RCUK Response to the Lambert Review of Business-University Collaboration (April 2003)

Background

Research Councils UK is a strategic partnership set up to champion the science, engineering and technology supported by the seven UK Research Councils. Through RCUK the Research Councils are working together with the Arts and Humanities Research Board (AHRB) to create a common framework for research, training and knowledge transfer. RCUK was launched on 1 May 2002 and further details are available at www.rcuk.ac.uk

The RCUK strategy group leads this partnership and is chaired by the Director General of the Research Councils. The members are the Research Councils' Chief Executives and the AHRB Chief Executive attends meetings as an observer.

This evidence is submitted on behalf of the seven Research Councils (BBSRC, CCLRC, EPSRC, ESRC, MRC, NERC and PPARC) and represents their independent views. It does not include or necessarily reflect the views of the Office of Science and Technology. The Arts and Humanities Research Board will, on this occasion, be responding separately.

Introduction

The Research Councils welcome the opportunity to contribute to this review of business-university collaboration, studied from the business side. Knowledge transfer is one of three key areas of Research Council investment. Knowledge transfer, as we understand it, encompasses the processes by which knowledge, expertise and skilled people transfer between the research environment and its user communities (in industry, commerce, the public and service sectors) as a basis for economic prosperity and to meet the policy needs of Government Departments and regulatory bodies. As such, knowledge transfer covers a major fraction of the activities usually referred to as "third stream". You will recognise that as Research Councils we are most knowledgeable about the universities and our Research Council institutes – the "research environment" referred to above. Your review focussing, as it does, on the demand side – exploring how business can best exploit the technologies and skills which are being developed in the university sector – will be particularly important in offering a complementary perspective.

Distinctive Roles

Public sector support for business-university collaboration includes three major providers, in the form of the Research Councils, the OST and the DTI. Each of these funders makes a distinctive contribution to promoting a climate in which the UK is able to make the most of its investment in SET. The Research Councils' activities are

centred on the research communities which they support in universities and institutes, and the relationships are, therefore, with individual researchers and research teams. The OST, often working with HEFCE, funds the organisations (universities and institutes), creating the institutional capacity to assist the successful transformation of good university research into business and other users, and to reap the economic and wider potential of public sector research establishments. DTI's locus is predominantly in the area of stimulating industrial pull.

University Responsiveness

University research in the UK is now accepted as a key source of the ideas and inventions which are a precursor to the innovative new products and services on which our future productivity and economic growth depend. Universities and their staff have demonstrated a growing willingness to understand the external context of their work, and to engage with their user communities. They have successfully diversified their funding base working with other partners, outside Government, to the extent that third parties now provide universities with over 40% of their funding for research, compared with less than 25% in 1988/89 *(Investing in Innovation, July 2002).* They are alert to the Regional Development Agencies and the devolved administrations, and give close and growing attention to knowledge transfer. Evidence of the changed attitudes in universities is provided in the latest Higher Education – Business Interaction survey for the academic year 2000/01. Some of the main findings, compared with the previous year, include:

- an around 25% increase in Intellectual Property disclosure
- a more than 20% increase in patents granted
- an over 30% increase in licences to UK companies
- a 20% increase in spin-off companies
- over 40% of HEIs offering incubation or "start-up" facilities

Future surveys may show even greater progress as the effects of "third stream" funding initiatives begin to kick in.

This willingness to work with many sponsors has not been without its problems. The pursuit of increasing volumes of research with insufficient regard for long term viability led to a growing funding gap and under-investment in research infrastructure. The gap is now being closed so that from 2005/06 university research can be put on a sustainable footing. It will mean that all research funders, not just the Research Councils, will need to pay higher prices for the research that they require.

Research Council Practice

<u>Selectivity and Relevance</u>

The Research Councils support the best research wherever it may be based and there is a trend towards greater selectivity as the demand has increased in recent years. The extent to which support is concentrated in research intensive universities is shown in the Table below. In promoting relevance, Research Councils consult widely and take account of nationally agreed priorities, such as Foresight. Industrialists provide a major contribution to decision making both through professional bodies and business

organisations and individually through membership of Research Council bodies and in refereeing individual projects. The Research Councils are also active participants in the CBI's Intercompany Academic Relations Group (ICARG), which brings together academic relations managers from major companies on a regular basis.

Table: Distribution of RC Spends at Universities

	First 5 universities	First 10 universities
EPSRC	25%	41%
MRC	48%	68%
BBSRC	32%	53%
ESRC	25%	40%
NERC	35%	55%
PPARC	42%	69%

Standard Schemes and Flexibility

The Research Councils use a common set of schemes to promote business-university collaboration. They are few in number and cover both research and collaborative postgraduate training. The majority are long-standing schemes (LINK, TCS, CASE, Industrial CASE, Faraday Partnerships), which are well known in industrial and academic circles. Schemes are valuable up to a point, but their significance can be overstated. They provide a valuable framework for new entrants to collaborative working, as well as for the individual company or university scientist who can be assured that their particular project is being set up on the correct lines. But set schemes need not be the only terms on which businesses can engage. The Research Councils have the flexibility and the will to develop programmes that fit the needs of the research as well as the partner organisations. These arrangements not only leverage additional funding to put alongside our own to strengthen the investment in university research but facilitate the flow of research outcomes into business and the economy. There is considerable scope for forging flexible partnerships on the following conditions:

- Research Council funds are placed with universities or equivalents
- all funded projects will be in the public domain
- all projects will undergo an independent quality check
- no exclusive agreements with a single company in any sector
- outputs will be exploited whenever possible and a collaboration agreement should be in place

Reducing Barriers

One of the remaining barriers to the take-up and commercialisation of research results is a lack of funds to demonstrate proof of concept. There is some funding available through schemes, such as HEIF, University Challenge, SMART and the Scottish Enterprise Proof of Concept Fund. The Quinquennial Review of the Research Councils emphasised the duty of Research Councils to encourage knowledge transfer and the intention is to establish a cross-Research Councils Proof of Concept Fund.

Currently, Intellectual Property Rights arising from research usually lie with the university or institute, as appropriate. Many have dedicated staff in, for example, Industrial Liaison Offices, with expertise to interact with industry. There is anecdotal evidence to suggest that greater training in best practice would be desirable (the recent Business Interface Training Provision review confirmed this perception).

There are concerns that an inadvertent effect of the recent Higher Education White Paper may be to divert funding and attention away from knowledge transfer in the main research institutions where the Research Councils invest most of their funding. The impact of student debt and uncertain career progression for researchers will also potentially reduce provision of skills in the future.

Some Specifics

The remaining paragraphs give some examples of how the Research Councils have used the "tool-kit" of schemes to ensure that the scientists and engineers which they support are able to collaborate with business across a broad front. The examples are organised under four broad headings, which represent the principal strands of the Research Councils' knowledge transfer taxonomy. Additional and more Council-specific information is provided as separate Annexes for each of the individual Councils, in the order BBSRC, CCLRC, EPSRC, ESRC, MRC, NERC and PPARC.

Cooperation in Education and Training

Since the 1970s, CASE PhD studentships (Cooperative Awards in Science and Engineering) have provided industry with the opportunity to influence the choice of research topics and to undertake joint research investigations cost effectively. Participation allows the company to gauge student quality and for the student to gain an insight into the company without any long term commitment.

People and Knowledge Flow

Each year, the Research Councils support over 5000 postgraduate students through Masters and PhD level training and around 4000 research assistants on research grants. At any one point in time, therefore, there will be typically 12,000 postgraduates and around 10,000 research assistants in the system on Research Council support. A large proportion of these will take up employment in the UK, thereby providing a conduit for knowledge and skills flow from the science base to industry.

Faraday Partnerships are major examples of the Research Councils and some Government Departments encouraging networks of academic and industrial interaction and cooperation. There are now 24 Partnerships aimed at improving the information flow between the science base and industry, thereby increasing academic familiarity of industry need and industrial awareness of academic capability. These networks provide a UK focus for key topic/technologies often mediated through a Research and Technology Organisation or similar body familiar with both the science base and industry (see www.faradaypartnerships.org.uk).

Royal Society Industry Fellowships provide opportunities for academics to work in an industrial environment and for industrialists to undertake research in an institution of higher education. The scheme is funded by the Royal Society, the EPSRC, the BBSRC and Rolls-Royce.

Collaborative Research with Users

LINK provides an enabling mechanism for joint public/private sector support and promotion of precompetitive research through business/research base partnership. LINK grants stimulate innovation, wealth creation and improve the quality of life. Around 16 Research Councils and Government departments sponsor LINK projects with 2001/02 expenditure totalling £43M and spend since inception in 1986 around £370M.

Since 1975, the TCS, (formerly the Teaching Company Scheme), has provided a valued opportunity for academic involvement in company development projects. Young graduates are appointed to work full time in the company under joint academic/industry supervision. Sponsorship from the 12 Research Councils and Government departments involved amounted to over £24M in 2002/03 with over 1000 associates being supported. Some 70% of TCS Associates are subsequently invited to join the company in which he/she has been working.

Commercialisation of R&D

The Research Councils' Business Plan Competition helps entrepreneurial researchers find successful routes to market. Proposers passing an initial screening phase receive knowledge and skills training, enabling them to take the business opportunity they have identified forward. An awards ceremony and prizes are provided for the business plans judged to have the greatest potential.

The Small Business Research Initiative (SBRI), announced in the Science and Innovation White Paper (July 2000), encourages high-tech firms to start up or to develop new research capacity, so stimulating innovation throughout the economy. Under SBRI, Government Departments and Research Councils are opening up at least 2.5% of R&D procurement programmes to small firms. The Research Councils have held one or more tendering rounds and made a variety of awards under the terms of the scheme (www.sbri.org.uk).

Further Information

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LAMBERT REVIEW: BBSRC RESPONSE TO THE QUESTIONS FOR CONSULTATION

1. BBSRC's principal aim is to foster a world-class biological science research community in the UK. Its mission is to fund internationally competitive research, to provide training in the biosciences, to encourage opportunities for knowledge transfer and innovation and to engage the public and other stakeholders in dialogue on issues of scientific interest and importance. BBSRC-funded science supports a number of key industrial stakeholders (including pharmaceutical, diagnostics, environmental, biotechnology, speciality chemicals, food and agriculture sectors). Council recognises the importance of research and training in collaboration with industry as a mechanism, which increases the likelihood that the UK economy and society will gain benefits from the research and training programmes supported by BBSRC. For this reason, BBSRC supports a range of activities to encourage knowledge transfer including collaborative funding mechanisms with industry. This Portfolio is designed to interface with Government initiatives such as University Challenge in order to create a connected approach, which provides a pipeline of mechanisms to support the efficient exploitation of research outcomes with commercial potential.

We would like to identify best practice and examples of excellence in business-university collaboration in the UK and abroad.

2. BBSRC supports a range of mechanisms to facilitate collaboration between the bioscience research community (in universities and BBSRC sponsored Institutes) and industry. These include Government schemes such as LINK, TCS and Faraday Partnerships as well as those developed by BBSRC, such as the Biotechnology Young Entrepreneurs Scheme, to meet specific needs of the bioscience sector. BBSRC takes account of the needs of industry and encourages direct industrial involvement in postgraduate training through for example CASE, Industrial CASE and Faraday Partnerships. BBSRC has developed Partnerships with 11 companies including for example GSK, AstraZeneca and Unilever, which have an established track record of involvement in CASE/Industrial CASE. These companies receive a quota of Industrial CASE studentships over a period of 3 years and are able to select the academic partners for these studentships.

3. BBSRC takes the view that commercial activity is best performed by the research generator and therefore delegates responsibility for the identification, management and exploitation of IP arising from research supported by Council to the university or institute undertaking that research. However, BBSRC supports activities to raise awareness of these issues, provides guidance and encourages best practice. These activities include for example the production and circulation of a basic guide to IP Management in the biosciences, sponsoring a programme of IP workshops in the leading bioscience universities and BBSRC Institutes to improve IP awareness. BBSRC maintains a network of the commercialisation managers from Council's eight sponsored Institutes as a mechanism to share best practice.

BBSRC has also developed a web-based Exploitation Guide aimed at the bioscience research community.

4. In the biosciences, commercialisation through start-up companies is an established route in order to build added value. BBSRC therefore considers it essential that the bioscience community should be well placed to commercialise research outcomes via spin-off companies whenever appropriate. BBSRC has been active in putting in place a number of connected activities, which interface with Government initiatives such as University Challenge, to promote the development of spin-off companies. These include the Bioscience Business Plan Competition run in 1999/2000 and 2001/02. A third competition is currently being run within the framework of an expanded joint Research Council activity.

5. The provision of a highly supportive environment can be a key factor in determining the eventual success of a start-up company. Bioincubators are designed to provide such an environment. A number of BBSRC institutes are well placed to offer access to expertise and specialist facilities and BBSRC has been active in developing new bioincubators at three of our institutes – Roslin, John Innes Centre and Babraham.

6. BBSRC has been in the vanguard in developing the Small Business Research Initiative following announcement in the July 2000 White Paper. It sees considerable value in the use of the scheme to enhance the research capacity of SMEs. Six contracts have been awarded to SMEs through a first call for proposals. A second call for tenders was issued in July 2002.

7. Council considers it is important to establish exploitation metrics in order to monitor trends within the bioscience community. For this reason BBSRC collects a comprehensive range of exploitation metrics from BBSRC sponsored Institutes and is working with the leading university Bioscience Departments to develop similar measures. In addition, Council periodically performs a more formal assessment of performance in knowledge transfer of Institutes supported by BBSRC.

If you do not have, or would like to strengthen such relationships, what are the main barriers to doing so.

8. It is important to provide incentives to HEIs to work with business; Council is concerned that the message of the recent Higher Education White Paper which emphasises the role of non-research intensive universities in technology transfer could be a disincentive to research intensive universities working with business, particularly with the RAE being a strong driver to focussing on research.

9. BBSRC is aware that one of the major remaining barriers to the take up and commercialisation of research results arising from the bioscience base is the lack of funds to demonstrate the commercial potential of ideas. This often requires small amounts of funds to enable activities essential to preparing a

robust business plan and securing commercial opportunities such as licensing, seed or venture finance. BBSRC is evaluating mechanisms to address this barrier to innovation.

How business can attract the best graduates and postgraduates with the skills that they require, especially in technology.

10. BBSRC places the highest priority on the supply of trained people and seeks to optimise the quality, volume and style of postgraduate and postdoctoral training to meet the needs of academia and industry.

11. Council is concerned about the extent to which increasing levels of student debt will impact on the number of quality students pursuing postgraduate research and this coupled with the lack of a defined career structure and levels of remuneration could lead to a shortage in skilled scientists to meet the needs of industry.

12. In a rapidly moving field such as the biosciences, it is also important that scientists working in industry are able to update their technical knowledge and skills. To meet this need BBSRC supports Continuing Professional Development through the Integrated Graduate Development Scheme (IGDS), and pump-primes short courses for which there is evidence of an industrial demand. In response to the needs of industry the current portfolio of support is focused on modular training.

The review team will also want to understand whether financial considerations currently help or hinder the relationships.

13. It is not appropriate for BBSRC to respond to this question.

LAMBERT REVIEW: CCLRC RESPONSE TO THE QUESTIONS FOR CONSULTATION

1. CCLRC's role is somewhat different to the other grant awarding Research Councils, in that it allocates resources, and brokers large scale international experiments and critical mass teams for the benefit of UK science. As such, it is the national portal and centre for world class science. To effect this function it undertakes to enable UK scientists to fulfil their scientific aspirations which cannot be realised in universities because of scale. It looks to reinforcing and exploiting partnerships at an international level with similar institutions in other countries. Since many of the experimental problems require access to more than one facility (some of which may be overseas), it seeks to promote a multi-disciplinary approach in its teams and facilities.

2. To fulfil this position, it needs to maintain certain facilities at the leading edge of science and technology, while contributing in kind and expertise to other facilities wherever they are built. Decisions to build or collaborate are taken after extensive consultation which can take a decade to prepare. RCUK has a roadmap of opportunities for large facilities which it updates on a regular basis. This allows all interested parties to see what is on the horizon and enable international discussions to be undertaken with some confidence. The final decision on funding and feasibility lies with government. A number of international bodies, in addition to bi- and multi-lateral discussions between countries and laboratories, inform the above. The main fora for setting out priorities are the OECD Megascience Forum and the European Strategic Forum for Research Infrastructure.

3. In addition to building and maintaining large scientific facilities, there are areas of science where large critical mass teams are required with appropriate infrastructure to allow the UK to be part of world science. CCLRC has groups in particle physics and space science which undertake these tasks. For example, the Space Science and Technology Department is the largest group in Europe and enables UK scientists and companies to take a full part in ESA and NASA missions. It provides design, building, testing, monitoring and data handling expertise in one place. In providing an interface between universities, industry and agencies, it is a stable entity which can enter into long term agreements, and not be subject to the vagaries of the normal academic cycle.

4. Underpinning these activities are Departments that cover instrumentation, engineering, data handling and simulations. All these departments work closely with industry in designing and testing equipment at the leading edge. An example is the design of detectors for the Large Hadron Collider at CERN. The requirements were developed by international scientists in conjunction with the particle physics department at CCLRC. Designs were simulated and prototypes built and tested at CCLRC. Contracts were then placed with industry for the several tens of thousands of detectors. Some of these are returned to CCLRC for testing (others go to other collaborating laboratories) before being verified for use. Thus CCLRC has to have in-house or access to state of the art technology (e.g. nanotechnology) for performing this task.

5. Frequent "industry days" are held to inform UK companies of the opportunities for tendering for equipment and support. CCLRC holds the UK subscriptions for ILL and ESRF in Grenoble and discussions have taken place recently with the directors of those facilities to ensure more UK companies take part in supplying components.

6. CCLRC is not a commercial operation and has its sights firmly on conducting world class science. However, it is cognisant of this that some of the technology and ideas emanating from its activities could be developed commercially.

7. In 2002, CCLRC formed a company, CLIK, whose duty was to undertake this task and received some "capacity funds" to help in this matter from the PSRE initiative. In addition, CCLRC, with PPARC, DSTL, and UKAEA received seed corn funds and formed a separate company (Spectrum) to administer under a fund manager. A CCLRC invention is the first project to be approved for funding under this scheme. There is no doubt that embedding the concept of commercial development within a fundamental science organisation will take some time to realise the extensive benefits available, and it will be necessary to pump prime the capacity building and seed corn fund for some time to come, before a substantial body of spin outs etc can be identified.

8. Before CLIK was formed, the Council had been involved in several other "ad hoc" developments. For example, Bookham Technology performed its early design and construction at the Rutherford Appleton Laboratory using the Central Microstructure Laboratory's facilities. At the time, the Laboratory was not permitted to hold an equity stake in the resulting highly successful company. More recently, the Central Laser Facility at RAL has been involved in developing a laser system for leaf clearing from railway lines with Laserthor, with a 4% stake in lieu of its contribution.

9. CCLRC has provided support services to companies for some time. Its Business Information and IT Department is involved in a large number of projects for companies and public bodies. For example, it holds the secretariat for the World Wide Web for Europe. At a more fundamental end, the Computer Science Department has recently installed the UK's supercomputer and undertakes large scale simulations, some of which for companies such as simulating catalytic behaviour in chemical plant.

10. CCLRC has been a pioneer in building and running synchrotron light sources. Its second generation source at Daresbury obtains commercial work under a separate company banner (DARTS), and is now giving advice on how commercial work can be integrated with scientific programmes, to the Canadian Government as it builds its own synchrotron

11. At both of its main sites, CCLRC is in discussion with its near neighbours on the development of focal points for science, innovation and exploitation. At Daresbury, a consultants report is being prepared to integrate the aspirations of CCLRC, NWDA, local universities and industry. At the RAL site, UKAEA

has commissioned a report in a similar vein involving CCLRC, MRC, NRPB, Oxford University and the Wellcome Trust. In both cases, there is an intention to proceed with the concept of an "innovation park" in the near future.

12. As a member of RCUK, CCLRC is responsible for the Research Councils' interactions with RDAs. Similarly, RDAs have appointed SEEDA to act as its interface. CCLRC has agreed to second staff to SEEDA (in particular) to ensure that this interface works efficiently. CCLRC has senior staff on both the North West and South East Science Councils. On specific initiatives (e.g. the national nano-technology centre) specific staff contribute to the discussions between RDAs as they develop plans for exploitation.

LAMBERT REVIEW: EPSRC RESPONSE TO THE QUESTIONS FOR CONSULTATION

1. EPSRC fosters the skills, knowledge and expertise of the UK research base in engineering and the physical sciences and stimulates the flow of knowledge and highly trained people into all parts of national endeavour.

2. HEI/Business collaboration is encouraged, where mutually beneficial. EPSRC believes in being flexible, and tailors the approach to the particular activity. In addition to encouragement for industry/academic collaboration in standard responsive grants, specific initiatives require industry involvement. The percentage of EPSRC research grants involving partnerships with industry is approaching 40%.

3. In recent years, EPSRC has made a strategic decision to increase the direct interaction with industry with the aim of gaining a better understanding of industry's needs e.g.:

   - it has developed a sector-based approach to understanding industrial requirements
   - the Council's User Panel is charged to give advice on industry's research and training needs across the portfolio
   - EPSRC staff are seconded to companies for limited periods often with reciprocal secondments

   These have proved to be very beneficial in developing our understanding of the industrial perspective. By strengthening this direct dialogue, EPSRC is now better placed to form a view on the potential barriers.

We would like to identify best practice and examples of excellence in business-university collaboration in the UK and abroad.

4. EPSRC sponsors a number of popular schemes designed to facilitate collaboration between academia and industry. These include:

   - Faraday Partnerships (EPSRC supports 22 of the 24 existing partnerships)
   - LINK collaborative research projects (EPSRC is the largest contributor)
   - TCS (EPSRC is the second largest contributor)
   - Research Assistant Industrial Secondments (RAIS)
   - EngD - postgraduates gain training in both research and business skills
   - Industrial CASE. – a company is free to select the academic partner of its choice

5. Increased appreciation of the industrial perspective via sector work and staff placements has enabled a more targeted approach and the development of strategic alliances e.g.

   - BAE Systems in the Aero Defence Sector (BAE Systems is contributing approximately two thirds of £30M over the next 5 years)

- Railway Systems Research Centre – Rail Research UK joint initiative.
- GSK in Combinatorial Chemistry
- The Carbon Trust. A £14M programme over a 3-4 year period on low carbon research
- Rolls Royce – support of "star" academic appointments, from industry or from outside the UK

6. EPSRC undertakes specific reviews of industry/academic collaboration and has recently started to collect knowledge transfer data from reports on research grants. An early result of an ongoing study at SPRU shows a steady increase in the numbers of university/industry co-publications, particularly in EPSRC fields.

If you do not have, or would like to strengthen such relationships, what are the main barriers to doing so?

7. From EPSRC's perspective, one of the main barriers to fostering collaboration between academia and industry is the perceived tension between the EPSRC role to encourage blue skies, generic research (which is also often preferred by academia) and the industrial preference for more applied, specific research. Other potential difficulties which occasionally arise are:

- timing issues e.g. different expectations between academic and industrial partners about the timing of research outputs
- differing view as to when/whether publication should occur

Many of the schemes above and in the cover paper encourage the two way flow of knowledge. A potential barrier can be the ability to identify suitable academic collaborators. Sector based work and web-based grant information are two activities aiding dissemination.

EPSRC also recognises that the process of technology transfer is not linear and can be serendipitous. There is a perception of a funding gap between research and commercialisation. Access to proof of concept funding is being considered.

Responsibility for IP generally lies with the funded university, which is expected to have suitable mechanisms in place to gain the appropriate benefit from its exploitation. EPSRC is planning to:

- provide IP training for the potential research leaders of the future (Advanced Fellows and First Grant holders)
- develop a pilot to monitor IP plans on existing grants

8. Universities have differing approaches to IPR and this can create problems. The academic community needs to have realistic expectations about the financial and other benefits from the ownership of IP. Industrial sectors also differ in their IPR approach.

How business can attract the best graduates and postgraduates with the skills that they require, especially in technology.

9. There is an acknowledged general shortage of graduates in the supply of trained scientists and engineers, and EPSRC, working with other organisations, is seeking to address this by increasing activities in public awareness. EPSRC also collects information on first destinations of postgraduates and has funded studies on career paths of postgraduates. More than 50% of EPSRC's postgraduates are employed by industry after graduation and this proportion rises over time.

10. A major challenge is to ascertain information on industry's skills requirements and through the steps above, EPSRC is trying to identify specific skills shortages. In some cases, particular skills gaps (e.g. operational research) are identifiable. However, it has been difficult to identify precise requirements as industry often does not distinguish between a requirement for postgraduates and "good" people. In some sectors, (e.g. photonics and computer science), competitive salaries have a detrimental effect on the supply of postgraduates overall.

The review team will also want to understand whether financial considerations currently help or hinder the relationships.

11. It is not appropriate for EPSRC to respond to this question.

LAMBERT REVIEW: ESRC RESPONSE TO THE QUESTIONS FOR CONSULTATION

1. ESRC's principal aim is to support high quality research and training in the social sciences which meets the needs of users and thereby contributes to economic competitiveness, public policy and quality of life. ESRC funded social science addresses directly issues of economic performance and development, knowledge communication and learning and work and organisations, three of the Council's seven priority themes. Knowledge transfer is being given increasing emphasis within these themes and the potential beneficiaries of this transfer range right across all business sectors, levels of government and the voluntary sector. Council recognises the importance of research and training in collaboration with industry to increase the likelihood that the UK economy and society will gain benefits from the research and training programmes supported by ESRC. For this reason, ESRC supports a range of activities to encourage knowledge transfer including collaborative funding mechanisms with industry. Council is about to review the scope for further measures.

We would like to identify best practice and examples of excellence in business-university collaboration in the UK and abroad.

2. ESRC supports a range of mechanisms to facilitate collaboration between the social science research community (in universities and independent research institutes) and business. These include Government schemes such as LINK, TCS and (potentially) Faraday Partnerships as well as those developed by ESRC such as its collaborative research funding policy. Within that policy, ESRC takes account of the needs of business at different levels: themes, centres/programmes and individual projects. Direct business involvement in postgraduate training is provided through CASE studentships.

3. ESRC takes the view that commercial activity is best performed by the research generator and therefore delegates responsibility for the identification, management and exploitation of IP arising from research supported by Council to the university or institute undertaking that research. However, in the social sciences much knowledge transfer takes place through the general and specialist media and ESRC supports activities to raise awareness of research, provides guidance and encourage best practice. These activities include, for example, the training of leading social scientists in dealing with the media, funded communication plans for major investments, production of the Council's own publication targeted at senior users ("The Edge") and circulation of guidelines to all researchers on how to write for business audiences. The Council also sponsors events including conferences and workshops to help communicate the outcomes of particular research to business at theme and investment level. The ESRC also encourages the spread of best practice between the directors of its major investments.

If you do not have, or would like to strengthen such relationships, what are the main barriers to doing so?

4. As the Council has no directly owned institutes of its own, it is especially important to provide incentives to HEIs to work with business; Council is concerned that the message of the recent Higher Education White Paper which emphasises the role of non-research intensive universities in knowledge transfer could be a disincentive to research intensive universities working with business, particularly with the RAE being perceived as a strong driver to focus on basic research alone.

5. ESRC is aware that one of the remaining barriers to the take up and commercialisation of research results arising from the social sciences is the lack of resources of time and other kinds to demonstrate the potential relevance of research outcomes to business. In research on management the Council is about to support international visiting fellowships to identify best practice from across the world. More generally, the Council review will identify if relatively small amounts of funds at the right time can enable further activities useful to getting social science research into practice.

How business can attract the best graduates and postgraduates with the skills that they require, especially in technology.

6. ESRC places a highest priority on the supply of trained people and seeks to optimise the quality, volume and style of postgraduate training to meet the needs of academia and industry.

7. Council is concerned about the extent to which increasing levels of student debt will impact on the number of quality students pursuing postgraduate research. When this is coupled with the perceived lack of a defined career structure and levels of remuneration in HEIs there could be a developing shortage of skilled social scientists to meet the needs of business, especially social scientists with quantitative skills.

The review team will also want to understand whether financial considerations currently help or hinder the relationships.

8. It is not appropriate for ESRC to respond to this question as a Council, but there are social scientists who are active in research in this area and if it would be helpful, the ESRC could put the Review in contact with the leading figures.

LAMBERT REVIEW: MRC RESPONSE TO THE QUESTIONS FOR CONSULTATION

1. Although MRC's main efforts in its interactions with industry are directed towards collaboration with and licensing to companies in respect of research within MRC's own establishments these frequently involve co-operation with technology transfer offices and research groups at the major research intensive universities. In the biomedical field at least we consider there is no great difference between MRC Institutes/Units and these universities in their relationships with industry and we are familiar with the issues involved.

2. The main commercial users of biomedical research are the biotechnology and pharmaceutical industries and there clearly has been productive, large scale and increasing interaction over the past 10 to 15 years between these sectors and the universities heavily engaged in biomedical research. Those interactions include substantial industrial funding for university research projects, extensive licensing by the academic sector both to existing and start-up companies, widespread use of academic staff as consultants to industry and participation of academic staff in new biotech ventures. As the technology transfer arms of the research–oriented universities have grown in size and sophistication in recent years those interactions have continued to increase.

3. In answer to your specific question of how these relationships came about we believe the key is that the biotech and pharma sectors employ highly qualified research and other staff often themselves with a university research background who can and do keep in touch with developments within university research teams, through publications, conferences and personal contacts. Similarly university technology transfer staff in research intensive universities, and often individual researchers, will not usually have difficulty in knowing or finding out who to approach in biotech company with respect to a particular proposal. The larger pharma companies usually have a designated academic liaison officer which, inter alia, helps to start discussion on new approaches.

4. We have some concerns but these relate more to points of detail in the academic/industry relationship in the biomedical field. These are:

   - there remains a tendency for companies to by-pass specialist technology transfer staff and play on some university investigators' relative inexperience on funding and ipr issues
   - related to (a) is the tendency for companies to supply proprietary biological materials to academics with an automatic request for exclusive rights to inventions made using that material
   - while most of the pharma and biotech sectors have long since recognised the particular concerns of academic partners (e.g freedom to publish, greater difficulty in provision of warranties) some venture capital companies investing in academic start-ups have a little to learn

5. In general, however we believe collaboration between academia and industry in the biomedical field is flourishing and in our experience the pharmaceutical

and biotechnology industries in the U.K at the highest levels take an enlightened view of the long term value of a strong science research base which is not simply geared to meeting the immediate requirements of industry.

LAMBERT REVIEW: NERC RESPONSE TO THE QUESTIONS FOR CONSULTATION

1. NERC's mission is to provide a world class UK environmental science capability which meets the needs of users and beneficiaries thereby contributing to the economic competitiveness of the United Kingdom, the effectiveness of public services and policy and the quality of life.

2. NERC's interest in business-university collaboration is to support the transfer of knowledge from producers (NERC funded scientist) to business users, and to support the training of scientists that meet the needs of the business community. Through these activities NERC funded science underpins innovation in a number of key business sectors in the UK including; environmental technology and services, water, insurance and oil and gas.

3. NERC places a high priority on supporting links between NERC funded researchers and the business community, and business views are considered at all levels of decision making. At the time of the last review (September 2002) Council had a total of 48 individuals from 38 businesses represented on its committee structure.

We would like to identify best practice and examples of excellence in business-university collaboration in the UK and abroad

4. NERC actively supports partnerships between business and universities through a range of partnership schemes and mechanisms. These address both research and training and include Government schemes as well as NERC specific initiatives such as CONNECT.

5. One of NERC's recent successes has been the management of two business plan competitions. The competitions provided training and mentoring for scientists to enable them to develop a business plan to commercialise their research. The key element of success here was the contribution made by business community to the initiative. All mentoring in the competitions was provided by business practitioners who gave their services free of charge. A total of over 100 days of help was offered to each competition by senior lawyers, patent attorneys, accountants and other professional service providers.

6. NERC recognises that most, if not all, business-university interactions are ultimately driven by university staff (researchers and teachers) and their counterparts in business. The motives of the individuals for interacting may not be the same as their host institution but they do need to be addressed. This is particularly important in universities, where staff may have considerable autonomy in setting their research agenda.

If you do not have, or would like to strengthen such relationships, what are the main barriers to doing so

7. We note the challenge the Higher Education Funding Council for England (HEFCE) Research Assessment Exercise (RAE) presents for business-university collaboration and we hope that the Roberts Review will tackle these issues.

8. A recent survey, carried out by Research Councils UK (RCUK), was concerned with asking universities what the research councils could do to facilitate the transfer of knowledge from universities to business. NERC is currently drawing up plans to respond to 2 of the main findings of the survey; the need for a proof of concept fund, and the need for greater opportunities for the exchange of research staff between universities and business.

9. The different culture between universities and business presents many challenges to interactions but it is clear that a good deal of progress has been made over the last few years. There are some remaining tensions, such as between the need to publish research results, and the need to protect intellectual property and business confidentiality, that will always require careful management.

How can business attract the best graduates and postgraduates with the skills they require, especially in technology

10. NERC supports PhD studentships under the CASE and Industrial CASE schemes. Both schemes enable PhD studentships to be operated by universities working in partnership with industry. Under the Industrial CASE scheme the idea for the project comes from the business partner. NERC also supports the TCS scheme that provides business training for new graduates and post-doctoral students.

11. A major concern for us is the current level of student debt and the impact this has on a student's decision of whether to apply for a PhD studentship.

The review team will also want to understand whether financial considerations currently help or hinder the relationships.

12. It is not appropriate for NERC to answer this question.

LAMBERT REVIEW: PPARC RESPONSE TO THE QUESTIONS FOR CONSULTATION

1. The Particle Physics and Astronomy Research Council (PPARC) funds research and training in particle physics and astronomy. Included in its mission is an aim to increase the competitiveness of UK industry. PPARC is unusual among Research Councils in supporting predominantly basic science, conducting very long term strategic planning and having a strong emphasis on large multinational projects and facilities (such as CERN and ESA). It invests largely in UK universities. The main benefits it has to offer industry are the provision of highly skilled individuals and cutting edge technologies, both of which have the potential to enhance innovation in companies. A particular challenge is for PPARC to broaden the range of industries exploiting PPARC-funded skills and technologies. The PPARC programme also presents opportunities for industry to develop and supply technology for its research groups and major facilities.

We would like to identify best practise and examples of excellence in business-university collaboration in the UK and abroad

2. PPARC places a strong emphasis on brokering new partnerships and promoting its technologies. It funds an *Industry Co-ordinator* to make connections between PPARC-funded university groups and industry and funds a busy programme of *promotional events*. PPARC maintains regular contact with related activities (e.g. those funded through Faraday Partnerships, university technology transfer offices and RDAs) to co-ordinate and share best practice. With a view to longer term networking, sharing best practice and adding value to its range of activities PPARC is launching an Industry Club – the *'PPARC KITE Club'* which will encapsulate all PPARC's industry-related activities and involve outside bodies such as other Research Councils and Government Departments. In establishing the Club we have looked to other examples such as the 'SMART' Clubs.

3. Another focus of PPARC is encouraging an entrepreneurial culture, particularly at the early stages of a research career. We identified the *Enterprise Fellowships* scheme run by Royal Society of Edinburgh for Scottish Enterprise as an example of good practice and adopted it for our own purposes. The scheme provides a year's salary and Masters-level training in 'New Venture Creation' to help commercialise ideas originating from PPARC funding – usually in the form of start-up companies. PPARC also provides a PhD-level short course *'Encouraging Enterprise'* and is a partner with other Research Councils in the *Joint Business Plan Competition.*

4. PPARC provides a range of schemes to support collaboration between universities and business. We maintain a mix of national schemes (e.g. *Faradays* and *TCS*) and PPARC schemes (e.g. the *PPARC Industrial Programme Support Scheme (PIPSS).* An acclaimed feature of PIPSS is its flexibility in terms of eligibility of business partners, the value and nature of the business contribution and fast turnaround of proposals. We also encourage

collaborative training and offer *CASE* studentships as well as a PPARC scheme *'CASE Plus'* which includes a subsequent period in industry.

5. PPARC has a well-defined *Science Strategy* and is developing a *Technology Roadmap*. This provides industry with a clear strategy for our future support and translates our science into technologies with which industry can more readily relate. We also provide an on-line searchable *technology database* aimed at industry. Whilst the priority given to delivering PPARC's scientific programme makes it difficult to divert time and effort away from the core programme into addressing industrial problems, the programme itself provides opportunities for industry to contribute to the development or supply of technologies.

6. We work closely with other Government Departments and interpret 'business' in its widest sense. We have signed concordats and maintain regular working contact with the *Ministry of Defence and Department of Health* to identify areas of synergy and assist in the transfer of PPARC technologies to services as well as industries in these sectors.

PPARC's perception of the main barriers to strengthening university/business relationships

7. There is a funding gap which needs to be bridged to enable proof of concept, development, prototyping and even descoping to make PPARC technologies targeted and affordable for industrial markets.

8. Whilst encouraged by the latest HEBI survey, cultural barriers still exist. There are few incentives to working with business and the RAE is a disincentive. PPARC could identify a small cohort of 'industry-active' researchers in universities but the vast majority are motivated by basic science and industrial relevance is seen as 'second best'. University technology transfer staff often overlook particle physics and astronomy in favour of research areas with more obvious applications. We would be happy to work with senior management and technology transfer offices in universities to help change the culture towards encouraging business links and entrepreneurship in physics departments.

9. There is some lack of clarity over the precise roles and responsibilities of various bodies engaged with universities and businesses (e.g. DTI, RDA, SBS, HEFCE, Research Councils) and metrics for success are not well established. Efforts are being made through RCUK's Knowledge Transfer Group to co-ordinate activity and agree common metrics.

10. Networking between business and universities could be improved. Whilst some good networks exist many are limited to particular sectors, geographical regions or technical scope – we lack an effective national framework for brokering new partnerships.

11. PPARC research is often conducted through extensive collaborative and often multinational partnerships which sometimes create complex intellectual property ownership issues.

How can business attract the best graduates and postgraduates with the skills they require, especially in technology?

12. Business can continue to participate in collaborative training through CASE, CASE-Plus, TCS and similar schemes.

13. There are concerns about the long-term supply of high quality physicists. The issue extends from schools, where the problem is one of attracting potential students, through undergraduate degrees with issues of student debt to long-term career structures for postdoctoral researchers. Industry can support the work of PPARC and others by presenting positive images of career prospects and stating their demand for physical scientists.

14. Continued dialogue is needed between all interested parties in response to the recommendations of the Roberts report and the Higher Education White Paper.

The review team will also want to understand whether financial considerations currently help or hinder the relationship

15. It is not appropriate for PPARC to comment.