STI OUTLOOK 2002 – COUNTRY RESPONSE TO POLICY QUESTIONNAIRE

UNITED KINGDOM

1. General Framework and Trends in Science, Technology and Innovation policy

The UK Government's strategy towards science and innovation has been taken a major step forward through policy commitments and initiatives made in two recent White Papers published by the Department of Trade and Industry. The *Science and Innovation White Paper*, published July 2000, set a framework for the Government's role as:

- The key investor in the science base.
- The facilitator for collaboration between universities and business.
- The regulator for innovation, including the promotion of public confidence in science.

The February 2001 *White Paper on Enterprise, Skills and Innovation* emphasised the importance of science and innovation to regional (and national) economic growth, with the need to raise skills as a key issue; again a number of initiatives were announced to invest in innovation and new technologies, including e-business; and foster an environment for enterprise.

The Government has made a number of commitments relevant to science, technology and innovation in these White Papers, which are outlined below.

Investment

Science and Innovation White Paper commitments:

- Invest in a new £1 billion programme (in partnership with The Wellcome Trust) to renew the infrastructure for science.
- Give a £250 million boost to research in key new areas that will shape life in the 21st century: genomics, e-science and basic technologies.
- Provide additional funding to increase (over three years) the basic support for post-graduate research students to £9,000 a year.
- Launch (in partnership with The Wolfson Foundation and The Royal Society) an initial fund of £4 million a year to assist in the recruitment of up to 50 top researchers.

- Make 2001/2002 Science Year and run a new Science Ambassadors Programme to capture children's imagination and encourage them to take-up careers in science and engineering.

Enterprise, Skills and Innovation White Paper commitments:

- Provide a further £90 million (to complement recent investment) to promote the commercial exploitation of research focusing on genomics, basic technologies and e-science.

Facilitation

Science and Innovation White Paper commitments:

- Establish a Higher Education Innovation Fund of £140 million over three years (incorporating the Higher Education Reach-Out to Business and the Community fund) to build on universities' potential as drivers of growth in the knowledge economy.

- Launch a new Foresight fund, initially up to £15 million, to get the best ideas from Foresight 2000 put into action fast.

- Run one further round of the University Challenge competition to provide seed venture funding for knowledge transfer.

- Double the number of new starts for Faraday Partnerships, from four to eight a year, to link the science base to business networks.

- Put £15 million more into Science Enterprise Centres to bring business skills into the science curriculum.

- Create new Regional Innovation Funds worth £50 million a year to enable Regional Development Agencies to support clusters and incubators and new clubs of scientists, entrepreneurs, managers and financiers.

- Support 20 Business Fellows who will lead their academic colleagues in working with business.

- Publish Science and Innovation Strategies for Government departments.

- Introduce a Small Business Research Initiative to open up to small firms R&D procurement worth up to £1 billion, with a target of procuring £50 million of research from them.

- Change the rules for Government funded research so that research bodies own the Intellectual Property Rights; issue new guidelines on incentives and risk-taking for staff in public sector research establishments; and provide £10 million to commercialise research done in the public sector, including the NHS.

- Double the number of International Technology Promoters from 8 to 16 and link their work closely with British Trade International and other UK agencies overseas to help UK

universities and businesses make new partnerships across the world; extend the network of science attachés in embassies abroad.

Enterprise, Skills and Innovation White Paper commitments:

- Establish new University Innovation Centres and Technology Institutes in the regions to boost research and development, innovation and technology transfer and to provide the regions with skills in ICT and high technology.

- Boost enterprise in all regions by launching a new £75 million Incubator Fund and developing £50 million of new funding to provide early stage money for new and growing businesses.

- Give special support to the manufacturing industry by establishing a new Manufacturing Advisory Service.

- Promote the growth of successful clusters.

- Remove constraints to growth by inviting Regional Development Agencies to develop strategies for success in their regions.

- Accelerate the take-up of broadband technology by businesses and households and, as a first step, is providing £30 million for innovative schemes to meet local requirements.

- Take action to boost digital TV which will transform the communications services available in the home and open-up new markets and service opportunities.

- Take action to stimulate the development of content for digital technologies.

- Provide a further £30 million to increase awareness and understanding among all businesses of the challenges and opportunities of e-business.

- Encourage development and take-up of more resource efficient and environmentally friendly products and energy systems by promoting markets for new technologies which reduce waste and by embarking on a major initiative with industry and others to achieve a UK Solar Photovoltaic Demonstration Programme in line with those of our main competitors.

Regulation

Science and Innovation White Paper commitments:

- Implement stronger guidelines from the Chief Scientific Adviser on how scientific advice should be used in drawing up Government policy.

- Publish a Code of Practice for all Scientific Advisory Committees committing them to high levels of openness and transparency in their work.

Enterprise, Skills and Innovation White Paper commitments:

- Significantly relax insolvency rules.
- Adopt a more commercial approach to company rescue proposals put to Government by companies in short-term financial difficulties.
- Give the Office of Fair Trading a new pro-competitive role to spot existing and proposed regulations which hold back dynamic and competitive markets.
- Drive forward the Small Business Service strategy "Think Small First".

Some of these commitments have already been met - details of the state of play of each can be found in the respective implementation plans:

- Science and Innovation White Paper Implementation Plan www.dti.gov.uk/ost/whatsnew
- Enterprise, Skills and Innovation White Paper Implementation Plan www.dti.gov.uk/opportunityforall

Current Objectives for Supporting Business Innovation

While the main thrust of the Department's expenditure for business innovation is directed at one of the DTI objective i.e. "to promote enterprise, innovation and increased productivity", it is not exclusive to it and makes a contribution across the other Departmental objectives. Many activities are closely linked with work to promote the exploitation of science and pull through the work of the science base into industry. This includes supporting new technologies for use in industries of the future. The Department works closely with other key sectors, such as cars and chemicals, where the adoption of new and existing technologies and best practice can help companies to compete and grow.
A technical, legal and design infrastructure is maintained – including the Patent Office, the National Measurement System, support for the setting of technical standards, and the Design Council — which underpins business confidence in innovation.

How objectives are met

DTI activities in support of these objectives are tailored towards specific needs, either at a national level, or within individual sectors or regions. There is a strong emphasis on activities to address regional issues, the needs of SMEs and on improving skills. The Department works closely with other Departments in taking forward these objectives, in particular the Department for Transport, Local Government and the Regions (DTLR), the Department for Education and Skills (DfES) and the Department for Environment, Food and Rural Affairs (DEFRA).

In April 2000, DTI established the Small Business Service (SBS) to be the focus for the provision of business support to SMEs.

There is a strong regional dimension to DTI's aim to increase competitiveness. The Department works through regional organisations to promote enterprise, innovation and increased productivity taking account of regional differences.

For each region, an overall framework is provided by the Regional Innovation Strategy (RIS) developed by the RDA in conjunction with a range of regional and sub-regional parties. Typical features of a RIS may include recognition and stimulation of:

- Industrial sectors of particular significance to the region.
- Networks that exist within the region to foster collaboration, exchange of good practice etc.
- The role of universities and research institutions, and the means by which their expertise is made accessible to business, particularly SMEs and those businesses unfamiliar with accessing such capabilities.

Main Programme areas

Whilst some support for R&D is focused on the needs of particular sectors, other support is focused on cross-sectoral issues such as materials and IT.

DTI support is mainly through knowledge transfer programmes. Programmes aimed at creating partnerships between the science and engineering base and businesses, such as Faraday Partnerships, the Higher Education Innovation Fund and the TCS (Teaching Company Scheme) are often jointly funded by the DTI and the OST through the Science Budget.

LINK, which is managed by OST, is the Government's principal mechanism for supporting collaborative R&D between UK industry and the science base.

The CARAD programme supports the aeronautical industry through pre-competitive research and technology demonstration to maintain and enhance the UK's position as a world-leading aerospace manufacturer.

Programmes to support the construction industry aim to secure an efficient market in the industry, with innovative and successful UK firms that meet the needs of clients and society and are competitive at home and abroad.

For activities developed specifically at the regional level, the Regional Innovation Fund, valued at £50m/year for the three years FY 2001/02 to FY 2003/04, offers the main source of funding. This funding stream offers the RDAs considerable flexibility to address regional and sub-regional needs in the area of business incubation and local or regional innovative clubs and networks.

The Department supports a wide range of activities, at both a national and regional level, aimed at helping industry become more innovative through accessing existing best practice and adopting existing and new technology from both home and abroad. Much of this activity is targeted at individual industry sectors or supply chains.

To achieve the goal of making the UK the best place in the world to trade electronically, efforts are being made to increase the use of information and communications technologies by business, particularly among SMEs.

An important aspect of competitiveness will be the development of green technologies, products and services. The DTI will continue, through its Sustainable Development Strategy, to work with business to make the UK an international leader in these markets.

Within the small firms' sector, the importance of science, technology, design and innovation are emphasised as part of a coherent approach to business development. The SBS's strategy is to ensure that both existing SMEs and those wishing to start in business have access to the help and expertise that they need to develop and successfully implement a forward-looking and challenging business development plan.

With the help of other departments, the DTI has also been instrumental in introducing a new Government-wide programme, the Small Business Research Initiative (SBRI), which will open up government R&D procurement programmes to small firms.

Public civil space activity within the UK is co-ordinated by the British National Space Centre (BNSC), an organisation led by DTI, and embracing Government, industry and the academic community.

DTI innovation support also includes a small area of expenditure on expert advice and other ad hoc issues. This primarily consists of a Consumer Safety Programme which is aimed at protecting the consumer and ensuring products sold on the market are safe, together with the run-out of the support for the Sector Challenge programme. Through a separate budget, DTI also supports activities to deepen the Department's understanding of what industry needs in order to improve its competitiveness. To help develop future thinking, the Department has recruited 24 industrial secondees into its Future and Innovation Unit. They provide a valuable role in understanding and working with business, in particular in developing the linkages between innovators and providers of finance, and between industry and education.

2. Public sector research and public research organisations

The Science Budget

In the last Spending Review (SR) 2000 (Science Budget 2001-02 to 2003-04[1]), the Government announced extra funding for science amounting to £1 billion for the period 2001-04, representing an average real terms increase of 7% per year. This included an increase of £725 million to the Government's Science Budget and more than £225 million from the Wellcome Trust. The increase to the Science Budget included £225 million for infrastructure, £250 million for new programmes, and over £110 million for exploitation activities.

The main emphasis was on a broad range of underpinning basic and applied research, technology and facilities of which the main outputs are:

- New knowledge and new technology.
- Highly trained people.
- Knowledge transfer.

Research Councils

The SR2000 provided a supportive funding settlement for the Councils when funding increased from some £1,770 million in 2001/2 to £2,155 in 2003/4.

[1] OST website: http://www2.dti.gov.uk/ost/ostbusiness/index.htm

The key features of the SR2000 settlement were the support for genomics, e-science and basic technology, all of which are progressing well.

A quinquennial review of the six grant-awarding Research Councils was announced on 13 February 2001. The outcome (published 4 December 2001) was that the Research Councils should continue to be executive NDPBs[1]. Through this review, it is hoped to secure more effective "joining up" between the Research Councils, their funding partners and their customers, strategically and operationally.

In addition, much innovation in science is taking place at the boundaries between traditional disciplines, including across the boundaries of the Research Councils and in multidisciplinary work. The review indicates how to promote this, while preserving the best features of the present Research Council system.

UK Basic Technology Research Programme[2]

The Research Councils' Basic Technology Programme is concerned with building UK capability in technology research to underpin the next generation of tools, techniques and processes that will have a significant impact across science and engineering, and will form the basis of industries of the future.

Started in May 2001, the allocation of £41M (over two years) will be to a number of high quality and high impact grants. The budget is managed by EPSRC on behalf of *all* the Research Councils.

The Programme seeks to develop a new 'technology community' that is not constrained by research council remit or academic discipline. It will develop new technologies and bring existing technologies together in new ways, to address challenges that have common ownership across the research community.

Science Research Investment Fund (SRIF[1])

The SR2000 established the Science Research Investment Fund (SRIF) to address underfunding in science research infrastructure in HEIs. SRIF is a partnership between OST, HEFCE, and the Wellcome Trust amounting to £1 billion for science infrastructure over two years (2002-3 & 2003-4).

Funds of £775m, of which £675m for HEIs (£375m from OST and £300m from HEFCE for disbursement in England) will start in 2002-2003. The balance of £100m is for the modernisation of Research Council institutes, and development of large national facilities. Funds are allocated to HEIs by means of a formula based on Institutions' quality related (QR) research income and on their total research income.

Whilst drawing up investment plans HEIs will need:

- To chose investments that bring benefits to the HEIs, to the science and engineering base and to the wider regional and national economies.

- To consider the research priorities of the Research Councils.

[2] http://www.research-councils.ac.uk/basictech/

- To consider the cross-Council themes - Genomics (MRC), E-Science (EPSRC), Basic Technology (EPSRC).

REVIEWS

Several Reviews have taken place or are underway since the SR2000 - see Annex attached.

Following the DTI Review, the position of OST is essentially unchanged. However, a new group is to be created, the Science Technology and Innovation Group, one of whose objectives will be to maximise the synergy between the Government's investments in sciences and innovation.

Dr John Taylor, Director General of the Research Councils (DGRC), will continue to be responsible for managing the nearly £2bn investment in scientific research, and will also sit on a newly established Knowledge Transfer Strategy Committee (see below), along with the head of the Science, Technology and Innovation Group and the Chief Scientific Adviser and others, to ensure that we make the most of the knowledge that comes from our investment in the science base.

Having OST within DTI enables the development of policy on science and technology more closely alongside policies on innovation. The Government White Paper - *Excellence and Opportunity – a science and innovation policy for the 21st century* develops this concept.

The OST has retained strong links with DfES, and the links between science policy, higher education policy and management of the universities have not suffered.

SR2002 Cross Cutting Review of Science and Research

The Science and Research cross-cutting review will include a review of funding of the UK science base, and the effectiveness of departments' own science and research programmes.

The terms of reference are:

To consider how to maximise the benefits provided by public spending on science and research to the UK's economy and quality of life. In particular:

- To take stock of studies commissioned or reporting since the last Spending Review, and with potential implications for resources, including:
    - The Transparency Review, on the costing of university activities.
    - The Roberts Review into the supply of scientific skills for business R&D.
    - The review of investment in university research infrastructure.
    - The Quinquennial Review of the grant awarding Research Councils.
    - The review of business support schemes in DTI.
    - The HEFCE/OST Higher Education Business Interaction Survey.

Lord Sainsbury (PUSS for Science & Innovation) is the Ministerial lead for the Review and is supported by a team of officials from HM Treasury, OST and the Department for Education and Skills. Professor King (Chief Scientific Advisor) is leading the cross departmental element on behalf of Lord Sainsbury**.**

The review will consider the effectiveness of departments' own science and research programmes to ensure that they deliver maximum long-term benefits to the economy and quality of life. One strand of the review will be looking at ways to improve departments' capacity to use science to deliver objectives by improving the quality of science expertise within the Civil Service.

Work is ongoing and, as yet, there are no firm conclusions. Final conclusions and recommendations are expected shortly.

Transparency Review

Following the 1998 Comprehensive Spending Review, additional funding for higher education was made conditional on improved transparency concerning the way public funds are spent in universities. A Government initiative, the 'Transparency Review', was initiated by OST, working closely with the Education Departments and Funding Councils. In 1999, a Transparent Approach to Costing (TRAC) was developed by the Funding Councils' Joint Costing & Pricing Steering Group, which was subsequently trialled in 9 universities by July 2000 – including (in London) University College. By mid 2001 over 100 HEIs made their initial transparent costing reports for publicly and non-publicly funded teaching and research to their Funding Council.

The TRAC methodology will enable universities to more accurately allocate overheads to specific activities (*e.g*. teaching and research), and so calculate their full economic cost. Specifically, in relation to building infrastructure costs, it will take into consideration depreciation, cost of capital employed, and cost of maintaining buildings on a 'going concern' basis. The use of such data in universities' management accounting systems will indicate the level of funds which need to be set aside to maintain their infrastructure, and so avoid a recurrence of the so-called 'funding gap' identified in the course of the Dearing Review.

The most research-intensive universities have a target to implement fully the new costing methodology by July 2001, and all remaining universities have a target to do so by July 2002. Consideration of the possible implications for (research) funding policy are still underway.

KNOWLEDGE TRANSFER

The new Knowledge Transfer Strategy Committee will help ensure that we utilise the knowledge that comes from our investment in the science base. HEIs are making rapid progress in generating businesses from the UK science base, with many universities creating strong links with industry[3]. As a result more companies are being spun-out from universities: 199 spin-off firms in 1999-2000, compared to 338 in the previous 5 years. Half of HEIs offer incubation facilities and 70% have some access to seed corn investment.

[3] A recent headline in the Times Higher Education Supplement confirmed that "Spinouts put UK in the lead".

A total of £30M from the Department's Spending Review 2000 settlement and current budgets will be available to support collaborative R&D and knowledge transfer activity, over the next three years, in the five projects announced in the White Paper[4].

The Higher Education Innovation Fund (HEIF) provides the basis for support of further projects of this type in other regions and covering other sectors. To encourage closer links between universities and business £140m has been made available to HEIF, making this a first step towards a permanent third stream. A further £15m of funding was announced in the Science and innovation White Paper. Awards were announced on 1st October 2001, involving some 39 institutions.

DUAL SUPPORT FUNDING - 2000- 2001

OST has the responsibility for overseeing public sector scientific research. The major source of research support in the UK higher education sector is split between the six research councils - see Table 1 below. Along with the direct funding given to universities by the four HE funding councils (in England, Wales, Scotland and Northern Ireland), this makes up the dual support system which both sustains the research effort and preserves and develops the research infrastructure.
The current Reviews will inform Government policy in order to ensure that the Dual Support funding system has a sustainable balance between funding for infrastructure, and funding for research programmes.
The responsibilities of the six research councils are allocated according to discipline or subject area: Biotechnology and Biological Sciences Research Council (BBSRC); Engineering and Physical Sciences Research Council (EPSRC); Economic and Social Research Council (ESRC); Medical Research Council (MRC); Natural Environment Research Council (NERC); Particle Physics and Astronomy Research Council (PPARC). The Council for the Central Laboratory of the Research Councils (CCLRC), while not providing direct research support, offers facilities, scientific and technical expertise to a variety of users including the research councils.

Table 1 - Allocations from the Science Budget 2001-02 to 2003-04

£ Million

Research Council	2001-02	2002-03	2003-04
MRC	349,614	371,930	387,151
BBSRC	213,987	232,603	250,151
NERC	192,865	205,414	216,750
EPSRC	436,202	461,540	489,911
PPARC	206,289	220,383	232,208
ESRC	74,447	82,763	91,533
CCLRC	7,421	8,113	9,952
TOTAL	**1,480,825**	**1,582,746**	**1,677,656**

A total of £356 million of resource was added to the science budget over three years to boost basic research. Of this, £252 million, is to be directed to cross-Councils research programmes in genomics, e-science and basic technology.

Through the Department for Education and Employment (DfEE); The Scottish Executive; Welsh Office; and the Department for Higher & Further Education, Training & Employment (DHFETE), the higher education funding councils (HEFCE, ELWa, SHEFC) provide funding for support of research

[4] Science and Innovation White Paper *("Excellence and Opportunity").*

infrastructure and long-term research strategies of HEIs, and support basic research and certain costs of Research Council supported projects as part of the dual support system. Most research funding is awarded selectively with key data provided by the research assessment exercise (RAE) of which the most recent was completed in December 2001[5].

3. Government support for private -sector R&D and Innovation

DTI business support for innovation and technology

The ICT Carrier Programme aims to improve the use of information and communication technologies (ICT) in engineering industries by helping support adoption and transfer of successful existing applications of ICT into or between engineering sectors.

Business Links (and equivalent offices outside England) have Innovation Technology Counsellors available to give you local advice and also to help you to tap into European Research and Development initiatives.

The SBS SMART scheme provides grants to individuals and small/medium-sized businesses to review, research, or develop technologies leading to commercial products. This is the only R&D support programme for which single companies are eligible. Further information can be found on the Business Link web site.

There are a range of programmes run by the Small Business Service to help industry to profit from knowledge and technology from the higher education and other institutions.

There are a number of initiatives to help you exploit particular new technologies - for Biotechnology - Biowise, and Manufacturing for Biotechnology, for computer and communications technologies - the UK Online for Business and (for European Union projects involving IT and related technologies) UKISHELP, for lasers - the Association of Industrial Laser Users, and for improving controls in manufacturing - the Advanced Control Technology Transfer Programme for sensors, the Sensor Website.

The International Technology Service - keeps companies aware of new technological developments and management best practice from across the world.

The LINK scheme (established in the late 1980s) promotes research partnerships between UK businesses and universities and other research base organisations. The research is precompetitive and strategic, with maximum grant of 50% of total eligible costs. Fourteen Government sponsors are involved in providing grants, with the balance of support provided by businesses in the partnerships.

Research takes place within a well-defined project management framework, usually within programmes covering particular technology or generic product areas. Additionally, the periodic Foresight LINK Awards competition, the latest round of which was used to pilot new fast track procedures, provides support for projects in key priority areas not covered by the LINK programmes which are open to new applications. There are also possibilities of funding individual ad-hoc or "stand-alone" LINK projects outside the programme structure, or through "franchises" granted to specific Government sponsors.

[5] http://www.rae.ac.uk/

LINK programmes now number over 70, with some 30 still open to new project applications. There have also been three rounds of Foresight LINK Awards, three franchises and five stand-alone projects. Altogether the number of LINK projects is around 1,500 with total eligible costs, met by Government and business, of over £1 billion. Participants have included over 200 research base organisations, including almost every UK university, and over 200 companies, more than half of which are SMEs.

The Foresight programme aims to develop visions of the future and bring together the knowledge and expertise of business, science and government to increase national wealth and quality of life.

NMS (the National Measurement System) is the UK's national infrastructure of laboratories, which delivers world-class measurement science & technology, providing traceable and increasingly accurate standards of measurement for use in trade, industry, academia and government.

The European initiative known as Eureka encourages international collaborations between companies and other organisations.

Businesses can tap into a range of regionally-based schemes that are designed to help them benefit from innovative ideas and technological advances and which are supported by European Structural Funds. They are normally administered by Government Offices in the English regions and delivered through your local Business Link (and equivalent offices outside England), Training and Enterprise Councils, etc. Further information is available from these organisations or the National Assembly for Wales, the Scottish Executive and the Northern Ireland Office.

The DTI's Future and Innovation Unit runs a website, www.innovation.gov.uk, which aims to help organisations understand innovation, why it is important and how the best organisations manage it.

An R&D tax credit for small firms was introduced in 2000 to help small and medium-sized companies undertake R&D either for the first time or encourage them to undertake even more R&D. Further information is available on the Inland Revenue's website. At the same time new Guidelines were introduced on the definition of R&D for tax purposes. The Guidelines, published by the Secretary of State, will benefit both large and small companies by providing added certainty for their tax affairs.

In the 2001 Budget, the Government announced proposals for a new tax incentive for R&D for larger companies, and launched a consultation document on its design. The proposed new R&D tax incentive for larger companies will complement both the R&D tax credit for small firms introduced in 2000 and other policies that act to support R&D and innovation. The consultation is being run by the Inland Revenue and closes on 8 June 2001.

The Patent Office helps small firms to protect their business ideas, inventions and logos by offering advice about patents, designs, trademarks and copyright and provides a range of free literature.

More information is available on the DTI Science and Tech. channel.

In addition, the DTI’s CARAD programme supports long term pre-competitive civil aeronautics research activity in industry, universities and the Defence Evaluation and Research Agency (DERA):

CARAD supports the UK aeronautics sector in three ways:

- Direct grants for collaborative work in industry, with funding split between DTI and industry.
- Funding for intramural work carried out DERA the results of which are disseminated to industry.

- Funding for collaborative work placed through DERA's extramural programme in industry, higher education institutions, research and technology organisations and research establishments, jointly funded with industry and sometimes also with the Ministry of Defence.

CARAD funds basic and applied research but does not provide assistance for product development activity. Launch Investment on the other hand is a risk-sharing Government investment in the design and development of specific civil aerospace projects in the UK. It has been used to support developments of airframes (or parts of airframes, such as wings), helicopters and aeroengines. The investment is not a grant and is repayable to the Government at a real rate of return, usually via levies on sales of the product developed. It matches comparable support provided to Aerospace by other major industrial countries.

UK companies are eligible for support through the EU Framework Programme for Research and Technological Development. Projects must involve cross-border collaborative partnerships. UK companies are estimated to receive about £100 million p.a. of support for collaborative research and early stage development. However the costs of participating in EU FP projects can be considerable but it is risky for UK firms not to participate when their principle continental competitors are doing so.

Knowledge transfer/exploitation funding

Over recent years much attention has been focussed on improving the capacity within the Science and Engineering Base to exploit knowledge and creating the systems to enable better interaction with businesses (*e.g*. Science Enterprise Challenge, University Challenge, HEROBAC/HE Innovation Fund, Faraday Partnerships, TCS, Baker Report follow-up).

Those activities aimed at business typically comprise a mix of benchmarking and self-help tools, advice and signposting. They may be targeted at improving management issues through the spread of best practice, for example, in sectorally focussed supply chain activities (*e.g*. Industry Forums) or other business-to-business learning programmes (*e.g*. Inside UK Enterprise), and highlighting the strategic importance of innovation (Innovation Unit - Celebration of Innovation). Some measures promote the use of specific technologies to enhance business performance (UK Online for Business) and improve sustainable development (Environmental Technology Best Practice Programme).

The University Challenge Fund provides support to universities or consortia of universities to set up local "seed" funds supporting early stage commercialisation.

The Teaching Company Scheme (TCS) aims to:

- Facilitate the transfer of technology and the spread of technical and management skills, and to encourage industrial investment in training, research and development.

- Provide industry based training, supervised jointly by personnel in the science, engineering and technology base and in business, for high calibre graduates intending to pursue careers in industry.

- Enhance the levels of research and training in the science, engineering and technology base that is relevant to business by stimulating collaborative research and development projects and forging lasting partnerships between the universities and industy.

The Science Enterprise Challenge (SEC) aims to encourage transfer of science and technology innovation to the business sector by establishing "centres of enterprise" in universities to:

- Teach enterprise and entrepreneurship to science and technology students.
- Make ideas and know-how available to business to support competitiveness and wealth creation.
- Encourage the growth of new businesses by supporting start-ups, including spin-out companies based on innovative ideas developed by students and faculty within the universities.

The Higher Education Innovation Fund (HEIF) (incorporating Higher Education Reach-Out to Business and the Community [HEROBAC]) provides funding for the establishment of centres of expertise in HEIs, ISR-oriented training for HEI staff, "one stop shops" for business partners.

The Joint Research Equipment Initiative (JREI) provides funding for equipment in areas of high quality research.

Collaborative Awards in Science & Engineering (CASE) provides grants to students for carrying out doctoral research addressing industrial problems and jointly supervised by HEIs and firms.

There is also an Industrial CASE studentship scheme where industrial partners choose an academic partner for research training and a CASE for New Academics scheme that provides a route for new academics to build links with a company at an early stage in their career through co-supervision of a CASE student.

Further information on these programmes can be found at: http://www.ost.gov.uk/ost/ostbusiness/index.htm

4. Enhancing collaboration and networking among innovating organisations

See references to LINK and Faraday programmes mentioned in section 3.

5. S&T human resources

Shortages of scientists and engineers

In response to concerns that innovative businesses in the UK sometimes find it difficult to recruit the skilled researchers they need, the Government asked Sir Gareth Roberts to lead an independent review of the supply of scientists and engineers in the UK. As well as examining the numbers of scientists and engineers in the UK the review will also consider the skills needed by business for their R&D activities, the skills gained by science and engineering graduates and postgraduates, particularly PhD students. A major focus of the work will be investigating how businesses and universities communicate and collaborate in providing the relevant training to students.

A consultation document was published in June 2001. Further details are at: http://www.hm-treasury.gov.uk/mediastore/otherfiles/37.pdf

A summary of responses was published in November 2001and can be found at: http://www.hm-treasury.gov.uk/mediastore/otherfiles/Roberts_Review.pdf

A final report, due out in March 2002, is expected to feed in to the Government's next spending review.

Training and education

The UK has programmes to attract graduates into public research. The main specific incentives are (increasingly generous) studentships and fellowships, though the broader push to improve research careers (see Universities UK website) is also relevant. Individual universities may offer students and staff a range of additional incentives ad hominem. As employers in their own right, the Research Councils have their own career development schemes, which may include some form of tenure-track. The universities, Research Councils and Government Departments generally have "returns to inventors" schemes. However, the prime incentive continues to be the quality of the research environment on offer, reinforced by increased Government funding for research, and the increased emphasis on encouraging and enabling researchers to exploit and benefit from their research by licensing, spin-out companies and so forth.

Some measures been taken to improve training in order to better meet demands of the labour market.
Examples can be found at:
http://www.epsrc.ac.uk/student/default.asp?S=0&Key=0&Menu=29&ODoc=252
http://www.epsrc.ac.uk/student/default.asp?S=0&Key=0&Menu=31&ODoc=175

Information on developments in postdoctoral training is available via the Universities UK website: http://www.universitiesuk.ac.uk/

and also the Higher Education Staff Development Agency site at: http://www.shef.ac.uk/hesda/nation/crs.html

We are currently delivering datasets on women and science to the European commission on women and science along with other member states. We also have a website — www.set4women.gov.uk in which there is a statistics channel. This is currently being updated and will contain further data and information on women's education and employment in SET.

The ATHENA project, funded by OST and the UK higher education funding councils is working to tackle the issue of women's under-representation in HE employment. It has been in existence for 2 years and a further 2 years is planned before a full review. However this project as seen a wider and high level acknowledgement of the issues facing women in HE and the recent (June 2001) launch of the Equality Challenge Unit as well as a lot of regional activity.

In part the Promoting SET for Women Unit (set up in 1994) is the main policy driving body to tackle women in HE - it is through actions of this unit that a number of issues have been considered in more detail and that includes research (Who applies for research funding) and women returners to SET and comparison of education and employment in IT, electornics and communication, to be published imminently. PSETW functions were reviewed in 1997 and an internal review of activities was also undertaken against its initial objectives in 2000. The unit is currently working to ensure that gender issues are taken up across the mainstream of science policy making, in funding and programme development.

Migration and Mobility

Data on international mobility of S&T personnel is not readily available. However, the UK higher education sector has experienced a net inflow of academic staff at every level for many years, with only very rare exceptions. Nonetheless, there are concerns about the emigration of the best researchers, and Government and its agencies share a determination to achieve "brain gain" for the UK.

We have no aggregate data on the proportion of UK postgraduates pursuing those studies overseas. The largest group is likely to be in the USA, for which NSF science and engineering indicators are available at http://www.nsf.gov/sbe/srs/seind00/start.htm. As far as PhDs are concerned, the number, as a proportion of UK postgraduates studying at home, is relatively small, though not insignificant (< 200 UK PhD qualifiers a year in the USA).

A relatively high proportion of pre- and postdoctoral researchers comes from overseas. For example, overseas students take about a third of PhDs. UK nationals may account for about 60 per cent of postdoctoral researchers, but a lower proportion in some branches of engineering.

The Government has backed a drive to increase the number of overseas students, and amended policies to facilitate their entry and continue their residence on the conclusion of their studies. Further details and links are at http://www.fco.gov.uk/news/newstext.asp?3246

The main targeted national resource is the Overseas Research Students' Award Scheme, worth about £11m a year. The expanded Chevening scholarships support relatively very few doctoral or postdoctoral students. Universities also use their own resources (which may include public sector funding) to support overseas students. Comparisons are therefore difficult. The Research Councils spend about £150m a year on studentships, available in full to UK residents and to other EU nationals to pay their fees only. Overseas postdoctoral researchers may be eligible for fellowships, can be supported on grants (subject to work permit), and are recruited to permanent academic posts.

Jointly with the Wolfson Foundation, the Government is funding a Research Merit Award scheme, run by the Royal Society and worth £20m over 5 years. This offers institutions additional funds to top up the salaries of researchers whom they wish to retain or recruit from industry or overseas.

The Government wishes to see healthy, preferably two-way flow between the research community and users of research. The flow can, however, take a variety of forms that may not always involve moving jobs. In general, there is a reasonably strong flow of personnel from most areas of academic research into industry, especially at the doctoral and immediately postdoctoral levels. Flows back – from industry to academia – are not unique but are rarer, partly because of reward differentials, but perhaps more because of the difficulty of switching career. Mobility is more limited in the biosciences, largely because of the relatively large sums of money available from public, charitable and private sources enabling researchers to pursue their research for longer, albeit possibly by moving institutions. Mobility between different public institutions is not a big issue.

6. International collaboration and globalisation

See references to Eureka and Framework programmes in section 3.