowned researchers and expert scholars in more mature areas, to bright and motivated young researchers.

Of particular concern to the UK's innovation agenda are the training, encouragement and motivation of more entrepreneurial leaders, who are needed to take forward novel ideas to successful products and services. Much attention has been given to the financing of university based spin-out companies, which is a particularly valuable mechanism for taking ideas towards the market, but successful spin-outs depend equally on having an excellent CEO and a robust business plan.

The Society also believes that the Government should have an in-depth review of its public procurement arrangements, including Treasury guidelines, with a view to encouraging more innovative approaches to public capital investment. Not only could more enlightened public procurement, with more emphasis on functional capability, provide an incentive to suppliers to propose innovative approaches, but over the lifetime

of the asset any increase in initial cost may well be much more than compensated by cheaper running costs and greater flexibility in use. As part of the review, the Government should consider whether it could expand and give greater publicity to the scheme to place R&D contracts with SMEs, based on the US Small Business Innovation Research (SBIR), which has been taken up in a limited way by UK Government Departments.

Q1 The Government would be interested in views about whether the existing framework for supporting science and innovation enables an appropriate level of risk-taking, and if not, suggestions of how any gap might be addressed.

Scientists more readily take risks with their research if they have long term and generous funding. Many of the successful spin-outs and research collaborations with industry have come from those with well-funded programme grants. Long-term funding enables Principal Investigators to conduct research programmes which go way beyond the original case for support. In fact the success of research is facilitated by funding the individual, and allowing them flexibility with the research programme over at least five year periods. Research funding bodies that monitor outputs too closely against the original proposals actually provide a very negative effect on any risk-taking. The balance between shorter term grants for specific projects, which are essential for young researchers, and longer term grants for larger research programmes should be explored.

An impediment to risk taking is the need for postdoctoral researchers and graduate students to produce publishable results in short periods of time or prejudice their own careers. While the Principal Investigator's career will not necessarily be damaged if he or she pursues risky projects as long as some of them are successful, this is not true for those who are actually engaged in carrying out the risky projects that fail. Young scientists cannot afford to fail, especially if their employment is only short term. Every Research Council should come forward with arrangements for addressing this issue, whether through separate funding schemes, special initiatives or criteria for their peer review bodies.

Q2 The Government invites views on measures to remove any remaining bias which unfairly favours established research fields over innovative ones. The Government also invites views on how funding mechanisms can be made more responsive to new research challenges.

There is a potential for peer review panels to self-replicate their own ideas, especially if they are under the pressure of too short-term objectives. The Research Councils have taken some steps to reduce the problem, but should be continually aware of the need to monitor the situation, including whether further joint committees or panels are required.

Within universities, good research leaders will recruit, where appropriate, post-doctoral researchers and research students from a multitude of different disciplines. For example major biotechnology groups may include mathematicians, engineers, physicists, chemists as well as a variety of biologically and clinically trained individuals. Such research leaders need the support of longer term programme grants. False emphasis on interdepartmental collaborations, while ignoring genuinely multidisciplinary teams can be counterproductive.

Q3 The Government would welcome views on the barriers limiting greater business innovation and business-university collaboration in the regions, and on what more could be done on a national and regional level to tackle these barriers effectively.

The UK needs to have the correct balance between the support of innovative activities of national and regional importance. Large firms will seek out the best universities wherever they are in the world and the UK must ensure that a significant number remain here. There is also a need to build up clusters of innovation surrounding real powerhouses of university research. However, it is also crucial to be able to support SMEs throughout the UK, and these firms will be highly reliant on their local universities. This places a constraint on the limits of selectivity in the overall support for university research, with implications for example for the selectivity applied to HE Funding Council research money and the importance of RDA support for research capability.

Q4 The Government would welcome views – in particular from outside Higher Education - which can be taken into account in developing best practice models for business university collaboration. In addition, the Government would welcome views on how to encourage businesses to work with universities for the first time, perhaps by introducing short-term, low-cost mechanisms for business-university interaction.

There are various schemes and tax regimes in the UK designed to encourage R&D within firms, especially SMEs, which are often the suppliers of new technology and innovation to larger firms. However, these schemes are not competitive with similar schemes in other countries, especially over the respective public and private sector contributions. For example, collaborative research between universities and business has in some countries a more attractive leverage of public funding to business.

The Knowledge Transfer Partnerships (KTPs), previously called the Teaching Company Scheme, has proved its worth over the years in transferring knowledge from universities, building up links between universities and business, and in training new graduates. Apart from building on the KTP scheme, OSI needs to an overall framework to facilitate the frequent interaction of academics, young entrepreneurial scientists from academia and industry, experienced industrial researchers and venture capitalists.

1. INTRODUCTION

The Royal Society welcomes the opportunity to respond to the Government's consultation over Chapter 2 of its document *Science and innovation investment framework 2004–14*: Next Steps (referred to in the remainder of this document as *Next Steps)*.

From its inception, the Royal Society has been concerned and involved with the exploitation of science and technology. It currently has a range of relatively modest but effective activities designed to contribute to knowledge transfer from the science base as set out in annex A. The Society's plans for 2010, its 350th anniversary, include a significant expansion of support for innovation. The Society welcomes the major increase in funding made available to the science base, including major improvements to the research capital infrastructure, and the plans for future growth. These increases are an investment in the future, and the science base must respond in playing its full part in developing the UK economy. However, to exploit this investment fully will require effort not just on the part of the science base, but also by others elsewhere in the economy: in Government, in business and in the financial sector.

While the Royal Society's constituency is science and technology, including mathematics and the medical and engineering sciences, there is a growing need to integrate fundamental research across all disciplines including the social sciences, the arts and humanities. This is now reflected in the family of Research Councils including the AHRC that are supported by the science budget. In this document, the science base should be taken to include all of the research undertaken by universities and research council and charity institutes, and the knowledge and skills residing within that base. The S&T community may have lessons to learn from the Royal College of Art and from fine arts departments within the universities on engendering entrepreneurial spirit in their students.

1.1 The Science Base

The Society has consistently stressed that the key feature of the science base is the people within it, and it is therefore crucial to attract and retain the very best faculty within our universities. This means not only leading edge internationally renowned researchers, but also expert scholars who understand areas of science which, although no longer fashionable or at the leading edge of research, underpin major areas of science and technology – for example, construction, thermodynamics and whole animal biology. Furthermore, it is essential to ensure the continuing retention of some of the best young people within the science base, and to ensure that their lack of a track record does not hinder their development.

It is important to recognise the full contribution the science base makes to the development of the UK economy, which goes far wider than the traditional technology transfer emphasis on patenting and licensing. This contribution includes:

- A continuing supply of highly qualified specialists, from first degree graduates through to post doctoral researchers;
- New ideas emerging from the science base;
- Access to and understanding of new ideas emerging from the more than 90% of world research that is conducted outside the UK;
- Advice and development of existing ideas, techniques and technological skills – the science base is a dynamic repository beyond the formalised information available within libraries;
- Attraction of new foreign investment and retention of existing foreign and indigenous investment.

Another factor can be added to this wide diversity of university contributions to business innovation – what Richard Lester from MIT (Lester 2006) has termed the "Provision of Public Space" for the formation and accessing of networks and the stimulation of the direction of industry development pathways, through, for example, meetings, conferences and forums, personnel exchanges, and industrial liaison programmes.

The Lambert Review (Lambert 2003) and other commentators have confirmed that on most broad brush metrics the UK university sector is at least as engaged with business and exploitation as the US university sector. However, the UK and indeed European economies differ than the situation in the US, which if anything increases the importance of our universities as significant drivers of innovation.

Finally, the generation of new ideas is not, of course, exclusive to the science base. New ideas develop in industry and the public services, and ideas generated by potential users can often be stimulating input to the science base. Since this two way interaction benefits all the participants, it is can be a major spur to university/business interaction.

2 LINKING SCIENCE AND INNOVATION IN CENTRAL GOVERNMENT

Improvements in "joined up" thinking across Government are essential in most areas of public policy and particularly so in this area. To a large extent, whether the OSI will deliver on its enlarged responsibilities will depend on whether it maintains and develops the existing links between the former OST and other Departments; in particular, with DfES and the Education Departments of the devolved administrations, and the many other Government Departments that depend on the output from the science base. It is essential to guard against OSI becoming identified too closely with specific DTI and "English" issues, rather than the science and innovation needs of the Government and wider UK economy as a whole.

Exploring best practice in other countries is always worthwhile, and the situation particularly in Finland and Sweden was examined in a report by the European Academies Science Advisory Committee in a report in 2004 (EASAC 2004). However, the Society is concerned that although lessons may be learned from the example of Finland quoted in the *Next Steps* document, the implications of the major differences between the UK and Finnish economies should also be taken into account. The UK has a much higher population and more diverse an economy than Finland, which is highly dependent on the electronics industry.

The Society has from the beginning supported the various schemes for encouraging knowledge transfer between universities and business that are now consolidated in three DTI schemes: The Higher Education Innovation Fund (HEIF); Knowledge Transfer Partnerships (KTPs); and Knowledge Transfer Networks (KTNs). In particular, the KTPs (formerly Teaching Company Scheme) projects are recognised as providing a well tuned and flexible structure for knowledge transfer, especially to SMEs.

3 INCENTIVISING HIGH-RISK HIGH-IMPACT RESEARCH

As the *Next Steps* document acknowledges, major advances in innovation are often the result of bringing together advances in disparate disciplines. Sometimes this convergence is at the fundamental research level,

but in many cases the merging of ideas takes place nearer to the market within existing firms or start-up or spin out firms.

Within universities, good research leaders will recruit, where appropriate, post-doctoral researchers and research students from a multitude of different disciplines. For example, major biotechnology groups may include mathematicians, engineers, physicists, chemists as well as a variety of biologically and clinically trained individuals. False emphasis on interdepartmental collaborations while ignoring genuinely multidisciplinary teams is counterproductive. Bright people, for example Crick and Watson, have always moved to where the action is.

An unfortunate detail of the current Research Assessment Exercise, which warrants further consideration by the Funding Councils, is that it seems to disadvantage multidisciplinary investigator papers, by discouraging submission of the same paper by more than one investigator in the same institution. This acts as a disincentive to multidisciplinary and novel research, and is causing real tensions in universities where quite often clinical, biological and chemical scientists have collaborated on major innovative papers published in Nature, Science, Cell, and other high impact journals.

> **Q1.** ***The Government would be interested in views about whether the existing framework for supporting science and innovation enables an appropriate level of risk-taking, and if not, suggestions of how any gap might be addressed.***

This is not just a funding issue. A further major impediment to risk taking is the need for postdoctoral researchers and graduate students to produce publishable results in short periods of time or prejudice their own careers. While the Principal Investigator's (PI) career will not necessarily be damaged if he or she pursues risky projects as long as some of them are successful, this is not true for those who are actually engaged in carrying out the risky projects that fail. Young scientists cannot afford to fail, especially if they are on short term contracts. Furthermore, pressure may arise, real or imagined, to achieve short term measures of research quality.

Scientists take risks with their research if they have long term and generous funding. Many of the successful spin-outs and research collaborations with industry have come from those with well-funded programme grants, either from the Research Councils, or increasingly in the biological area from the Wellcome Trust or CR-UK. Examples include Kudos, Chroma, Biotica and Astex. Long-term funding enables the PIs to conduct research programmes which go way beyond the case for support. Some Research Councils have already shown the success that can be achieved by funding the individual and allowing flexibility with the research programme over at least five year periods. Research funding bodies that monitor outputs closely against the original proposals actually provide a very negative effect on any risk-taking. The Councils should review of the balance between longer term programme funding for established successful researchers, and smaller and short term (3 years) project grants, which are nevertheless invaluable for aiding other researchers establish their credentials for longer term programme funding. Every Research Council should come forward with arrangements for addressing the problem of risk for young researchers, whether through separate funding schemes, special initiatives or criteria for their peer review bodies.

As far as risk taking closer to the market is concerned, for innovation investment there must be an acceptance that projects may fail to succeed in the market. Indeed if all were to succeed then clearly there was not enough risk taking and perhaps more of the projects should have been privately funded. That is not

to belittle the need to ensure that failure is not the result of inadequate finance or management or marketing expertise.

The role of public procurement, and SBIR type schemes are considered in the next section. Tax incentives for firms also have a role to play, and possibly the Government sharing of private sector risk through provision of loans, repayable on market success.

> ***Q2. The Government invites views on measures to remove any remaining bias which unfairly favours established research fields over innovative ones. The Government also invites views on how funding mechanisms can be made more responsive to new research challenges.***

As implied in this question, the Research Councils have put in place a number of special initiatives and advice to their peer review bodies to address the problem of members self-replicating their own ideas. However, this is to a certain extent a cultural problem, and the Councils need to be continually alert to the issue. There may also need to be more joint committees between two or more Councils empowered to take decisions.

4 ENCOURAGING BUSINESS INVESTMENT IN R&D

4.1 The university-business interface

Discussion of the role that should be played by the science base in encouraging business investment in R&D often overlooks the fact that the most important aspects of academic/industrial interactions in terms of impact are not the transfer of single pieces of intellectual property, but rather continuous interaction involving the development of networks and collaborations. This allows the incremental exchange of information and materials, both from academic institutions to business and in the opposite direction. The latter is an important aspect of research development and quite often overlooked by those developing policies.

Best practice models for business/university collaboration must include encouragement of such networking, which should comprise:

a. Outstanding young scientists in their 30s and 40s. The best spin outs and collaborations will be initiated by outstanding researchers whose ambition is both to succeed in basic science, and to contribute something useful.

b. Senior academics acting as role models. These will include successful entrepreneurs and academic research leaders who can short cut university bureaucracy and protect research of younger scientists.

c. Young researchers in large companies. These individuals will often have been taught by the senior academics and have kept good research links, collaborations with the universities.

d. Senior retired large-company researchers. Many researchers retire early and act as consultants and sit on advisory boards. Many will be long-term collaborators of the university academics.

e. Young recently graduated researchers. These are the products from the university who choose to establish themselves in the spin-out community, often subsequently moving jobs between small

companies and larger companies every four or five years. Their ambitions will often be to lead their own companies.

f. Venture capitalists. The best for science are scientists, who are well networked into the academic, small company and large company communities, as well as the financial sector.

Networks are created through genuine collaborations developing from the exchange of ideas, materials and long-term collaborations. These develop proper understanding and trust between the individuals concerned. Facilitating the formation of such networks should be a major objective for OSI.

4.2 Routes for exploitation from the science base

It is helpful to consider three different aspects of the exploitation of the new ideas and the existing knowledge within the science base, although in any particular case of innovation there may be a combination of these:

a. ensuring that high technology businesses in the UK (irrespective of ownership) make full use of the UK science base. However, such firms should also maintain and develop their own applied research and development capability. Although there is scope for sub-contracting to the science base and other firms including suppliers, it is essential for firms to retain an understanding of the role of relevant technologies for their business;

b. increasing innovation in less high technology sectors, where the underlying technology may well not be from leading edge research, but the firm may benefit from the background knowledge within the science base, for example, in the construction industry;

c. the transfer of new ideas from the science base when there is no obvious initial business partner or other business interest.

The last of these may require the establishment of a new company or joint venture and is discussed further in section 4.3. In the case of the first two of these, the relationship between universities and businesses discussed above are clearly of fundamental importance. There are various schemes and tax regimes in the UK designed to encourage R&D within firms, especially SMEs, which are often the suppliers of new technology and innovation to larger firms.

However, these schemes are not competitive with similar schemes in other countries, especially over the respective public and private sector contributions. For example, collaborative research between universities and business in some other countries within the EU has a more attractive leverage of public funding to business. Typically LINK type schemes require 50% matching funds, whereas in Ireland the CSET centres (industry linked) only require 20% matching funds. Under these circumstances, it is quite easy to get industrial partners with real input and interest, yet maintain the research freedom of action in choice of subject and projects for the University staff. For example, the CRANN centre in Dublin has £25M research funding, involving partnerships with Intel and HP. Once a centre is running, industry usually increases its support, tending to over 30%. Similar centres in the US also require less than 50% matching funds, From industry's perspective the leverage difference is huge – a factor of 2 in the UK, compared with a factor of 5 in Ireland.

As the Next Steps document implies, more can be done over the use of public procurement to encourage innovative approaches to capital investment. Not only could more enlightened public procurement, with greater emphasis on functional capability, provide an incentive to suppliers to propose innovative approaches, over the lifetime of the asset any increase in initial cost may well be much more than compensated by cheaper running costs and greater appropriate flexibility and facilities. As part of the review, the Government should consider whether it could expand and give greater publicity to the scheme to place R&D contracts with SMEs, based on the US Small Business Innovation Research (SBIR), which has been taken up in a limited way by UK Government Departments.

The Society notes that while the Government rightly stresses the UK's fundamental role in the development of medical imaging (which extends well beyond the magnetic resonance techniques mentioned in box 2.2, and, for example, includes for example the work of the late Sir Godfrey Houndsfield at EMI on X-ray tomography) the benefits to the UK business would have been significantly greater if the full potential for the devices to the NHS had been recognised in more enlightened public procurement, with less concentration on the more immediate benefits. It is essential that the full potential of the NHS is realised to pull through new devices from the UK's now small but dynamic medical instrumentation sector. There are no doubt examples from other areas.

The private financing of high technology firms at all levels from SME to those in the FTSE100 is the subject of a review chaired by Sir Peter Williams and involving the Engineering Technology Board, the Society, the Royal Academy of Engineering, and a range of financial service organisations. This group will report in the early summer.

4.3 The balance between licensing and spin out activities by universities.

The Lambert Review (Lambert 2003) and other commentators have confirmed that on most broad brush metrics the UK university sector is at least as engaged with business and exploitation as the US university sector.
There has been debate as to whether the Government has overstressed the importance of spin-out activity from universities in comparison with licensing to existing business. For example, Lambert points to a different balance in the US, where licensing predominates. However, it is important to recognise that there are two major differences from the situation within the US. Firstly, within the US there is a much better developed existing business sector eager to take up ideas arising from the universities, including foreign universities, than is the case generally within the UK or elsewhere in Europe. This creates a greater need for spin-out/start up companies to take forward these ideas towards the market place. The fundamental requirement is the proof of concept in order to attract licensing agreements or investment capital to take the development further forward to a satisfactory exit strategy. Secondly, compared with the US there are fewer entrepreneurs outside of the universities looking for opportunities to establish new companies.

Hence, for the present, at least, in the UK and wider EU contexts the universities may well have to take a major role in the creation of new businesses. This will require further consideration of ways to increase the ease with which companies can be spun out from universities. It will also require an increase in the finance available for satisfactory exit strategies for successful spin-out ventures, and for the growing of successful medium sized companies into significant entities either within a larger company with a UK (or European) base or as a company in their own right.

Most attention has been given to the financing of such university based spin-out companies, but successful spin outs depend at least as much on the choice of CEO and on having a robust business plan. There are, especially within academic environments with a long record of successful exploitation and spin-out activity, some academics who have proved to be particularly successful in managing such activities. Successful spin-out companies have often been founded jointly by academics and researchers with experience of large companies who have previously collaborated together. They have then employed young people from their laboratories, attracted young entrepreneurial scientists from the large (pharmaceutical) companies, invited experienced industrial researchers whom they have worked with earlier onto main boards and science advisory boards, and interacted with venture capitalists. Any innovative framework has to facilitate the frequent interaction of such individuals; this should be a major objective of OSI.

However, by no means all academics with suitable ideas for exploitation are either willing, or have the expertise and experience to act as CEO, and it is thus important to address the shortage of available management expertise. The Society is also concerned about the difficulties faced by both innovative companies and their customers recruiting specialist technical staff. Specialised masters courses are one source of such expertise, but it has become increasingly difficult to obtain grants for these as Research Council training funding has been increasingly directed at PhDs.

4.4 Intellectual Property

The Society agrees that proper control of IP is an essential foundation to underpinning the knowledge economy. However, this is a complex area, and as experience in the US has shown (at least within that economy) a portfolio of different arrangements are required to cover different situations. Furthermore, it is also important that the necessary exceptions required to ensure that education, private study, scholarship and research are not diminished either by new legislation or new technological IP management devices that frustrate such exceptions (Royal Society 2003).

5 MARKETING THE UK SCIENCE BASE

The science base is an important factor in attracting inward investment to the UK. Historically, the UK has been successful in attracting foreign investment in R&D. The science base also plays a key role in retaining existing investment by indigenous and existing foreign owned UK firms. However, the fact that the UK's gross expenditure on R&D as a proportion of GDP, which is low compared with our main competitors, contains such a significant component financed from abroad, leave the UK vulnerable. UK and wider European based firms are increasing their investment outside of Europe, and this export of funding can only accelerate as the Chinese and Indian economies expand. Much effort will be required to secure offsetting inflows of investment into the UK.

6 BUILDING INTERNATIONAL LINKS

This aspect of the science base has already been stressed in the introduction, and will become increasingly important. The Society agrees that it is essential to increase links with China and India, but is surprised that no mention was made of links with top universities elsewhere in Europe.

The role of the science base in providing a link to work originating outside of the UK can be enhanced by its involvement with international initiatives.

7 SUPPORTING INNOVATION IN THE REGIONS

Q3. The Government would welcome views on the barriers limiting greater business innovation and business-university collaboration in the regions, and on what more could be done on a national and regional level to tackle these barriers effectively.

The UK needs to have the correct balance between the support of innovative activities of national and regional importance. Large firms will seek out the best universities wherever they are in the world and the UK must ensure that a significant number of comprehensive world class institutions remain in the UK. There is a need to build up clusters of innovation, often of SMEs, surrounding real powerhouses of university research, which must be supported. Many, but by no means all, of these will be within the London, Oxford and Cambridge triangle, and the creation of the N8 group of universities[1] also creates a critical mass of research excellence. However, it is also crucial to have specialist clusters elsewhere in the UK, and to support SMEs throughout the UK. Technology based SMEs are highly reliant on their local universities. This places a constraint on the limits of selectivity in the overall support for university research, with implications for example for the selectivity applied to HE Funding Council research money and the importance of RDA support for research capability.

The Society's response to the Lambert report stressed the crucial role for the RDAs, particularly in facilitating the development of building bridges between universities and business in their region, and in identifying university research capability of strategic importance to their plans for regional development...

8 FURTHER SUPPORT FOR BUSINESS – UNIVERSITY INTERACTION

Q4. The Government would welcome views – in particular from outside Higher Education - which can be taken into account in developing best practice models for business-university collaboration. In addition, the Government would welcome views on how to encourage businesses to work with universities for the first time, perhaps by introducing short-term, low-cost mechanisms for business-university interaction.

Since the requirements of business vary, a range of options is required. The role of interactions with the science base are set out in section 4, and need to take account of the wide range of outputs from the science base set out in section 1.1 and to consider both national and regional scale activities. Furthermore, policy needs to take account of the fact that UK business includes fewer S&T based firms than in many other advanced countries and that within the UK economy there is a significantly lower demand from UK business for early stage novel high technology ideas than in the US.

There are various schemes and tax regimes in the UK designed to encourage R&D within firms, especially SMEs, which are often the suppliers of new technology and innovation to larger firms. However, as discussed in section 4.2 these schemes are not as generous or competitive as some similar schemes in other countries, especially over the respective public and private sector contributions. For example, collaborative research between universities and business has in some countries a more attractive leverage of public funding to business.

[1] The N8 group comprises the Universities of Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York.

As far as national scale is concerned, the experience from the Cambridge MIT activities indicates that a key way forward is to encourage critical mass projects that draw in the complete supply chain in certain areas, so that the businesses help each other while working together with the universities. The aim is to build a community that integrates knowledge (mission research, pedagogical reform and industrial outreach) around an issue and project that goes to the heart of future prosperity.

The Knowledge Transfer Partnerships (KTPs), previously called the Teaching Company Scheme, has proved its worth over the years in transferring knowledge from universities, building up links between universities and business, and in training new graduates. More generally, an overall framework is needed to facilitate the frequent interaction of academics, young entrepreneurial scientists from academia and industry, experienced industrial researchers and venture capitalists. In less integrated areas, placements of business staff in universities and of academics in business creates better mutual understanding of the other sector's potential and problems. The offering by business of short or year long sandwich placements for undergraduate work experience is not only important for the student experience, it should also be used to develop firmer interactions between the faculty and business staff. Facilitating such interactions should be a major objective of OSI.

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Annex A

Royal Society Activities to Support Innovation

Overview

The Royal Society promotes innovation and wealth creation through science in three distinct, but complementary ways. In its first role it operates as an independent academy, to promote awareness of science and technology issues in the UK – including the key underpinning importance of science and technology education. As an independent academy, the Royal Society also provides professional support to the scientific community – including training for researchers in innovation and entrepreneurship.

In a second role, the Royal Society comments on policy issues ranging from the role of intellectual property in science to tax credits for small/medium enterprises. The Society has a programme of activities to take such links forward and of submitting ideas and responding to consultations on the development of relevant Government and EU policy in this area.

In its third role, the Royal Society is committed to supporting and recognising innovative science through a range of funding schemes and awards. The Society has a strong track record and devotes substantial resources to advancing excellence through identifying and supporting future leaders in science.

As well as supporting creative and innovative science, the Society has begun to develop programmes to encourage technology transfer between the UK's science, engineering and industrial bases.

Courses for Fellowship Holders

The Royal Society offers a range of training programmes to its University Fellows, a group of approximately 400 leading university researchers. In 2006 the Royal Society, together with the Tanaka Business School, offered a business programme, which covers science-based innovation, leadership skills and entrepreneurship. The twelve month course is made up of two three-day modules and one two day module, and the first module has just received a glowing evaluation from the 21 members of its inaugural cohort.

This tailor-made programme was designed for the Royal Society as part of its response to the Lambert Review of Business-University Collaboration. The Royal Society requested a training programme that would help young scientists to work more effectively with business and to target the market with their research. Each module consists of sessions taught by Tanaka Business School faculty and workshops lead by scientists, entrepreneurs and industry heads that have extensive experience of the challenges involved in transforming inventions into products. For example, John Kay, a leading economist spoke to participants during the first module, and Sir Peter Williams, who made a major contribution to developing Oxford Instruments Group plc, which originated as a spin-out company from the University of Oxford.

Industry Fellowships

The Royal Society's Industry Fellowships are funded are funded by the Royal Society, the Engineering and Physical Sciences Research Council, the Biotechnology and Biological Sciences Research Council, the Natural Environment Research Council, Rolls-Royce plc and Astra Zeneca. The Scheme aims to enhance knowledge transfer in science and technology between those in industry and those in academia. It provides opportunities

for an academic scientist to work on a collaborative project with industry, or someone employed in industry to work on a collaborative project with a university department or a not-for-profit research organisation. It is anticipated that fellows will establish personal and corporate links between the two sectors in the UK as a foundation for their long-term future development.

Highlighting Innovation - Labs to Riches

Labs to Riches is an annual Royal Society event, bringing together past and present Royal Society-funded scientists to share and discuss their experiences of commercialisation. This event, by bringing together a mixture of academic entrepreneurs, financiers, journalists and prominent industry figures, help our scientists build up the skills and contacts to facilitate technology transfer and the commercialisation of scientific research.

The Brian Mercer awards for innovation

The Brian Mercer Awards for Innovation provide up to £250,000 to develop ideas, products or processes relating to nanotechnology and/or the built environment. They enable individuals or groups to investigate the commercialisation of a particular element of their research from concept to the creation of a near-market product for commercial exploitation, in conjunction with a third party.

Mercer Feasibility Awards provide smaller amounts to enable recipients to look at the technical and economical feasibility of commercialising an aspect of their scientific research.

The Mullard award

The Mullard Award has been given annually since 1967 to a scientist, engineer or technologist whose work is currently making or has the potential to make a contribution to national prosperity in the United Kingdom. The Award is aimed at younger scientists, engineers and technologists, typically in their early to mid thirties.

Innovation Panel

The Royal Society is in the process of establishing an Innovation Panel to be chaired by Professor John Burland, and supported by an Innovation Advisory Network. The purpose of the proposed Panel is twofold: on the one hand, it would take decisions on innovation awards and prizes; on the other the Panel would advise Council on Royal Society innovation strategies.

In order to support the Panel and to guarantee a readily available wide range of knowledge and business expertise both award decisions, strategy formulation and review knowledge transfer plans, the establishment of an Innovation Advisory Network is recommended. Such an approach would also follow current practice expected by Government from Research Councils.