Science and innovation investment framework 2004-2014:

Annual Report 2006

July 2006

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INTRODUCTION

1.1 This is the second annual report on the realisation of the Government's *Science and Innovation Investment Framework 2004-2014*. The ten-year framework set out a long-term vision for UK science and innovation across six broad themes[1], together with the ambition that public and private investment in research and development (R&D) should reach 2.5 per cent of GDP by 2014 (from a current level of 1.9 per cent).

1.2 The ten-year framework seeks to ensure a strong and successful UK research base effectively linked to a thriving innovation culture. This is essential if the UK is to compete in a global future of increasing sophistication where success will be based upon the ability to generate, access and apply new knowledge as never before.

1.3 The focus of the first annual report was on taking initial actions and putting new activities in place. Much of the focus was on the research base, as the health of this provides the springboard for the UK to generate and access new knowledge as well as providing the capability to innovate in many cases. This is not, however, to overlook the importance of developing a strong innovation culture in the UK and ensuring that investment in the research base is effectively linked to innovation. This year has seen a number of important developments to progress these aims including:

- the creation of the Office of Science and Innovation (OSI) bringing responsibility for science and innovation in Central Government together for the first time;
- the publication of the *Science and Innovation Investment Framework 2004-2014: Next Steps*[2] document alongside the budget, with key proposals on increasing science, technology, engineering and mathematics (STEM) skills supply, reforms to the Research Assessment Exercise (RAE), funding of Health research and for an arms length Technology Strategy Board (TSB);
- further meetings of the UK Science Forum, which have addressed issues relating to skills, procurement and monitoring progress in developing an innovation culture.

Whilst it is too early for these to have had an impact on outcomes, they will affect how activities develop over the coming year.

[1] World class research, Responsiveness to the needs of the economy, Business R&D and innovation, Supply of scientists, Public understanding and engagement, Science and innovation across Government.

[2] Available at http://www.hm-treasury.gov.uk/media/1E1/5E/bud06_science_332.pdf

On course but clear challenges remain

1.4 A broad assessment of progress overall is that, two years into implementation of the ten-year framework, the programme is on course. From an already strong position, the UK research base continues to improve, helped by increased investment to develop both new areas of research and a sustainable capability for the future. However, as noted in the first annual report, considerable challenges remain to lift both levels of business R&D and to ensure that the UK has the continued throughput of trained scientists that it needs. There is also a need to improve the measurement of innovation and business R&D in the UK economy to allow the impacts of Government action to be better understood. The actions noted above will begin to address these, but there remains a need to monitor their impact and this will be developed over the coming year. A number of new metrics for innovation activity are being considered, drawing upon the work of key stakeholders, including the UK Science Forum, to provide a baseline of performance.

1.5 This document follows the original chapter structure of the ten-year framework reporting on each broad theme in turn, with a final chapter on progress to date on the measures set out in the *Science and Innovation Investment Framework 2004-2014: Next Steps* document. Each chapter begins with a section outlining evidence of progress against that theme, before going on to highlight the key policy developments over the past year, summarised below.

World Class Research

1.6 Continued world-class research performance. The most recent report for the Department of Trade and Industry (DTI)[3] shows that, despite increasing competition, the UK continues to increase its world share of citations and high impact papers and remains at the head of the G8 on research efficiency and productivity measures.

Improved financial sustainability

1.7 Important steps have been taken to improve the financial sustainability of the research base. Research Councils now pay 80 per cent of the full economic cost of the grants they award and, as a result of the careful preparations by both the Research Councils and universities, implementation has proceeded smoothly. Action to ensure the sustainability of Public Sector Research Establishments (PSREs) has also moved forward with strategic dialogue between the major sponsors and Institutes established at the Research Establishment Sustainability forum (RESUK). The programme of investment in research infrastructure through the Science Research Investment Fund (SRIF) has continued to help remedy the legacy of under-investment in the research base. To date over £2 billion has been invested in science facilities in Higher Education Institutions (HEIs). A major review of the impact of SRIF and future investment needs has been carried out and will be published shortly. This will confirm that significant progress has been made. The year also saw the Higher Education Funding Councils produce their first report on the overall sustainability of the UK university system based on consideration of university plans to achieve sustainability and a set of 'trigger metrics'. The report, published today, shows the vast majority of institutions on a positive trajectory[4].

[3] PSA target metrics for the UK research base, December 2005. Available at http://www.ost.gov.uk/research/funding/psa_metrics_report.pdf

[4] http://www.dti.gov.uk/science/science-funding/funders-forum/index.html

Global partnerships

1.8 The Government is continuing to work with global partners and institutions to maximise the value of the UK's international collaborations. This includes delivery of the Global Science and Innovation Forum (GSIF) strategy, continuing bilateral and multilateral engagement with international partners including through the EU Framework Programme (FP).

Greater responsiveness to the needs of the economy

1.9 Universities are continuing to strengthen their links with business and community organisations. The Higher Education Innovation Fund (HEIF) and a number of smaller knowledge transfer schemes are helping them build their capacity to do this. While the most recent Higher Education – Business Community Interaction (HEB-CI) survey showed a decline in the number of spin-out companies being created, this was more than counterbalanced by an increase in the number of licenses granted. This suggests that institutions have recognised that licensing is inherently less risky than the spin-out route and more likely to succeed in a shorter time period. The PSRE community has also demonstrated an increased number of successful applicants in the PSRE3 competition, while the Regional Development Agencies (RDAs) and Research Councils capacity building fund is under way and helping to increase university-business interactions. Transatlantic knowledge transfer links are also now being fostered through UK-US Science Bridges to develop collaborations between leading UK universities and US partners.

Increasing business investment and engagement

1.10 Raising the level of business engagement in innovation and investment in R&D is a challenge for which the major decisions are outside the control of government. The business-led Technology Strategy Board (TSB) ensures the needs of business are reflected in Government thinking and that activities such as the development of a national Technology Strategy are market focused. By developing a clear picture of the environment for business innovation through more sophisticated measurement, Government can help business develop the clarity necessary to make informed decisions on future development. Work is underway to develop better outcome-focused measures of innovation. Government is able to further facilitate business engagement with the challenges of innovation by providing targeted support. There has been much progress with R&D tax credits, the development of Knowledge Transfer Networks (KTNs) and support for Collaborative Research projects through the Technology Programme, follow up to the Cox report on creativity, and action to prevent animal rights extremism stifling progress in bioscience. The year ahead will see further progress, for example, the UK Trade and Investment (UKTI) strategy on global markets and foreign direct investment will be looking to strengthen the international competitiveness of UK business and the image of the UK as a globalised economy.

Supply of scientists

1.11 The challenge of ensuring an adequate supply of science, technology, engineering and mathematics (STEM) skills to the economy remains work in progress. The Government's strategies to promote the teaching and learning of STEM skills require periodic refreshment if they are to remain effective. Despite some fluctuations, the measures that have been put in place over the last five years or so, and in particular as a result of the ten-year framework, have had a positive impact on the quality and quantity of STEM learning at all levels of the education system. In some areas, notably the supply of school teachers, important progress has been achieved. The package of new measures, mainly in the area of schools policy, that were announced in *the Science and Innovation Investment Framework 2004-2014: Next Steps* document are designed to lift performance significantly in this area.

Public engagement

1.12 On the public understanding of and engagement with science the Sciencewise programme has moved to directly commission work that delivers a legitimate public voice into scientific decision-making. Priority has been given to building public engagement in the key areas of nanotechnology, brain science and stem cell research. These have been chosen to reflect the importance of public debate in developing areas deemed critical to future economic success.

Science across government

1.13 Government continues work to ensure the management of science and scientific advice underpins decision-making processes and improves service delivery. Individual departments and agencies are rising to the many challenges in this area. Cross-Government and cross-disciplinary collaboration have become increasingly important in this area, and joint working on the Comprehensive Spending Review (CSR), Grand Challenges and other cross-cutting priorities are likely to provide useful models for future priority setting and strategic decision making across Government.

Next Steps

1.14 A number of the main areas of activity in the coming year have been noted above. These focus around the proposals in the *Science and Innovation Investment Framework 2004-2014: Next Steps* document. Several are subject to consultation, but actions will include:

- Establishing the single, jointly held, health research fund to bring together clinical and basic research support;
- Action on STEM skills to improve numbers and performance up to 'A' level;
- An increasing role for the Technology Strategy Board in Government innovation strategy;
- An enhanced role for UKTI in marketing the science base to business;
- Extension of additional support through the R&D tax credit to companies with between 250 and 500 employees (subject to the outcome of state aid discussions).

1.15 For those wishing to read, in more detail, about the Government's progress against target indicators and policy measures set out in both the original ten-year framework and *Science and Innovation Investment Framework 2004-2014: Next Steps* there is an accompanying, internet only, document *Science and Innovation Investment Framework: Progress Against Indicators* available on the DTI website at http://www.dti.gov.uk/science/science-funding/. The report will be updated as new innovation metrics are introduced.

2 RESEARCH EXCELLENCE

This chapter outlines key achievements and actions to increase the global competitiveness of UK research and improve its long-term sustainability including:

- continued strong research performance, the UK has increased its share of world citations to 12 per cent and its share of highly cited papers to 13.2 per cent;
- implementation of Full Economic Cost (FEC) regime from Sept 2005, provision of £200 million by 2007/08 to ensure all grant submissions to the Research Councils paid at 80 per cent FEC;
- substantial progress in addressing investment backlog in university infrastructure under SRIF, continued investment of £500 million per annum;
- consultation on reform of higher education research assessment and funding; and
- consultation on the organisational arrangements needed to deliver world class health research outputs from the creation of a single health research budget.

Amibitions

2.1 Ambitions relating to research excellence and sustainability for UK science and innovation were outlined in the ten-year framework as follows:

World class research at the UK's strongest centres of excellence:

- maintain overall ranking as second to the USA on research excellence, and current lead against the rest of the OECD; close gap with leading two nations where current UK performance is third or lower; and maintain UK lead in productivity; and
- retain and build sufficient world class centres of research excellence, departments as well as broadly based leading universities, to support growth in its share of internationally mobile R&D investment and highly skilled people.

Sustainable and financially robust universities and research institutes across the UK:

- ensure sustainability in research funding accompanied by demonstration by universities and public laboratories of robust financial management to achieve sustainable levels of research activity and investment.

2.2 To achieve these ambitions, the 2004 Spending Review allocated over £1 billion in additional funding for the research base up to 2007-08, thereby more than doubling funding to the research base since 1997 from £1.3 billion to £3.4 billion. This includes funding to enable Research Councils to cover a greater share of the full economic costs of research and continued dedicated capital funding for the renewal of university infrastructure.

EVIDENCE OF PROGRESS

2.3 With money, people and ideas flowing around the world faster than ever the competition for scientific talent continues to intensify. China, India and a number of smaller nations continue to increase their world share of publications and citations. The leading G8 nations have to work ever harder simply to retain their existing world share. Against this backdrop UK research continues to perform extremely strongly. The UK has increased its share of world citations to 12 per cent and its share of highly cited papers to 13.2 per cent. The UK has also sustained a more consistent performance across the range of scientific disciplines than most other countries (see Table 2.1 below) and retains its lead in the G8 on productivity and efficiency measures. The rapid rise of China in world citations ranking is particularly notable. For example, in Mathematics China has moved up to second in the world in 2004 from 8th in 1995[1]. For the first year data on the Arts and Humanities are available and reveal encouraging results, with the UK second only to the USA on world citation share.

Table 2.1: PSA target metrics for the UK research base[2]

Research field	World ranking	Trend 95-04	Highlights:
Bioscience	2	⟷	•UK increasing overall citation and highly cited share.
Business	2	↑	•UK very high on citation "productivity".
Clinical	2	↑	
Environmental sciences	2	⟷	•Agile research base - second in seven out of ten broad disciplines.
Humanities	2	NEW	
Pre-clinical	2	⟷	
Social sciences	2	↑	
Mathematics	3	⟷	
Physical sciences	4	↑	
Engineering	4	⟷	

[1] The UK remains third in the world to USA and China. Despite having overtaken France, it was in turn overtaken by China in 2004.

[2] Source: http://www.ost.gov.uk/research/funding/psa_metrics_report.pdf Data reflects UK number and share of world citations in ten major research fields.

KEY HIGHLIGHTS AND NEXT STEPS

World-class research

Research Assessment Exercise

2.4 *Science and Innovation Investment Framework 2004-2014: Next Steps* announced the Government's intention to consult on proposals for a metrics-based research assessment and funding system with the intention of creating a less burdensome and costly system to succeed the RAE after 2008. The proposals, which were developed by a working group chaired by Sir Alan Wilson and Professor David Eastwood, were published on 13 June 2006[3]. The consultation period will run until 13 October 2006 and final decisions will be announced before the end of the year.

Research Councils Performance Management System

2.5 The Performance Management System for the Research Councils has been operating for a full year. All the Research Councils and Research Councils UK (RCUK) have now published Delivery Plans, scorecards and output 1 and 2 frameworks related to the health of the research base and better exploitation of research. The Delivery Plans and scorecards were refreshed and republished in May 2006 in response to achievements and changes in direction to consolidate success[4]. Annual Delivery Plan reports were submitted at the end of June and the first set of data on the metrics in output frameworks 1 and 2 was also submitted to the Director General Research Councils (DGRC). The Performance Management System is being used by Research Councils to encourage and promote best practice and to measure the impact of Government investment in science and innovation.

Case Study 2a : Fighting crime with science

Work, funded under the Engineering and Physical Sciences Research Council's (EPSRC) Crime Prevention and Detection Technologies Programme, undertaken by a team at the University of Sheffield, has slashed the time it takes to identify fingerprints. They have developed a technology that can compress the size of fingerprint images so they can be sent over the mobile telephone network without losing data. On average, it takes four hours to get an ID rather than eight days. This technology was approved for use in British police forces in January 2006 and is now being rolled out around the country.

Financial Sustainability

2.6 Returning the research base to financial sustainability is an important long-term goal within the ten-year framework. This year has seen a number of key initiatives implemented to make progress towards this.

[3] Available online at http://www.dfes.gov.uk/consultations/

[4] For more details and links to individual Research Council's delivery plans and scorecards see http://www.rcuk.ac.uk/deliveryplan.asp

Full Economic Costing (FEC)

2.7 In July 2005, the Joint Costing and Pricing Steering Group (JCPSG) completed its project to develop effective costing and pricing approaches for HEIs, and to encourage their implementation and use across the HE sector. The project developed the Transparent Approach to Costing (TRAC) as a robust and effective costing system based on the principles of activity-based costing. The extension of TRAC to allow the forecasting of FEC at activity and project level, has been of considerable importance in helping create the conditions for research and related activities to become sustainable over the next few years. HEIs now have better information to guide their further development into market-based and valued-based pricing.

2.8 Since the beginning of September 2005, all proposals to the Research Councils have been submitted on the basis of FEC, and the resulting grants funded at the rate of 80 per cent FEC providing an extra £200 million per annum by 2007/8. This follows on from £120 million distributed to HEIs in 2005/6, in advance of the move to FEC to improve the resourcing of existing research projects. This represents a major increase in the contribution the Research Councils make to the cost of the research projects they support in HEIs and is in itself a significant step towards the return of the system to a sustainable basis. The Research Councils carried out an initial review of the implementation in May 2006 which concluded that, although it was still too early to see the effects of increased funding, implementation so far has been straightforward, with no major problems reported.

2.9 The funding councils "quality related" (QR) recurrent grants are also being increased over the SR04 period providing a further contribution to sustainability within the dual support system. This will be further progressed with £135 million being made available via the Charity Partnership Fund to underpin the high quality research funded by charities.

Funders' Forum

2.10 The UK Research Base Funders' Forum brings together representatives of the major funders of 'public good' research including business, charities, Funding and Research Councils, Government Departments and HEIs to consider their collective impact on the sustainability, health and outputs of the UK Research Base.

2.11 In 2005/06 Funders' Forum meetings received reports on health of disciplines, research careers and university financial sustainability. Preparations for the next stage on full economic costing have also been discussed. The report from the UK Funding Councils on the progress of UK HEIs towards long-term financial sustainability is published alongside this report[5]. The key findings from the report show that the vast majority of HEIs are on a trajectory towards long-term sustainability. The Funders' Forum held its first plenary meeting in November 2005, bringing together a wider group of senior representatives from various funders to discuss full economic costing and ways to increase the rate of knowledge transfer from universities to business. A second plenary meeting on strengthening the links between science and innovation is planned for November 2006.

[5]Available at http://www.dti.gov.uk/science/science-funding/Funders_Forum/index.html

Science Research Investment Fund (SRIF)

2.12 Complementary to the work being undertaken on FEC, between 1999 and 2006 over £2 billion has been invested in university research infrastructure to update and renew university science facilities and buildings. A third round of SRIF, jointly funded by DTI and the Department for Education and Skills (DfES), commenced in April 2006 and will invest a further £1 billion in university projects.

2.13 Looking to the future, an independent study jointly commissioned by OSI and the UK higher education funding bodies to look at the future need for infrastructure funding will report by September 2006.

Case Study 2b – Cardiff Brain Imaging and Repair Centre

SRIF2 investment of over £8 million has enabled the establishment of state-of-the-art imaging facilities at the Cardiff University Brain Imaging Centre (CUBRIC). The centre will improve the understanding of normal and damaged brain function, as well as informing treatment of brain impairments such as head injury, stroke, dementia and schizophrenia. Housed in a new purpose-built building, CUBRIC will enable psychologists and brain specialists to gain a better understanding of how the brain works and what happens when people suffer from brain injury and other disorders of the brain. CUBRIC is one of few centres in the UK to combine Functional Magnetic Resonance Imaging and Magnetoencephalography solely for research. The facility will be a boost for the whole scientific community in the UK.

Public Sector Research Establishmts' (PSREs)

2.14 Progress towards sustainability is also taking place within PSREs. To help Government Departments and Research Councils implement full economic costing for PSREs, OSI has established the RESUK forum where matters relating to the implementation of FEC and the Research Council Institute and PSRE Sustainability Study guidelines can be discussed. OSI has also completed the first annual survey of sustainability in PSREs[6] published today and this information will provide a baseline against which to measure future progress. Although the survey indicates there are concerns about the current sustainability of something like a third of PSREs, action is already being taken in many cases to address the problems identified in individual PSREs.

Strategic Subjects

2.15 Science and Innovation Awards were introduced by EPSRC in 2005 to address the issue of giving support to strategic areas of research that are particularly at risk. EPSRC, together with the Higher Education Funding Council for England (HEFCE), the Scottish Funding Council (SFC) and the Department for Employment and Learning Northern Ireland (DELNI), is funding seven new programmes with a value of over £27 million in the areas of nanometrology, statistics, plasma physics and the Mathematics-Computer Science interface.

[6] http:www.dti.gov.uk/science/science-funding/ripss/page22675.html

Case Studies 2c: University of Strathclyde and King's College London
This project will be used to advance the emerging field of nanometrology, for applications in molecular science, medicine and manufacture. Led by Professor David Birch at the University of Strathclyde and in collaboration with Professor John Pickup's team at King's College London, the project will facilitate the multidisciplinary research environment required to develop the extra capacity needed to make the UK a leader in nanometrology.

Queen's University Belfast

Led by Professors Bill Graham and Ciaran Lewis, this project aims to address the UK's need for more plasma physicists by complementing and strengthening the current experimental activity in high and low temperature plasma physics with theoretical and computational expertise. They also plan to create the first UK-wide, web-based teaching programme in plasma physics, in partnership with other universities, laboratories and industry.

2.16 The Arts and Humanities Research Council (AHRC), Economic and Social Research Council (ESRC) and HEFCE are collaborating on a £20 million initiative with the aim of creating world class researchers with the language skills to undertake contextually informed research that will enhance the UK's understanding of the Arabic speaking world, China, Japan and Eastern Europe. The Scottish Funding Council (SFC) and the Higher Education Funding Council for Wales (HEFCW) have also agreed in principle to support the initiative.

2.17 A partnership between the Biotechnology and Biological Sciences Research Council (BBSRC), Medical Research Council (MRC), Higher Education Funding Councils, and pharmaceutical companies (AstraZeneca, GlaxoSmithKline and Pfizer) has established an £11 million dedicated fund to springboard capacity building in integrative mammalian biology.

Large facilities

2.18 The Large Facilities Road Map[7] was published by RCUK in 2005. The Road Map is a fifteen-year forward look of all large facilities that Research Councils consider priorities for UK researchers, both national and international, within the UK and abroad. A prioritisation exercise determining which future projects should move to the next stage of development, and which may receive funding from the Large Facilities Capital Fund, has just been concluded[8].

[7] http://www.rcuk.ac.uk/lfroadmap/

[8] More details can be found at http://www.ost.gov.uk/research/funding/lfroadmap/index.htm

Box 2.1: Diamond Synchrotron

The Diamond Synchrotron currently under construction will be the largest scientific facility to be built in the UK for 30 years. Diamond will be completed in December 2006 and is on schedule to open in January 2007. When it opens, Diamond will provide researchers from the UK and abroad with state-of-the-art instrumentation, cutting edge analytical techniques, and support services for the next 30 years or more. A synchrotron is designed to produce very intense beams of x-rays and ultraviolet light. This "synchrotron light" can penetrate deep inside matter and allows scientists to investigate the world around us at the scale of atoms and molecules. Many everyday commodities, from revolutionary drugs to surgical tools, have been improved or developed using synchrotron light. It is being constructed by a Joint Venture company with two shareholders: the Council for the Central Laboratory of the Research Councils (CCLRC) acting on behalf of the Government (86 per cent share) and the Wellcome Trust (14 per cent share).

Supporting world-class health research

2.19 The Government's vision is of a holistic health R&D system that will maximize the value of the UK's health research base ensuring the UK's health research is more closely aligned with wider health objectives, builds on scientific progress to date, and translates the results of research into economic benefit.

2.20 Building on recent reforms, Budget 2006 announced an intention to ring-fence the Department of Health's R&D budget and that the Secretaries of State for Health and Trade and Industry will create a single, jointly-held health research fund of at least £1 billion per annum, for which they will agree strategic priorities.

2.21 Sir David Cooksey was invited to advise the Government on the institutional arrangements required to deliver the objectives set out above. His consultation was launched in May 2006[9] and he will report on options in time for the 2006 Pre-Budget Report.

Global Partnerships

GSIF

2.22 The ambition for the "UK to be the partner of choice for global business looking to locate R&D overseas and for foreign universities seeking collaboration with the science base and business … to maximise the value of collaborations at an international level and in European fora" was set out in the ten-year framework. The Global Science and Innovation Forum (GSIF) strategy brings together all the main players in international science and innovation to develop a strategy to deliver this objective. The strategy will continue to promote existing international initiatives, but it will also encourage proactive engagement focused on a limited number of countries and issues – chosen to be those where top-level coordination of the UK's focus will add value.

[9] http://www.hm-treasury.gov.uk/independent_reviews/cooksey_review/cookseyreview_index.cfm

2.23 Since its establishment in 2005, GSIF has been developing its international strategy – commissioning and considering evidence, prioritising key objectives in focus countries and developing its first recommendations for changes in the way that support for international engagement in R&D should be provided in the UK. The strategy is due to be published in the autumn and implementation across the GSIF partners will then roll out. GSIF will continue to develop its understanding of how international science and innovation will develop over the next ten years of increasing globalisation, and anticipate its impact on UK prosperity.

EU Framework Programme

2.24 EU-financed R&D expenditure is channelled through the multi-annual Framework Programmes for Research. The Seventh Framework Programme (FP7) negotiations dominated the research agenda during the UK Presidency of the EU Council of Ministers held in the second half of 2005. Although negotiations are ongoing the UK Presidency culminated in agreeing a Partial General Approach (PGA) on FP7 at the Competitiveness Council in November 2005. The PGA was an important achievement that sent a clear signal about the importance of research to Europe's future and was crucial for keeping FP7 to the overall legislative timetable. It confirmed agreement on some of the main principles behind FP7, notably the critical importance of improving Europe's research, technology transfer and innovation performance to enhance global competitiveness and to increase growth and employment. The PGA provided the Austrian Presidency with a firm foundation to take forward the negotiations on FP7 in 2006.

European Research Council

2.25 One of the major innovations in the FP7 proposal is for the creation of a European Research Council (ERC) to fund basic research. Unlike traditional funding under past Framework Programmes aimed at supporting collaborative research, this would not require cross-border collaboration as a pre-condition of funding and research would be funded solely on the basis of excellence, determined by international peer review. The work of the ERC will be overseen by an independent Scientific Council. The inaugural Scientific Council, chaired by Professor Fotis Kafatos of Imperial College, has been established and is currently preparing for the launch of the basic research actions in FP7.

2.26 The UK welcomes the establishment of the ERC on this basis, viewing it as a valuable mechanism for creating a genuinely pan-European competition for funding basic research. This should help raise the quality of basic research across Europe as well as providing valuable benchmarking for national funding authorities.

3 GREATER RESPONSIVENESS TO THE NEEDS OF THE ECONOMY

This chapter highlights key achievements over the past year to increase knowledge transfer and innovation from universities and research institutes. In particular:

- strong growth in licensing and intellectual property in higher education institutions (HEIs), showing their increasing ability to exploit the fruits of their research;
- formula funding for HEIF 3 helping HEIs to build their capacity to make regional, national and global contributions;
- an increase of awards made to PSREs receiving funding from 16 to 29 for the third round of funding;
- an increase of, respectively 198 per cent and 32 per cent in the number of licenses granted to HEIs and PSREs; and
- Research Council Knowledge Transfer Plans which include metrics to measure progress included in Research Council Delivery Plans published in May 2006.

Ambitions

3.1 The 2003 Lambert Review of business-university collaboration concluded that the UK was strong in research, but less effective at translating the products of research into social and economic benefits. The ten-year framework therefore set out to encourage greater responsiveness of the publicly-funded research base to the needs of the economy and public services, focusing especially on two targets:

- improve UK performance in knowledge transfer and commercialisation for universities and public laboratories to world leading benchmarks; and
- Research Councils' programmes to be more strongly influenced by, and delivered in partnership with, end users of research.

3.2 The ten-year framework included the Government's response to the Lambert review and announced increased support for knowledge transfer from universities in England through the Higher Education Innovation Fund (HEIF).

EVIDENCE OF PROGRESS

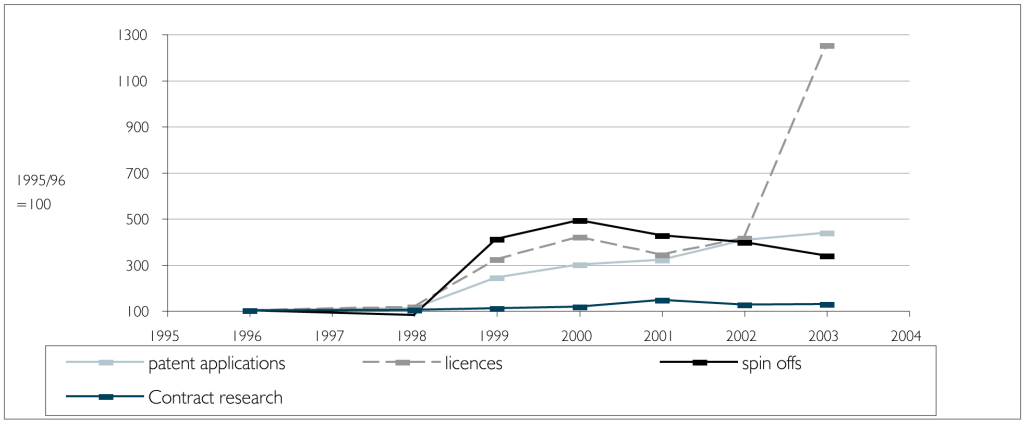
HE-BCI

3.3 The Higher Education – business community interaction (HE-BCI) survey, which helps to assess the volume and development of interaction between higher education, business and the wider community, is collected by HEFCE and provides an indication of knowledge transfer activities against the OSI basket of indicators.

Growth in licensing and IP

3.4 The latest survey results reveal positive trends in knowledge transfer activities. The data from the university sector predates the ten-year framework (HE-BCI is in its fifth year) and is illustrated in Chart 3.1. Although the number of spin-outs has fallen, licensing and IP continue to grow. These trends suggest that, as knowledge transfer activities become embedded in mainstream university life, institutions are increasingly turning to licensing rather than company formation as the likelihood of success and financial returns are greater for licenses.

Chart 3.1 Relative Changes in HEI Knowledge Transfer Indicators 1996-2003



3.5 The first ten-year framework annual report highlighted the flotation of ten university spin-out companies, with a combined market value of £604 million, in 2004. A further ten were floated in 2005 bringing the Initial Public Offering (IPO) value to over £1 billion. The current market value of the twenty companies is now close to £1.5 billion. Although the number of new spinouts has fallen since 2000-01, the quality of investments made by universities in commercialisation seems to have increased.

- the total number of people employed by spinouts has increased by 43 per cent since 2000-01; and
- the total turnover of all active university spinouts has increased by 129 per cent since 2000-01.

Research by the University Companies Association (UNICO) has shown that the quality of university spinouts is high. They grow faster and have lower failure rates than more conventional start-ups.

Case Study 3a: Cambridge Antibody Technology - Spin out success

Cambridge Antibody Technology (CAT) was originally spun out from the MRC Laboratory of Molecular Biology in Cambridge. Currently they are based near Cambridge, UK, and with a new site in Palo Alto, California, overall they employ around 290 people. CAT is listed on the London Stock Exchange (CAT) and on NASDAQ (CATG).

CAT has developed, among others, a drug for treating rheumatoid arthritis called Humira. Licensed to Abbott, HUMIRA, is the first CAT-derived antibody to be approved for marketing. It was isolated and optimised in collaboration with Abbott and has been approved for marketing as a treatment for rheumatoid arthritis in 57 countries and for early rheumatoid arthritis and psoriatic arthritis in some European countries and the US. In January 2006, Abbott announced HUMIRA sales of over US$1 billion, making it the first product originating in the UK biotechnology industry to achieve blockbuster status.

Drug giant AstraZeneca confirmed in May 2006 that it is to buy biotechnology firm CAT for £702 million ($1.32 billion). The two companies have been in partnership to develop drugs since 2004 when Astra Zeneca paid £75 million to acquire just under 20 per cent of CAT.

KEY HIGHLIGHTS AND NEXT STEPS

Higher Education Innovation Fund (HEIF)

3.6 HEIF helps universities to build their capacity for knowledge transfer activities. Government investment to date is £500 million. During the past year, and following consultation, OSI, DfES and HEFCE have reshaped the scheme, following principles set out in the ten-year framework. Under the third round of HEIF, 75 per cent of funding is being allocated to institutions according to a new funding formula. This formula balances the need to build capacity and to reward successful interaction with business and the community.

3.7 The move to a formula marks the coming of age of knowledge transfer as a core activity providing a more predictable stream of funding and reducing the burden of having to bid competitively. It ensures that every institution in England has an opportunity to develop knowledge transfer activities. In addition to the formula funding, 25 per cent of funding has been allocated for a competition to encourage the most innovative, high impact ideas on new approaches to knowledge transfer. 11 winning projects, totalling £52 million, were announced in May 2006. These projects cover a range of different disciplines and business sectors and many involve collaboration with international research establishments. Over 40 institutions will participate in the projects.

Case studies 3b: Examples of HEIF 3 Competition

University of Arts London: Creative Capital World City - will increase the competitive advantage of UK creative companies doing business in China and India. In 2001 creative industries accounted for 8.2 per cent of UK GDP and delivered £54.8 billion to UK Gross Value Added. The global market for creative Industries is estimated at around $1.3 trillion in 2005.

University of Leeds: White Rose Health Innovation Partnership - will develop new methods, not yet tried in the UK, to stimulate innovation in healthcare using the experience of medical technologies in the US. The next ten years will see radical treatments and technologies covering nanotechnology, biomedical materials and sensor technology that will focus on targeting prevention diagnosis. The global health market is worth around £150 billion.

University of Sheffield: Centre of Excellence in Customised Assembly (CECA) - strengthening customised assembly lines is a critical factor for the future competitiveness of UK manufacturing. CECA will support UK manufacturers in aerospace, defence, pharmaceutical-medical devices, and automotive supply to help them become global leaders by developing new industrial processes and high skilled workplaces. UK manufacturing is crucial to the prosperity of the UK accounting for 1/6th of the economy and over 5 million jobs.

Research Councils Knowledge Transfer Plans

3.8 £15 million in earmarked funds have been provided to Research Councils to boost their knowledge transfer capabilities. Each Council has developed a knowledge transfer plan. Metrics designed to measure scale and quality were incorporated into Research Council delivery plans published in May 2005. These included:

- interaction with business and public services;
- collaborative research;
- commercialisation of research;

- cooperative training; and
- people exchanges between the research base and users.

3.9 An independent review was commissioned by RCUK to assist the Research Councils in strengthening and refining their knowledge transfer and innovation activities. Research Councils participated in this review and the external challenge report was published in April 2006[1]. RCUK have welcomed the recognition that Councils have made significant progress in delivering and promoting KT. However, all Councils agree that greater progress will be needed across all forms of KT to deliver the step change in the economic impact of Research Council investments sought by the Government. The recommendations in the External Challenge report have been useful in stimulating Councils' thinking about this challenge and in shaping their strategic and operational responses.

3.10 Simultaneously, the House of Common's Science & Technology Committee launched an enquiry into Research Council effectiveness in knowledge transfer in December 2005. Research Councils are responding to the recommendations in this report following its publication in June 2006[2].

Case Study 3c: Examples of Research Council Knowledge Transfer activity

AHRC: Funded research has discovered new techniques to read damaged Roman tablets. This has been adapted for use in medical imaging procedures, such as mammography.

BBSRC: Research into the biology of crop pests has led to commercial alternatives to chemical pesticides. 'Nemaslug' is a commercial product that uses nematode worms to kill slugs without harming the environment.

CCLRC and PPARC: Terahertz imaging used to monitor planets is being applied to the security market. The technology can image hidden guns and explosives. Trials are currently underway at UK airports.

EPSRC: Research into mathematical models funded by EPSRC helps drivers to avoid congestion: traffic lights respond automatically to traffic volume.

ESRC: Funded research contributed to the auction of the 3G mobile phones spectrum. The auction raised £20 billion more than expected.

MRC: The latest in a series of trials sponsored by MRC have shown that statins (cholesterol controlling drugs) prevent a third of all heart attacks and strokes. Statins are now widely prescribed and have been shown to be beneficial to all individuals with diseased arteries.

NERC: Provide the data required to inform decisions on when to raise or lower the Thames barrier. Failure to prevent a flood in London would cost £30 billion, without counting the cost of human lives.

[1] http://www.rcuk.ac.uk/exchallenge.asp

[2] http://www.publications.parliament.uk/pa/cm/cmstech.htm

Regional Development Agencies (RDAs)

3.11 Following the enhanced role of RDAs in strengthening business-university links, OSI have provided each RDA a capacity building fund to help strengthen their personnel and understanding of research base issues. Total funding provided was £2.5 million.

Science Cities

3.12 In the 2004 Pre-Budget Report the Government welcomed plans by the English Regional Development Agencies (RDAs) to develop three Science Cities (in York, Manchester and Newcastle), and a further three Science Cities were announced in Budget 2005 (in Nottingham, Birmingham and Bristol).

3.13 The aim of Science Cities is to provide a clearer focus for investment in science and innovation, concentrating on existing centres of excellence; and to encourage RDAs, local authorities, HEIs and business to work more closely together in formulating a coherent strategy that will attract a critical mass of innovative businesses into the city.

3.14 The RDAs are currently working together with local authorities, higher education institutions, and industry to draw up detailed delivery plans for the six Science Cities. The Science Cities are at different stages of their development and there is no central "template" for how to develop a science city, in order to allow strategies to be tailored to the needs and strengths of each individual city.

3.15 Good progress is being made, and at the first national Science Cities Workshop in York in September 2005 the cities reported on their initial strategies for promoting higher levels of innovation and business activity. A follow up summit took place in Manchester in May 2006 where detailed plans were presented by the "first wave" (Newcastle, Manchester and York). Some of their initiatives are now in the early implementation stages. The "second wave" of cities (Nottingham, Birmingham and Bristol) reported on their ongoing progress in setting out their key priority areas and developing strategies for how best to exploit and build on their assets.

3.16 Government is also in discussions with the Science Cities about how well the existing national policy and funding framework is suited to support their development. The first meeting between representatives from the Science Cities and government officials took place in July 2006.

Public Sector Research Establishment (PSRE) Fund

3.17 The outcome of the third round of the PSRE Exploitation Fund was announced in January 2006. This will provide nearly £25 million to support 29 projects aimed at commercialising the research of a wide variety of PSREs, including Research Council Institutes, Government Laboratories, NHS Trust and major museums. It includes support to the Forensic Science Service to develop a commercial DNA database package so police and governments can store, search and match forensic DNA profiles; and to the Tate to develop sealed picture frames that protect valuable works of art from light damage. This round of PSRE funding has attracted more PSREs to knowledge transfer than ever before. Income from licensing and income from business rose by 32 per cent and 40 per cent respectively in 2003/04.

UK-US Science Bridges

3.18 This is a £6 million initiative to promote UK-US collaboration. Eight Universities and University consortia with the highest research income were invited to submit bids in the range £0.5 to £1.5 million. The four successful projects supported by this fund will each receive £1.5 million over two years. The details of the areas of activity and partner organisations for each project are:

- University of Manchester will work with University of Washington, the Northwest Aerospace Alliance, Airbus, Boeing and a wide range of businesses in the UK and US on the development of composite materials for use in aircraft design;
- Imperial College London will work with University of Texas MD Anderson Cancer Centre, Oak Ridge National Laboratory and Georgia Institute of Technology on two areas - treatments for cancer and energy research;
- University of Cambridge will take forward work from their existing collaboration with Massachusetts Institute of Technology (MIT). The £1.5 million allocated from this fund will be used to develop innovative and entrepreneurial skills among students by taking forward CMI's programme of education and development of new courses; and
- SETsquared Partnership (a collaboration of the universities of Bath, Bristol, Southampton and Surrey) will work with the University of California, San Diego and University of California, Irvine to develop further their expertise in commercialisation and spinning out their research, especially in the areas of wireless technology, life sciences, the environment and advanced materials.

Stem cell research

3.19 Budget 2005 established the UK Stem Cell Initiative (UKSCI) to develop a ten-year vision for UK stem cell research, which seeks to make the UK the most scientifically and commercially productive location for this activity. UKSCI, chaired by Sir John Pattison, reported in December 2005 and in the 2005 Pre-Budget Report the Government accepted UKSCI's recommendations and announced that total public sector funding for stem cell research over the two year period 2006-07 and 2007-08 will be up to £100 million, representing an additional investment of around £50 million.

National Institute for Energy Technologies

3.20 Budget 2006 announced the intention to develop a 50/50 public private partnership to bring a new level of focus, ambition and industrial collaboration to the UK's work in the field of energy science and engineering. The Energy Research Partnership under the joint chairmanship of Paul Golby and Sir David King is committed to raising substantial sums of private investment. Proposals are now being worked up by DTI for consultation as part of the outcome of the Energy Review.

4 INCREASED BUSINESS INVESTMENT AND ENGAGEMENT

This chapter highlights key achievements and actions to increase business investment and engagement in the last year including:

- stimulating collaborative R&D, Knowledge Transfer Networks and Knowledge Transfer Partnerships across the UK;
- enhancement of R&D tax credits;
- development of the Small Business Research Initiative (SBRI);
- strengthening of the Technology Strategy Board (TSB); and
- a new five-year strategy for UKTI.

Amibitions

4.1 The ten-year framework set out ambitions to raise investment in R&D to 2.5 per cent of GDP by 2014 and improve business engagement with the UK science base for ideas and talent:

- increase business investment in R&D as a share of GDP from 1.25 per cent towards a goal of 1.7 per cent over the decade; and
- narrow the gap in business R&D intensity and business innovation performance between the UK and leading EU and US performance in each sector, reflecting the size distribution of companies in the UK.

The ten-year framework outlined a range of support measures to encourage greater business investment in R&D.

EVIDENCE OF PROGRESS

4.2 Although public investment in R&D continues to increase in real terms, business R&D as a share of GDP has yet to show similar progress at this early stage in the ten-year framework. In 2004, £21 billion was spent on total R&D performed in the UK. The represents a 22 per cent increase in real terms since 1997, but a small (1 per cent) drop from 2003 in real terms. Of the £21 billion spent in 2004, 33 per cent was spent by the Government (28 per cent of civil R&D and 64 per cent of defence R&D), up from 31 per cent in 2003. The main drivers underlying this aggregate picture were:

- R&D performed by the Government sector (including Research Councils) increased by 0.5 per cent on 2003 in real terms, to £2.1 billion;
- R&D performed within universities and other higher education institutes increased by 4 per cent on 2003 in real terms, to £4.8 billion; and
- following a 20 per cent real increase in R&D performed by the business sector between 1997 and 2003, business R&D in 2004 fell 3 per cent in real terms from 2003, to £13.5 billion.

4.3 Overall, Gross Domestic Expenditure on Research and Development (GERD) as a proportion of GDP was 1.78 per cent in 2004, down from 1.86 per cent in 2003. The small decline in business R&D is more likely to reflect the cyclical nature of R&D rather than represent a trend, but it does highlight the scale of the challenge if the goals of the ten-year framework are to be met. It is also worth bearing in mind that the data, while the most recent available, cannot reflect the full impact of the policies set out in the ten-year framework.

4.4 Using R&D alone as a measure of innovation provides only a partial picture. As the OECD noted last year, the UK's strengths in knowledge intensive services and creative industries – where innovation is less likely to be picked up in indicators such as R&D – probably mean that the UK's innovation performance is under-stated.

4.5 The most recent UK Innovation survey, covering the period 2002-2004, has shown a significant improvement in headline innovation indicators, including:

- 62 per cent of firms were "Innovation active" up from 45 per cent in the 2001 survey;
- 29 per cent of firms brought new products to market, up from 18 per cent; and
- 19 per cent of businesses introduced new processes, up from 15 per cent.

4.6 To assess the overall contribution of business investment and engagement to the ten-year Framework, there is a need for a broad range of indicators on Business R&D and innovation outcomes. Current indicators of performance are outlined in the corresponding section of the *Science and Innovation Investment Framework: Progress Against Indicators Report*.

4.7 The Government recognises that there is a need for current reporting requirements to include more information on the outputs of innovation. OSI will review the scope and scale of coverage of innovation in the *Progress Against Indicators Report* to increase the emphasis on outputs of innovation. The DTI recently published detailed analysis of the latest UK Innovation Survey results, from which potential indicators could be drawn[1].

4.8 It is clear that there is still much to do to assist the demand-pull from businesses to innovate. The government recognises that the measurement of innovation is a challenge that needs to be better addressed as the ten-year framework moves forward. However it is also clear from the key highlights and next steps outlined below that there is strong evidence that Government interventions into business investment, and engagement with innovation, are making progress.

[1] Innovation in the UK: Indicators and Insights DTI Occasional Paper No.6 July 2006.

KEY HIGHLIGHTS AND NEXT STEPS

The Technology Strategy Board

4.9 The Technology Strategy Board (TSB) is responsible for advising the Secretary of State for Trade and Industry on business research, technology and innovation priorities for the UK, the allocation of funding across these priorities and the most appropriate form of intervention to support them. It reports annually on its own activities and on cross-Government policies that relate to technology, innovation and knowledge transfer and oversees the Technology Programme. The Board has two broad lines of approach - the support for key technologies and the development of Innovation Platforms, where the integration of a range of technologies and the better co-ordination of policy and procurement will result in a step change in UK performance. The Innovation Platforms require collaboration across Government to help solve major challenges facing Government and society.

4.10 Plans were announced in Budget 2006, for the TSB to operate at arm's length from central Government. *Science and Innovation Investment Framework 2004-2014: Next Steps* stated that: "It is timely to build on the success of the Technology Strategy Board, which has introduced user defined requirements in order to fulfil its mission of stimulating innovation in business. The Government expects the Technology Strategy Board to play an increasing role in contributing to developing the Government's innovation strategy across all-important sectors of the UK economy. This wider remit will require the Board to set priorities for its support on innovation, on areas which offer the greatest scope for boosting growth and productivity, in the context of an increasingly globalised economy. Plans for delivery of the Board's remit, operating at arms length from central Government will now be worked up, to secure improved value for money and better delivery to business." Options for how to enhance the role of the TSB are currently being explored.

Technology Programme

4.11 The UK wide Technology Programme supports Collaborative Research projects and Knowledge Transfer Networks with the aim of increasing business investment in R&D and innovation. The Technology Programme works in partnership with Government Departments, the Research Councils, RDAs and the Devolved Administrations to deliver support.

4.12 There have been six Collaborative R&D competitions: February 2004 (£15 million), April 2004 (£50 million), November 2004 (£80 million), April 2005 (£100 million), Autumn 2005 (£63 million) and Spring 2006 (£80 million). To date over 350 projects have been supported across a number of technology areas.

Case Study 4a: Nanotechnology for sustainable water purification

Scotoil Services and its partners, the University of Aberdeen, OpTIC Technium and Yorkshire Water, are working to develop a new technology that uses sunlight to treat dirty water and create electricity simultaneously.

Due to run until 2008, the Collaborative R&D project started in March 2005 with planned spending of £1.2 million. The project attracted a DTI grant of £600,000 under the micro and nanotechnology manufacturing initiative part of the Technology Programme.

The objective is to build a working prototype in order to demonstrate that the technology is commercially viable within the water supply industry. The project has already demonstrated proof of concept and, if work goes to plan, it could become a significant piece of technology.

Key benefits of the project are that it:

• purifies contaminated water;

• is sustained by light and able to generate electrical current;

• is more cost effective and environmentally friendly than existing technology; and

• can treat both chemical and biological contaminants.

By attracting the right partners and working closely with both manufacturers and end-users, the University of Aberdeen believes it can take the technology out of the laboratory and into the marketplace. The consortium is confident of meeting any remaining challenges and of completing a working prototype for the water industry within the timeframe of the project. But this is just the start. As it is activated by light and has the potential to generate electrical current, the technology has a number of beneficial applications.

4.13 Eighteen Knowledge Transfer Networks (KTNs) are now actively stimulating innovation in the UK's key technology areas by promoting collaboration, best practice and knowledge sharing between industry and academia[2]. KTNs feed into Innovation Platforms and support the development of the Technology Strategy. Current spend is £12 million per annum rising to £20 million in 2007.

4.14 Knowledge Transfer Partnerships (KTPs) enable graduates to work in a firm to introduce new processes/services/product development in partnership with a suitable university/college/research organisation. DTI spends £18 million per annum leveraging £12 million from other public sector organisations and £54 million from business. On average £1 million of government money invested yields a £4.24 million increase in business profit, a £3.25 million increase in investment, with the equivalent of 112 new jobs created and 214 company staff trained[3].

[2] http://www.dti.gov.uk/innovation/tech-priorities-UK/about_the_programme/page12567.html

[3] Further information at http://www.ktponline.org.uk/

Case Study 4b: Elekta Ltd and Coventry University

Sponsored by the DTI, this award winning KTP used mathematical modelling and control theoretic techniques to integrate a radiotherapy patient support system (PSS), to design and implement a new controller for PSS. Clinicians need accurate targeting for successful radiotherapy treatment. The Patient Support System (PSS) positions the patient and the X-ray beam to ensure that the cancerous tissues are accurately targeted.

"Elekta decided to work with Coventry University to improve our knowledge of control systems, and to apply additional academic know-how to our development. Following the KTP, the Synergy product was released onto to the radiotherapy market with widespread acclaim from many leading centres." John Allen, Control Systems Manager, Elekta Ltd

The successful delivery of the KTP objectives increased company turnover and developed excellent PR opportunities.

R&D tax credits

4.15 To provide greater incentive for business investment in R&D the Government introduced R&D tax credits, for SMEs in 2000 and for large companies in 2002. So far, nearly 22,000 claims have been made for R&D tax credits; over 19,000 under the SME scheme and nearly 3,000 under the large company scheme. In total almost £1.8 billion of support has been claimed, just under £1 billion of which has been claimed by SMEs. Early evaluation results, from an independent survey[4] of nearly 1,000 R&D performing companies, suggests encouraging early signs that R&D tax credits are affecting business R&D activity. Half of the companies surveyed who had successfully made a claim had either been able to change their R&D spending and/or the type of R&D projects they undertook because of R&D tax credits.

4.16 Making the claims process for R&D tax credits as simple and as certain as possible for companies is key to the effectiveness of the scheme, and the Government has made successive improvements to the scheme to ensure this, in full consultation with business. In December 2005, the Government announced that it would be setting up new specialist R&D units within HM Revenue & Customs to deal with all SME R&D tax credit claims. These new units, which have been welcomed by business as a significant step forward, will be in operation around the country by the end of 2006.

4.17 The Government is eager to ensure that R&D tax credits fully support growing R&D performing firms. Following discussions with business, and the recommendations of the Cox review of creativity in business, it was announced in Budget 2006 that the Government intends to provide additional support to firms with between 250 and 500 employees, subject to outcome of state aid discussions with the European Commission. Further details will be published later this year.

[4]The survey report is available at www.hmrc.gov.uk/research. Further details on R&D tax credits can be found at www.hmrc.gov.uk/randd

Small Business Research Initiative

4.18 In Budget 2005, the Chancellor made it mandatory for Government Departments to participate in the Small Business Research Initiative (SBRI)[5]. The overall SBRI target is that Government Departments will procure at least 2.5 per cent of their extramural R&D from small firms. In 2004/05, of a proposed SBRI baseline of £2.5 billion, £269 million (10.6 per cent) went to small firms in the form of contracts. Results for 2005/06 will be published in the autumn.

4.19 A series of SBRI seminars recently promoted the programme to Business Link, RDAs and others, with a view to increasing the number of high tech SMEs offering R&D to Government.

Global markets and Foreign investment in R&D

4.20 In July 2006 UKTI will launch a five-year strategy to market UK business internationally, focusing particularly on China, India and other emerging markets. UKTI will introduce an R&D programme to encourage overseas owned R&D intense business to undertake R&D (or more R&D) in the UK and improve the trade capacity of UK based R&D intense companies. The Programme will deploy virtual public sector teams to pinpoint selected companies and a cadre of specialists with knowledge of the UK research base. The Chancellor has announced the creation of a high level group to promote London as a global financial centre. UKTI will have responsibility for executive delivery of this strategy.

UK Science Forum

4.21 The UK Science Forum is a high-level forum between the Government, business leaders and academics to support the UK's R&D and innovation goals and contribute to evidence informing future spending decisions. The group, chaired by Sir Tom McKillop met in July 2005 and discussed a number of key issues, including STEM skills, the role of public procurement, joint programmes and projects between industry and government and public attitudes to science. A working group was established to take forward this agenda jointly with HM Treasury, the Department of Trade and Industry and the Department for Education and Skills. The forum will present its findings on these issues to the Government and discuss next steps today.

Cox Review of Creativity in Business

4.22 Sir George Cox's review *Creativity in Business- building on UK's strengths*[6] addressed how to enable businesses in the UK to make more use of the UK's world-class creative talents to improve productivity and competitiveness. The Chancellor endorsed the report and its findings were further supported in the Budget 2006. Five core recommendations in the review are now being implemented with progress monitored by a high-level group chaired by Lord Sainsbury:

- roll out of the Design for Business Programme across the country. By the end of 2006, the first four RDAs – Yorkshire Forward, One NorthEast, South East England Development Agency (SEEDA) and Advantage West Midlands will be offering this programme to businesses in their regions through delivery partners. Work is ongoing in the rest of the country;
- improving R&D tax credits – as detailed earlier, the creation of specialist R&D units in HM Revenue and Customs (HMRC) and the intention to extend additional support to companies with between 250 and 500 employees ;

[5] http://www.supply2.gov.uk/

[6] http://www.hm-treasury.gov.uk/independent_reviews/cox_review/coxreview_index.cfm

- embedding creativity and design in higher education courses;
- driving creativity through innovation in public procurement; and
- developing a network of Centres of Creativity and Innovation with a hub in London.

Animal Rights Extremism

4.23 The Government remains absolutely committed to tackling the threat posed by a small number of animal rights extremists to vital, well regulated, bioscience research and safety testing in the UK.

4.24 The National Policing Plan for 2006-7 identifies animal rights extremism as a key priority for the police. The policing response, co-ordinated by a National Co-ordinator for Domestic Extremism, has gained real momentum. Action is taking place across the criminal justice system to ensure extremists are effectively investigated, prosecuted and sentenced. There are a significant number of investigations underway and the number of incidents is reducing. Individuals have already been charged under tough new laws passed by Government last year to deal with harassment and disruption.

4.25 Government and law enforcement agencies are sharing appropriate information and working with partners overseas to co-ordinate action and tackle the international nature of this threat.

National Centre for the 3Rs

4.26 The Government is committed to developing alternatives to animal testing wherever possible. To co-ordinate and promote these efforts the Government established the National Centre for the 3Rs (replacement, refinement and reduction). Additional research funding is also provided by the Research Councils to pursue this objective. A growing number of stages of research and testing can now be done without the use of animals. UK universities and companies have an excellent record of developing and using these alternatives.

Intelligent Government Procurement

4.27 The Government is the single biggest customer in the UK economy. It has a huge role to play as a demanding and intelligent customer of new products and services. Innovative public procurement will not only get greater value for the £125 billion spent every year on public procurement, but will find better solutions to the challenges of improving public services and in helping UK companies find new commercial opportunities at home and overseas.

4.28 The Government's focus on innovation as core to achieving best value was initially set out in the Innovation Report.[7] DTI's Five Year Programme[8] (2004) further stressed the need for Government to become a more intelligent customer, committing the Government to look further at how the public sector's purchasing power can be harnessed to foster more innovation. DTI and OGC are working together to explore how to harness innovation more effectively in the public procurement programme.

[7]Innovation Report: Competing in the global economy: the innovation challenge (2003) http:www.dti.gov.uk/files/file12093.pdf

[8]DTI five year programme (2004) http://www.dti.gov.uk/about/strategy-objectives/Five-Year-Programme/page12613.html

Aho Review

4.29 In addition, the informal meeting of the EU Heads of State and Government at Hampton Court in October 2005 identified the importance of business investment in R&D as one of the priority areas for Europe if it was to respond to the challenges of globalisation. As a result, a high-level Expert Group, led by Esko Aho (the former Finnish PM), was asked by the Commission to set out priorities for action in areas such as the venture capital market, the role of public funding in promoting public-private partnerships, the role of public procurement as a driver of investment and innovation, and optimal exploitation of global knowledge networks.

Regional Development Agencies (RDAs)

4.30 The strong commitment to innovation and science within the RDAs is reflected in the recently updated Regional Economic Strategies (RES):

- all English regions now have a Science and Industry Council providing strategic advice and industrial input at a regional level. They have increased focus on innovation in the regions and advised on spending decisions;
- the Science City plans are continuing to develop, and there is significant cross-boundary knowledge sharing, with Science Cities meeting to jointly progress this agenda jointly (see also Chapter 3);
- the RDAs are working to ensure that work on science and innovation is linked with work on the European agenda and that innovation is firmly at the heart of European strategies in the regions; and
- the RDAs participated fully in the development of HEIF 3, including advising universities on the alignment of their business plans with the Regional Economic Strategy (see also Chapter 3).

5 Supply of Scientists, Engineers and Technologists

The key achievements in ensuring the UK retains a strong supply of scientist, engineers and technologists over the past year include:

- between 2004 and 2005, the overall percentage of pupils achieving grades A*-C in science GCSE and grades A-E in science A Level rose;
- teacher recruitment in the STEM subjects has risen for the sixth year in succession. There were over 7,500 recruits in these subjects in 2005/06, 70 per cent more than in 1999/2000. That does not include the rising numbers of graduate career-changers following employment-based training routes;
- from September 2006, trainee teachers in mathematics and science will receive a higher bursary of £9,000, plus a £5,000 Golden Hello after they enter the classroom;
- at January 2006, the number of unfilled teaching posts in secondary science, mathematics and technology were all at their lowest levels since January 2000;
- there have been around 130 recruits to a pilot scheme to train science specialist Higher Level Teaching Assistants. Next Steps are now being planned;
- findings of a survey on the recruitment and retention of post-16 staff commissioned by the DfES Standards Unit have informed the Government White Paper 'Raising Skills, Improving Life Chances';
- continuing success of the RCUK Academic Fellowship scheme with 400 further awards being made;
- a database of practice launched by the UK GRAD programme to collect and share examples of good practice relating to skills development for researchers; and
- 38 schools involved in a new £1.5 million ethnic minorities STEM access grants initiative run by the Science Engineering and Technology Network (SETNET).

Ambitions

5.1 The ten-year framework highlighted the importance of a strong supply of scientists, engineers and technologists to the long-term health of the science base and the wider UK economy, and set clear ambitions to achieve a step change in:

- the quality of science teachers and lecturers in every school, college and university, ensuring national targets for teacher training are met;
- the results for students studying at GCSE level;
- the numbers choosing STEM subjects in post-16 education and in higher education;
- the proportion of better qualified students pursuing R&D careers; and
- the proportion of minority ethnic and women participants in higher education.

5.2 Building on the original framework proposals *Science and Innovation Investment Framework 2004-2014: Next Steps* included a range of further commitments. These aim, notably, to:

- raise further pupil attainment and the quality of school teaching in science and mathematics;
- promote more collaboration between schools and higher education institutions in the teaching and learning of STEM subjects; and
- review and evaluate the changes to the curriculum to ensure science continues to enthuse and inspire pupils.

EVIDENCE OF PROGRESS

Context: the supply and demand environment

5.3 One of the key aims of the ten-year framework is to review annually the relative balance between the supply of and the demand for skills, provide a more detailed assessment every two years and recommend where there is a need for further action by Government or others. The following are the summary findings from work considering whether the current supply of scientists, engineers and technologists is satisfactory to meet the needs of the science base and the wider economy, now and in five and ten years' time. A full length paper with the detailed analysis is published separately by the DfES[1].

5.4 The overall position of the UK in terms of its stock of STEM skills is a strong one – according to the OECD the UK compares favourably on the supply of STEM skills and there are signs that the UK's relative position has recently improved further. There is a steady increase in the stocks of these skills and a relatively constant flow of them into the working-age population. Breaking down the headline figures by subject area reveals an increasing number of UK entrants to HE in subjects allied to Medicine but sees falls in entrants to Engineering and the Physical Sciences (particularly Chemistry). Whilst the numbers entering Mathematics degrees have remained relatively constant, Mathematics A-Level is a requirement for most Engineering and Physical Sciences degrees and first degree entry to these subjects has been falling in recent years.

5.5 High returns to subjects like Mathematics, Engineering, Computing and the Physical Sciences suggest there is high (and for Engineering, increasing) demand for graduates with these skills. As students become more aware of the information on earnings and employment prospects the Government expects to see more students choosing to pursue these subjects.

5.6 Projections suggest an increasing demand for STEM skills over the next ten years. However projections are not broken down by individual subject and rely on a number of assumptions, in particular the continuation of historic growth in demand for skills. The projections of increases in supply of STEM skills and progression rates to STEM jobs would suggest that, at the broadest level, supply is likely to meet the increase in demand for these skills over the next 10 years. However there may be problems with specific subjects. On current trends the supply of engineering and physical sciences is relatively weak and with over half the graduates in these subjects not going on to STEM occupations straight away there is a possibility that demand for these skills will not be met by supply. Still, the increasing premium to engineering suggests that the market for these skills is adjusting to the reduced flow.

[1] Available at http://www.dfes.gov.uk/rsgateway/contents

5.7 Overall, the UK is in a good position in relation to the growing demand for STEM skills in the economy. The Government will continue to monitor the differences between subject areas.

KEY HIGHLIGHTS AND NEXT STEPS

Schools

5.8 Since last year's report there has been some improvement in GCSE attainment for science and mathematics. However, there has been a continued decline in the number of A level entries in Physics. Training bursaries and 'golden hellos' have been raised to attract more science teachers into the profession, and Regional Science Learning Centres have been established to provide continuing professional development for teachers. The new GCSE programme of study will be taught in schools from September 2006.

5.9 Overall attainment is improving. In 2005, 50 per cent of pupils achieved A*-C in GCSE science, up from 48 per cent in 2004; and 52 per cent achieved A*-C in mathematics, up from 50 per cent in 2004.The percentage of 16-18 year olds achieving A – E at A Level were: Biological Sciences 95.1 per cent, up from 94.7 per cent in 2004; Chemistry 96.6 per cent (96.7 per cent in 2003/04); and Physics 95.3 per cent (95.2 per cent in 2003/04).

5.10 In 2005, entries into A-level Biological Sciences were up by 1,427 students to 45, 662, Chemistry up by 1,034 to 33,164; with Physics down by 506 to 24,094.

5.11 Despite the progress in taking forward the measures of the ten-year framework the Government recognizes that it cannot be complacent. Alongside Budget 2006 the Government announced a further set of ambitions to improve the provision of science in schools. To meet these goals, the Government announced a package of measures to improve the skills of teachers, the quality of science lessons and increase the progression to A Level sciences. DFES has established programme management arrangements to manage the implementation of the various commitments. A School Science Board has been established to manage the implementation process and meets monthly.

School Workforce

5.12 In 2005/06, recruitment to conventional science initial teacher training was 91 per cent of the allocated places available. This figure has risen from 88 per cent in 2004/05. As announced in the ten-year framework, the training bursary for mathematics and science trainee teachers was raised from £6,000 to £7,000 in September 2005. Following a general review of teacher recruitment incentives by the Training and Development Agency for Schools (TDA), the mathematics and science bursaries are being raised again from September 2006 to £9,000, plus a £5,000 Golden Hello payable after one year in teaching.

Graduate Teacher Programme

5.13 From 2005/06, the TDA is offering incentives to training providers to recruit additional science trainees. Its policy of incentives saw an increase in total science recruitment of 115 trainees compared with 2004/05. The above figures do not include career-changers following the employment-based Graduate Teacher Programme (GTP) route. A final total of 503 were recruited for the 2004/05 academic year and in 2005/06, providers indicated that they would be able to recruit 524 science trainees. *Science and Innovation Investment Framework 2004-2014: Next Steps* included commitments to offer new incentives to training providers to recruit physics and chemistry graduates to the GTP and undertook to pilot a new Continuing Professional Development diploma for existing science teachers seeking to develop a specialism in physics and chemistry. Furthermore, the School Teachers' Review Body has been remitted to advise on improving the use of current pay flexibilities to reward mathematics and science teachers and will report at the end of the year.

Science Learning Centres

5.14 Science Learning Centres have made good progress over the year in delivering courses on continuing professional development. Over 11,000 teacher-training days were delivered from 1 April 2005 to 31 March 2006. The feedback from those attending continues to be positive and DfES will continue to monitor subsequent take-up.

Higher Level Teaching Assistants

5.15 The pilot process to recruit a new group of specialist Higher Level Teaching Assistants (HLTAs) began in 2005 and is ongoing. The science pilot now has around 130 candidates who are in training to reach the necessary attainment levels in relation to: subject knowledge, subject pedagogy, and the HLTA standards. TDA and DfES are now considering how best to implement the pilot's findings.

Student Associates Scheme

5.16 The number of undergraduate volunteers supporting pupils learning science has continued to rise steadily. In 2003/04, around 1,000 placements were science-based; this increased to around 1,500 placements in 2004/05 and the provisional figures for 2005/06 show a further increase to 2,000. As announced in Budget 2006 the Student Associates Scheme received additional funding for 2006/07 and 2007/08 of £700,000 a year to increase the number of mathematics and science placements. The TDA believe that this could fund an additional 450 mathematics and science placements compared to 2005/06 levels.

Case Study 5a: Student Associates Scheme

The Student Associates Scheme run by the TDA has demonstrated effective working relationships between schools and higher education institutions. Over the past three years, the scheme will have placed nearly 20,000 undergraduates into schools, with around 2,500 of those being mathematics students. The scheme has proved to be universally popular with schools, institutions and undergraduates.

The Scheme's primary aim is to enable students who have expressed an interest in teaching to gain an insight into the profession at the sharp end. The TDA have judged that around 45 per cent of all participating students have applied or intend to apply for initial teacher training. In addition, the scheme has been shown to raise awareness of participation into higher education particularly among school pupils who would not normally have considered higher education as an option. School pupils see the undergraduates who work with them on projects as role models. They can demystify the whole university process and this almost peer-to-peer working has had a positive impact on attainment and helped to enrich the teaching and learning environment in many schools.

Additional funding was made available in Budget 2006 to expand the number of mathematics and science placements on the Student Associates Scheme in 2006-07 and 2007-08. This additional money will enable even more bright young mathematicians to be placed in schools, many of whom will go on to become mathematics teachers themselves and inspire a new generation of mathematicians and scientists.

Further Education

5.17 The DfES Standards Unit commissioned a large-scale survey to explore the issues of recruitment and retention of staff working with learners across the post-16 learning and skills sector. The findings, which were published in November 2005[2], have informed the development of a range of new programmes such as 'Making a Difference', 'Business Interchange', 'Business Talent' and 'Give Something Back', to increase recruitment, improve retention and promote diversity across the sector. These are detailed in the White Paper *Raising Skills, Improving Life Chances*[3].

5.18 The Government has decided that the increased Golden Hello of £5,000 for teachers of science subjects taking jobs in FE colleges from September 2005 will be maintained for 2006/07. There has been recognition that shortage subject areas attracting incentive support (Golden Hellos and Training Bursaries) needed to be more clearly defined. Recent research carried out by Lifelong Learning UK to look into this has now been completed, and as part of that exercise maths and science have been defined within the shortage subject area list. The research findings have been endorsed by Government and a revised list of shortage subject areas has been published; this was announced by the Secretary of State for Education and Skills at the Quality Improvement Agency conference on 7 June.

[2]Available at http://www.dfes.gov.uk/rsgateway/DB/RRP/u014388/index.shtml

[3]This government White Paper is accessible from the DfES website http://www.dfes.gov.uk/furthereducation

Higher Education

5.19 Between 2003/04 and 2004/05, UK undergraduate qualifications obtained in Physics and Chemistry rose by 5 per cent and 1 per cent, respectively. Biological Sciences increased by 8 per cent but stabilised (0 per cent growth) when not including Sports Science and Psychology. Engineering and Technology qualifications fell slightly (by 1 per cent), Mathematical and Computer Sciences both decreased by 4 per cent. This is based on Higher Education Statistics Agency data, and includes figures for all undergraduate qualifications but excludes the Open University. The subject of study is defined using the Joint Academic Coding System, which is based upon the proportion of time spent on each subject. The definition of the data used is slightly different to that reported last year[4].

5.20 The Government has no current plans to intervene in institutional decisions about which subjects should be provided, but Ministers have made clear that they expect institutions to work in partnership with each other and HEFCE at an early stage to help manage changes smoothly, where they decide to make them. Ministers have also made clear that they are conscious of national expectations and the potential national consequences resulting from individual decisions. They have therefore asked HEFCE to continue to monitor whether there are areas where current provision seems out of step with the national need, and if so, what might be done.

Teaching Quality Information

5.21 Results from the first ever independent national student survey of students' view of the quality of their course were published at the Teaching Quality Information (TQI) website[5]. The site will be further developed during 2006/07 to present information in the most easily accessible format for learners and other stakeholders.

Research Careers

5.22 The minimum PhD stipend has been raised to £12,000 in 2005 (from £5,295 in 1997) and will increase to £12,300 in 2006 and thereafter in line with the GDP deflator. Overall numbers of studentships have been maintained. A recent report highlighted the positive impact of higher stipends: "The increase in the stipend to that of a living wage, in particular, has made a big difference. Several of the PhD students that the Panel spoke to indicated that they would not have been able to pursue a PhD with the old level of support and funding. However, there are still a number of issues that need urgent attention, such as the length of PhD study and the inflexibility of postgraduate education." [6]

5.23 The funding for transferable and careers skills training for researchers and PhD students has been successful in encouraging and supporting the work of skills practitioners in the HEIs. Although significant success has been achieved with postgraduate transferable skills there is still some way to go to enhance the level of career development skills for research-only staff. During 2006 the strategy for research staff will be given greater emphasis.

5.24 All Research Councils have put in place mechanisms to support PhDs of longer duration than 3 years.

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[4]Differences are that the data now only includes UK domiciled qualifiers (previously the School Science Review reported all qualifiers) and those who have qualified from dormant modes of study (last year this was excluded).

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

[6] International Perceptions of UK Research in Physics and Astronomy 2005 (EPSRC, PPARC, Institute of Physics and Royal Astronomical Society - January 2006)

Attracting and retaining the best researchers

5.25 The first four cohorts of RCUK Academic Fellowships have now been awarded.

Case Study 5b: RCUK Academic Fellowship scheme

The annual reports to RCUK clearly demonstrate the impact of the scheme:

- the recruitment procedures attracted high quality applications averaging 20 per post;
- the fellowships provide an important mechanism for building interdisciplinary bridges. At least 2 HEIs have created their own schemes analogous on the Academic Fellowships concept;
- the scheme is a very effective tool for development of contract research staff and career management; many fellows are taking recognised qualifications in HE teaching and supervision; and
- many fellows are undertaking recognised outreach activities such as Science Ambassadors.

RCUK has compiled a report on the response of the sector to this scheme, which will be published on the RCUK website during July 2006.

5.26 Since 2003 the Research Councils have taken concerted action to provide increased doctoral stipends and researcher salaries in problem areas. Following concerns at the impact and particularly the response of the HEIs in applying for and paying such enhancements, the Research Councils have funded a study to assess the initial impact of enhanced stipends and salaries on the recruitment and retention of postgraduate and postdoctoral researchers in key shortage areas.

Case Study 5c: Report on Enhanced Salaries and Stipends

The funding for enhanced PhD stipends in areas of recruitment or retention difficulty was allocated differentially across Research Councils to match the Office of Science and Innovation's assessment of differences between disciplines. Likewise the distribution of the funding for postdoctoral researchers in areas of recruitment or retention difficulty was skewed towards areas of science with severe difficulties.

In 2005 a study of the impact of this additional funding was undertaken for the Research Councils by the Centre for the Study of Law and Policy in Europe (CSLPE). CSLPE utilised a web-based questionnaire open to all, and in-depth interviews with a wide range of staff at ten research intensive UK HEIs as well as interviews with other funders (the Wellcome Trust), the Trade Unions and the European Commission (DG Research).

The report will be published on the RCUK website in July 2006.

Women's Resource Centre

5.27 Since its launch in September 2004, the Women's Resource Centre (UKRC) has developed its work as both its strategic and delivery functions have taken shape. The UKRC has produced 36 publications, and hosted or spoken at 68 events. Two new centres have been launched in Scotland and Wales and three regional hubs in Yorkshire and Humber, South East and North West.

5.28 In 2005/06 the UKRC has supported over 200 women with science or engineering qualifications currently out of the labour market, through an online training course in partnership with the Open University. The UKRC is supporting a further 122 women in trying to find them work placements or training progression. They have established links and are in contact with over 250 companies, have been involved with three employer awards and five networking schemes and have allocated nine grants and 26 bursaries.

Athena SWAN

5.29 The Athena Scientific Women's Academic Network (SWAN) Charter – a recognition scheme to award universities for their gender equality commitment and demonstration of best practice - was launched in June 2005. The Charter is open to all Universities and their STEM departments across the UK. To date, 21 universities have signed up as Charter members, demonstrating their commitment to gender equality. The first awards were made on 15 March 2006 at The Royal Society. A total of 11 awards were made to ten institutions. Nine universities were awarded bronze Charter status and The University of Edinburgh Chemistry Department and Imperial College London were the first silver winners. The UKRC Website[7] contains a vast array of resources including information on research, policy, careers, publications and funding and receives 6,000 hits per day.

[7] http://www.setwomenresource.org.uk

Case Studies 5d:

Employer of the Year Awards

Jaguar and Land Rover were the first recipients of the UKRC Women in Science Award at the highly successful Employer of the Year Awards.

Jaguar and Land Rover's maternity policy include 52 weeks on full pay, with an option of an additional 52 weeks unpaid leave whilst retaining employee status. This has resulted in a 99 per cent return rate from maternity leave. Further support is offered around the time of a second child, which has been identified as a time when women are more likely to leave and, at one plant, nursery places have been offered to grandparents caring for their grandchildren.

There is a range of flexible working policies, including part time, job share, variable hours, telecommuting, and unsupported home working. Currently 81 per cent of part time or job share employees are women. Two sites offer workplace nursery facilities and there are plans for a further site.

Women influence 80 per cent of car purchase decisions, so Jaguar and Land Rover are increasingly using women as part of their design process.

'SET for Work' Scheme

In October 2004, the UKRC launched the 'SET for Work' scheme to improve the retention of female undergraduates on science, technology and engineering courses and their progression into the related labour force. This scheme was funded by the DfES and administered by the UKRC to run during the 2005/06 academic year. Although the funding was a one-off, DfES have now made available an extra £125,000 for the continuation of these projects which involve a range of support mechanisms including mentoring and networking, so that they can run during the 2006/07 academic year. Those higher educations institutions which received grants in 2005/06 were therefore asked to bid against this extra funding. A total of £105,000 has been awarded to twelve successful bidders. The remaining £20,000 will be spent by the UKRC on a range of development activities for the institutions involved in the pilot and others who would like to emulate their example. These activities will include a series of workshops on topics of interest such as mentoring and gender stereotyping, networking events for developing and sharing good practice, and the production and dissemination of materials and guidelines to help and encourage other institutions to support and inspire their female students on SET courses. The future sustainability of the funded projects by the host institutions has been strongly encouraged as central government funding discontinues at the end of the 2006/07 academic year. By the end of 2006, the UKRC will set up a dedicated website to display the materials developed, best practice, and present case studies from the current projects, to serve as a future guide to interested institutions.

Ethnic Minorities initiative

5.30 The DTI has set aside a sum of £1.5 million to fund a new initiative aimed at encouraging secondary school students from black and ethnic minority backgrounds, specifically Afro Caribbean boys and Bangladeshi and Pakistani girls, to become more involved in science.

STEM Access Grants

5.31 The STEM Access Grants have been warmly embraced by schools, who are using it to complement the work teachers are already doing to tackle under achievement and social exclusion in science subjects. The first round, launched during National Science week, has seen 38 schools awarded funding to set up projects aimed at boosting students' interest. Several projects involve clusters of schools working together to reach a larger number of students and create stronger links within their communities.

Case Study 5e: STEM Access Grants

Mulberry School for Girls – London: Raising achievement in science through raising awareness of bioscience.

The project aims to raise achievement in science across the whole Key Stage 4 cohort by running master-classes in bioscience at London Metropolitan University. Approximately 20 girls from each cohort will attend these, and will then report back to their peers in class. The master classes will be practically based bioscience projects based on an existing model for London Gifted and Talented. Each project will be accredited by means of Bronze, Silver and Gold CREST awards.

International initiatives

International initiatives

5.32 DfES will be launching in Summer 2006 a new partnership programme to support capacity building in the African HE sector through sustainable links between institutions in England and in Africa. A total of £3 million is being spent over 2005-06 and 2006-07 including £0.5 million in each year to support partnerships specifically with South Africa. The aim is to enhance long-term sustainable links through academic exchanges and research collaboration.

6 PUBLIC ENGAGEMENT WITH SCIENTIFIC RESEARCH AND ITS INNOVATIVE APPLICATIONS

This chapter highlights key achievements over the past year on building understanding and improving public attitudes to science including:

- expansion of the Sciencewise programme of public dialogue on science and technology into new areas;
- record breaking attendances at UK Science Week;
- developing a new approach to supporting the network of science engagement practitioners in the UK; and
- embedding key ethical principles into the practice of science through the Universal Ethical Code for Scientists developed by the Government's Chief Scientific Adviser.

Ambitions

6.1 The ten-year framework highlighted the importance that the Government attaches to greater public confidence and improved engagement in scientific research and its innovative applications. Greater engagement will identify public aspirations and concerns regarding the health, safety, environmental, ethical and social issues related to science and technology. It will help to inform Government policy and decision-making, and will also build understanding and appreciation of the wider benefits of science and technology to society. The ten-year framework set an objective to:

- demonstrate improvement against a variety of measures, such as trends in public attitudes, public confidence, media coverage, and acknowledgements and responsiveness to public concerns by policy-makers and scientists.

EVIDENCE OF PROGRESS

6.2 OSI has taken a number of important steps forward in increasing the scale, reach and impact of its work to embed public dialogue into policy and decision-making regarding key science and technology-related challenges. The Sciencewise programme has shifted to become a direct commissioning scheme, enabling resources to be targeted at public engagement which considers the potential ethical, health, environmental and safety concerns that may arise from emerging technologies. In particular, Sciencewise is supporting public engagement on the future development of nanotechnology, brain science and stem cells - three areas of science and innovation that are likely to be critical to achieving UK success in the knowledge economy.

Nanotechnology

6.3 In August 2005 the Government published an outline programme on public engagement on nanotechnology. This made clear that the Government wishes to:

- enable citizens to understand and reflect on issues related to nanoscience and nanotechnologies, both personally and through inclusive processes involving citizens, policy-makers and researchers;
- enable the science community and the public to explore together both aspirations and concerns around the development of nanotechnologies;

- enable institutions working in the area of nanotechnologies to understand, reflect on and respond to such public aspirations and concerns;
- establish and maintain public confidence in the development of technologies by understanding the public's concerns and showing their impact on Government regulation;
- contribute to wider government initiatives to improve the general trustworthiness of science and technology-related institutions; and
- support wider government initiatives to support citizen participation in public policy and service delivery.

Nanotech. Engagement Group

6.4 Since August, many of the elements of the programme have begun work – particularly Nanodialogues and the Nanotechnologies Engagement Group (NEG), both funded through OSI's Sciencewise programme. NEG published its first research report in April 2006, and the Nanodialogues project has completed the first of its activities, bringing citizens and scientists together to discuss the application of nanotechnologies to the clean-up of contaminated land. OSI also participated on the steering group of the independently funded NanoJury UK process. These activities have been fed into Government through the Nanotechnologies Issues Dialogue Group (chaired by OSI), and this has informed Government thinking regarding its approach to research and regulation related to , unbound engineered nanoparticles.

6.5 In particular, in November 2005, Government published the first research report of the Nanotechnologies Research Coordination Group[1]. This included an overarching research objective to consider the social and ethical aspects of nanotechnologies as the technology unfolds over the coming years.

KEY HIGHLIGHTS AND NEXT STEPS

Openness, dialogue and effective communication with the public

Science Week

6.6 The OSI sponsored National Science Week 2006 generated record-breaking numbers of events around the country, with more people participating than ever before. With strong media coverage, the event this year provided a major platform for Government in demonstrating its commitment to science and innovation in the UK.

6.7 A highlight of Science Week was the Prime Minister's participation in 'Click for the Climate', a nationwide initiative to raise awareness of, and build personal commitments towards tackling climate change by reducing energy use. At a ground-breaking showcase of the best of science in Britain, Alistair Darling, the Secretary of State for Trade and Industry, made his first major address on science, and the DTI also launched an important paper on the supply of science, engineering and technology skills in the UK over the period to 2014[2].

Sciencewise

6.8 Sciencewise has grown in strength and stature, and now represents the hub of the Government's approach to public dialogue on science and technology. During 2005, the programme has taken on two keynote projects, which will roll out during 2006 and into 2007 by:

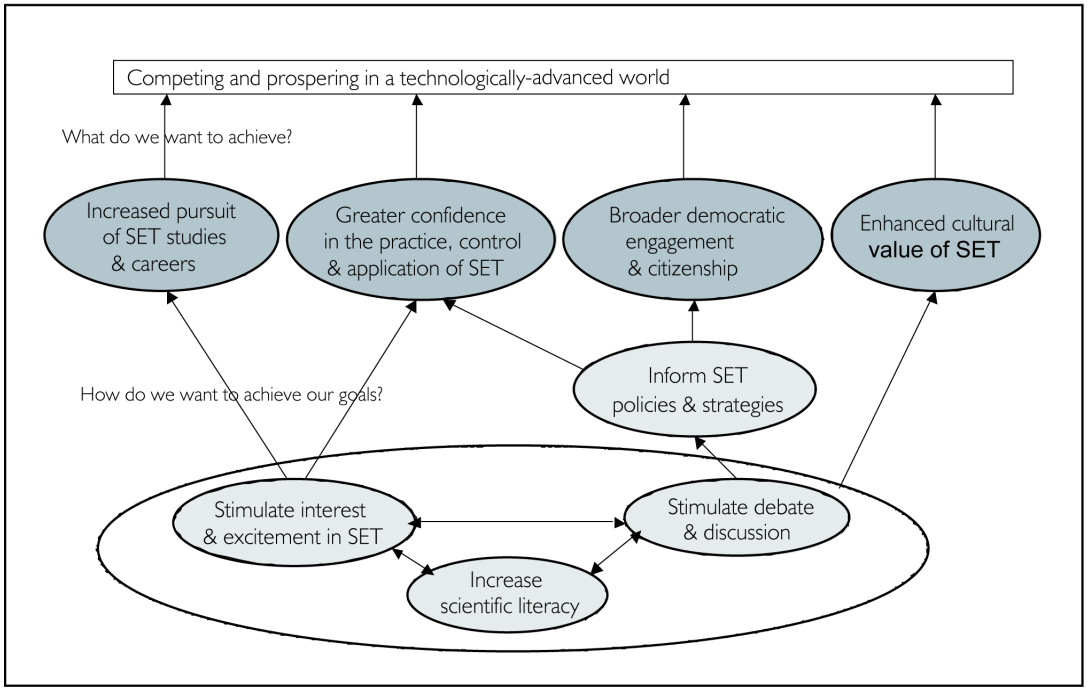
[1] http://www.defra.gov.uk/environment/nanotech/nrcg/index.htm

[2] DTI Economics Paper No.16 "Science, Engineering and Technology Skills in the UK", March 2006

- enabling the Academy of Medical Sciences to embed public dialogue into its process of advising the Government on future research and regulation around the use of psychoactive substances (such as cognition and mood enhancing drugs); and
- taking forward public discussion of the wider implications of new and emerging areas of science and technology as highlighted by by OSI's Horizon Scanning Centre. This project will also help to identify future priorities for public dialogue on new and emerging areas of science and technology.

6.9 Working with other principal funders of public engagement with science and technology[3] the OSI has led discussions regarding the objectives for funding public engagement with science and technology (chart below). These have included how to take forward public investments to meet these goals, and how a 'network convenor' could enable the complex webs of those involved in delivering public engagement to function effectively.

Chart 6.1: Objectives for public engagement with SET



[3]DCMS, NESTA, the Wellcome Trust, DfES, Scottish Executive, RCUK, HEFCE, and the BBC.

Council for Science and Technology (CST)

6.10 In September 2005, the Government published its response to the Council for Science and Technology's (CST) report 'Policy Through Dialogue'[4]. In this it made clear its intention to build on the useful suggestions that the CST has made. In particular, to take forward the recommendation to develop a "corporate memory of past experience that will enable collective learning" with regard to public dialogue on science and technology. Through the Sciencewise programme, a scoping study was conducted to explore the desirability and feasibility of establishing a resource centre on public dialogue on science and technology to work across government.

Ethics in science, engineering and technology

6.11 During 2005 CST undertook a consultation with key stakeholders in the science, engineering and technology community regarding Rigour, Respect and Responsibility: a Universal Ethical Code for Scientists (see below). The conclusions of the consultation were clear. There is widespread support for the code, both in terms of its content, but also in terms of its value in broadening debate, enabling individuals and institutions to make a public statement of the values expected from scientists, engineers and technologists, and as an educational tool for use in schools, colleges and universities.

Box 6.1: Rigour, respect and responsibility: A Universal Ethical Code for Scientists

Rigour, honesty and integrity

- Act with skill and care in all scientific work. Maintain up to date skills and assist their development in others.
- Take steps to prevent corrupt practices and professional misconduct. Declare conflicts of interest.
- Be alert to the ways in which research derives from and affects the work of other people, and respect the rights and reputations of others.

Respect for life, the law and the public good

- Ensure that your work is lawful and justified.
- Minimise and justify any adverse effect your work may have on people, animals and the natural environment.

Responsible communication: listening and informing

- Seek to discuss the issues that science raises for society. Listen to the aspirations and concerns of others.
- Do not knowingly mislead, or allow others to be misled, about scientific matters. Present and review scientific evidence, theory or interpretation honestly and accurately.

[4] http://www.ost.gov.uk/society/cstreportresponse.pdf

6.12 In parallel, the Government has been piloting the code within its own scientific workforce. Since September 2005, a sub-group of members of the Chief Scientific Adviser's network of Science and Society Champions has been exploring how the code can be embedded in the policies, procedures and practices of their organisations – e.g. in recruitment, training and development, and staff appraisal. The code pilot ends in September 2006, and working through the Chief Scientific Adviser, for the remainder of 2006 and into 2007, this will be rolled out further across Government before seeking to extend it into the wider science, engineering and technology community.

New policy developments

Supporting public engagement in universities and colleges

6.13 Over the last year the UK Science Forum has explored public engagement with science and noted that the public is generally positive about science, but that scientists feel that they have insufficient reward and recognition for engaging with society. Government is working with HEFCE, RCUK, the Wellcome Trust, the Royal Society and others to develop a public engagement scheme for universities and colleges and will continue to support this initiative.

Public engagement with science in developing countries

6.14 The UK is committed to helping developing countries to build their capacity for science, engineering and technology as a major sustainable route out of poverty. The African Union/New Economic Partnership for African Development Consolidated Plan of Action for Science makes clear the need "to increase awareness of the contributions that science and technology can make to Africa's economic recovery and sustainable development" and "to increase public participation in science and technology policy-making." Public engagement with science in developing countries.

7 SCIENCE AND INNOVATION ACROSS GOVERNMENT

The ten-year framework highlighted that science and innovation are not only key drivers of wealth creation, but also underpin evidence-based policy making and improved service delivery. Government therefore needs to use – and be seen to use – the highest quality science and scientific advice.

Over the past twelve months, Government has:

- merged the Office of Science and Technology and the Innovation Group to bring science and innovation at the heart of the DTI;
- continued its rolling programme of independent science reviews;
- started a new Foresight project – Tackling Obesities : Future Choices;
- provided an analytical framework for the CSR07 "Emerging Technologies" challenge;
- begun a number of independent reviews into innovation and wealth creation by UK companies; and
- launched the Energy Research Partnership.

EVIDENCE OF PROGRESS

7.1 The past year has seen a number of important steps taken to improve the Government's own use and management of science and innovation. The Government is committed to ensuring that the best evidence is used in policy-making and delivery including through integration and management of processes.

7.2 The DTI's Office of Science and Technology and Innovation Group merged in April 2006 to form the Office of Science and Innovation (OSI) bringing together science and innovation under a single command at the heart of the DTI. Sir David King continues as the Government Chief Scientific Advisor and as head of OSI. Sir Keith O'Nions is Director General and also DTI's Chief Scientific Advisor.

7.3 There are a number of rolling programmes that continue to monitor and progress the use of science within government. These include the ongoing Science Reviews of individual government departments with three reports due to be completed later this year and the continued work of Foresight.

7.4 The Government has also sought to offer advice and guidance on the use and management of science. Based on evidence reviewed by the Chief Scientific Advisers' Committee (CSAC) and the Council for Science and Technology (CST) the Horizon Scanning Centre (HSC) provided an analytical framework for CSR07, relating key emerging technology clusters to policy priority areas.

7.5 CST is looking at progress in a number of key science, technology and innovation areas for example, data sharing; innovation in the services sector and in SMEs; and nanotechnology. A number of reviews on the progress of these investments and their translation into innovation and wealth creation by UK companies were begun through the CST. One of the emerging priorities of the past year has been energy resources and investment. To support this the Energy Research Partnership was launched in January 2006. This is a joint public/private initiative to provide enhanced leadership and coherency to the UK's effort and investments in energy research and innovation.

KEY HIGHLIGHTS AND NEXT STEPS

Cross-Government working

Coordination of Research and Analysis Group

7.6 OSI has increasingly worked with the Coordination of Research and Analysis Group (CRAG) in identifying balanced analytical priorities for the Government, engaging all analytical communities. OSI joined with CRAG to inform Treasury's analytical inputs to CSR07. In addition to this the Government Chief Scientific Adviser and Government chief social researcher presented their evidence jointly to House of Commons Select Committee Inquiry on Scientific Advice, Risk and Evidence.

Grand Challenges

7.7 Three Grand Challenges (cross-Government policy challenges where scientific evidence could offer a significant contribution) were identified by the Chief Scientific Advisers Committee in the areas of the carbon footprint of the built environment, ageing population, and the exploitation of real-time data in support of policy and service delivery. This work was endorsed by the first meeting of the Cabinet Committee on Science and Innovation (SI) in December 2005. Departments are now working closely together on projects to help meet these challenges.

Head of Profession

Head of Science and Engineering Profession

7.8 The principal role of the Head of Science and Engineering Profession (HoSEP) is to help build and support the government community of scientists and engineers. As part of this remit a Skills Framework and an associated Learning and Development Document for the profession has been developed. An "information resource" web site includes information on career paths and a list of organisations within the community. It has been established that, in gender terms, the make-up of civil service scientists and engineers is representative of the wider national picture.

Infinite Monkeys

7.9 During the next year "Infinite Monkeys", a newsletter for government scientists and engineers, will be launched. This will help build a government wide community. It will also help in disseminating information, for example, by providing an overview of the recently launched Professional Skills for Government initiative.

Identifying and promulgating best practice

7.10 Through its work with other departments, OSI is currently building a programme to identify and share good practice in a number of areas, including guidance on issues affecting the use of science and scientific advice across government[1]. This will include a series of seminars and networking events on a wide range of topics relating to the gathering, use and communication of advice within government[2]. A revised 'Guidelines on scientific analysis in policy making' was published in October 2005.

Working with advisory groups

Council for Science and Technology

7.11 CST is the UK Government's top-level advisory body on science and technology policy issues[3]. Over the last year its innovation agenda has particularly focused on ways to encourage high technology spinouts and small and medium-sized companies to grow and foster innovation in services sector companies. CST consider there is a need for a better strategic focus for the services sector within government, and for better use of strategic procurement to recognise the value of SMEs in meeting government procurement needs.

7.12 CST have also been involved in a variety of other issues, a key focus was on the energy agenda. This included a response to the Government's Energy Review and engaging with the Energy Minister on energy technology timelines and public engagement. CST were also involved in the organisation of the Royal Academy of Engineering conference "Energy 2100".

7.13 Other issues examined included a publication of the report "Better use of personal information: opportunities and risks" which set out the benefits arising from better use of personal data by government. CST is also investigating ways of ensuring that the UK remains at the forefront of the international research endeavour over the next twenty years. It has a number of new projects which include investigating how potential health impacts are assessed and used in policy-making across government. CST has also begun a review of the progress Government has made in taking forward the actions set out in its response to the Royal Society and Royal Academy of Engineering report on nanotechnology, this will be reported on in spring 2007.

Chief Scientific Adviser's Committee

7.14 The Chief Scientific Advisers Committee (CSAC) brings together the chief scientific advisers from all those Departments with a significant reliance on scientific evidence, several key Agencies and the Devolved Administrations. CSAC promotes a consistent approach to identifying and delivering scientific evidence into policy across Government. Its regular full meetings are supplemented by ad hoc meetings for urgent or more specialised discussion (e.g. nanotechnology). CSAC is also supported by sub-groups where a more limited number of Departments have a direct interest or, as in the case of horizon scanning, where new thinking is emerging.

[1] http://www.dti.gov.uk/science/science-in-govt/works/advice-policy-making/codeofpractice/page9483.html; http://www.dti.gov.uk/science/science-in-govt/works/advice-policy-making/guidelines/page9474.html.

[2] http://www.dti.gov.uk/science/science-in-govt/works/advice-policy-making/good_practice/page27428.html.

[3] Htpp://www.cst.gov.uk

Measuring government performance

Science Reviews

7.15 Government performance is measured by OSI in a number of ways. One of the principle tools is the system of science reviews. The Science Review team was set up in 2003, to conduct a rolling programme of authoritative and independent reviews of Government Departments. The reviews evaluate the quality, management and use of science in policy development and informing the work of the Departments. Departments currently under review are the Health and Safety Executive (HSE), the Department of Communities and Local Government (DCLG) and the Department of the Environment Food and Rural Affairs (DEFRA).

Science and Innovation Strategies

7.16 As well as the science reviews Government Departments have to produce a Science and Innovation (S&I) Strategy. These S&I Strategies show how they contribute to departmental priorities and objectives and Public Services Agreement (PSA) targets. The value of S&I strategies has become widely recognised, to the extent that some Agencies and Devolved Administrations have voluntarily undertaken their own. Some Departments have benefited from drawing on the experience of those who pioneered the development of these strategies. As the wider debate has matured about better integration of all evidential streams, Defra has led the way in creating a second-generation "Evidence and Innovation Strategy" which is now being looked at closely by OGDs, to help further embed evidence-based policy-making and delivery. So far, Defra, DTI, DWP and Home Office have published strategies. DfES, DfT and DCLG strategies should be ready for publication in the next six months. Over the next year, OSI will be working with departments to ensure that advances in this area will contribute to meeting the Government's vision for the management of science and research across Government[4].

Priority issues

Energy

7.17 January 2006 saw the launch of the Energy Research Partnership, a joint public/private initiative to provide enhanced leadership and coherence to the total UK effort and investments in energy research and innovation. The Partnership includes key funders from across the public and private sectors, plus other bodies such as the Office of Gas and Electricity Markets (OFGEM). Budget 2006 announced plans for a new jointly funded, public/private National Institute for Energy Technologies.

7.18 A key development in autumn 2006 will be the conclusion of a major review of the economics of climate change. The review has involved extensive consultation and has drawn on research and evidence from across a wide range of disciplines to understand more comprehensively the nature of the economic challenges arising from climate change and how they can be met, in the UK and globally.

Nano-technologies

7.19 In February 2005 the Government published a report[5] setting out their agenda for the responsible development of nanotechnologies in the UK. These activities are coordinated by the Nanotechnology Issues Dialogue Group (NIDG), which is chaired by OSI.

[4] http://www.dti.gov.uk/science/science-in-govt/works/metrics/page27410.html .

[5] http://www.ost.gov.uk/policy/issues/nanotech_final.pdf .

7.20 The Government has published a number of documents since including:

- an outline programme for public engagement on nanotechnologies[6].
- the first Government research report on characterizing the potential risks posed by engineered nanoparticles[7]. - identifying nineteen research objectives.
- Defra[8] and the HSE[9] both published reviews on the adequacy of current regulatory regimes in relation to nanotechnologies and their respective areas of policy responsibility.

7.21 In summer 2006, the Food Standards Agency will publish a review of the potential implications of nanotechnologies for regulations and risk assessment in relation to food. This will be followed in the autumn by a regulatory overview report from OSI.

Futures work

Horizon Scanning Centre

7.22 Launched in March 2005 the remit of OSI's Horizon Scanning Centre (HSC) is to look at least five to ten years ahead to identify and examine potential opportunities and threats. HSC have created and piloted processes for Horizon Scanning and leveraging evidence from across analytical workstreams. In addition, they also provide orientation training and have created a cross-Government and private sector 'Future Analysts Network'.

7.23 As part of a portfolio strategy of raising Horizon Scanning capacity across Government, the HSC has carried out significant Horizon Scanning projects. These include:

- "The future of Asian Trade with the UK" - a systematic engagement and analysis of perspectives from stakeholders in five Asian countries;
- assisting the Coordination of Research and Analysis Group (CRAG) with data and processes for prioritising its activities in June 2005; and
- responding to a request from HM Treasury to inform the CSR07 “Emerging Technologies” challenge – by providing an analytical framework relating key emerging technology clusters to policy priority areas.

7.24 HSC have a number of plans for the coming year to both carry out Hoizon Scanning and to help others to do so. HSC are assembling two databases of Horizon Scanning information - the Sigma Scan (issues across the public policy spectrum) and the Delta Scan (S&T), which should be available in Autumn 2006.

7.25 In collaboration with the Sciencewise project (see also Chapter 5) HSC will use its Delta Scan (S&T), and other sources, to help identify future public engagement priorities. HSC will work with others in Government, and a broad range of stakeholders, to explore emerging trends in science that may raise significant health, safety, environmental, social, ethical and regulatory issues.

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[6] http://www.dti.gov.uk/files/file27705.pdf

[7] http://www.defra.gov.uk/environment/nanotech/nrcg/pdf/nanoparticles-riskreport.pdf .

[8] http://www2.defra.gov.uk/research/project_data/More.asp?I=CB01075&M=KWS&V=Nanotech&SUBMIT1=Search&SCOPE=0 .

[9] http://www.hse.gov.uk/horizons/nanotech/regulatoryreview.pdf .

Foresight

7.26 Foresight is the Government's science-based think tank, providing challenging visions of the future to ensure effective strategies now. It aims to provide evidence on strategic cross-departmental issues with particular relevance to future policy. Recent projects include: Intelligent Infrastructure Systems; Detection and Identification of Infectious Diseases; and Tackling Obesities: Future Choices[10].

Case study 7a: Foresight: Brain Science, Addiction and Drugs Project

The findings of the Foresight project on Brain Science, Addiction and Drugs were launched in July 2005. It explored the implications of future science on addiction, drug use and treatments. They concluded that the greatest changes for society in the near future will be in our understanding of the brain, how it functions and performs, its capacity and limitations and how it affects our behaviour.

It suggested that cognition-enhancing drugs will probably be developed for therapeutic purposes, but use of these drugs may well spread to the enhancement of the healthy, and their effects could influence many aspects of mental functioning. Many such agents are available though the Internet and this form of distribution is set to grow. [11]

7.27 All projects have been successful in mobilising diverse groups of specialists to work in a multidisciplinary framework and have demonstrated the scope for collaboration across disciplinary boundaries. An independent evaluation of the programme of Foresight projects concluded that it has succeeded in being regarded as a neutral interdisciplinary space in which forward thinking on science-based issues can take place. Two new projects are due to commence in Autumn 2006 and the next project to report will be Tackling Obesity: Future Choices, in the Autumn of 2007.

International

7.28 Policy influencing and negotiations with global partners of choice were further developed over the year – most notably with Russia, Brazil, South Africa, China, India and the US and focused primarily around the G8 Presidency priorities of climate change and African development. Influencing mechanisms included high-level visits and calls. Programmes that serve to package and market UK S&T strengths and activities internationally continue to be refined, and rolled out into an increasing number of countries. Similarly, Joint Commissions are being upgraded and their remit widened to include science, technology and innovation across wide-ranging agendas.

[10] http://www.foresight.gov.uk

[11] Drug Futures 2025? Horizon Scan, Office of Science and Technology, July 2005.

8 NEXT STEPS CONSULTATION AND FORWARD LOOK

8.1 *Science and Innovation Investment Framework 2004-2014: Next Steps* sets out the Government's thoughts on the long-term challenges facing UK science and innovation, and the actions needed to build on the *Science and Innovation Investment Framework 2004-2014*. The document covers a range of proposals designed to create a more effective science and innovation system in the UK, and maximise the impact of public investment in research on the economy.

8.2 Consultation responses were invited by 16 June 2006 on proposals outlined in Chapter 2, "Maximising the impact of science on innovation" and Chapter 3, "Improving Research Councils' effectiveness".

8.3 The response to the consultation has been good, with over 170 submissions from a wide range of stakeholders including business, charities, the research base and the public services.

MAXIMISING THE IMPACT OF SCIENCE ON INNOVATION

8.4 Over 100 responses were received to questions from this section of the consultation. Universities represent the largest stakeholder group of responses, with businesses, charities and public sector organisations also well represented. In the next three months, OSI will produce a summary of responses, a formal reply and publish all responses unless respondents have requested confidentiality.

CONSULTATION ON A PROPOSAL TO CREATE A LARGE FACILITIES COUNCIL

8.5 Over 120 responses were received on this section of the consultation. OSI are currently reviewing the responses and hope to make an announcement soon. All responses not listed as confidential will be made public.

SUPPORTING EXCELLENCE IN UNIVERSITY RESEARCH

8.6 Although responses were not specifically invited on this subject, a number were gratefully received and these will be used as evidence in the formal consultation on 'Reform of higher education research assessment and funding'[1] launched by DfES in June 2006.

SUPPORTING WORLD CLASS HEALTH RESEARCH

8.7 Although responses were not specifically invited on this subject, a number were gratefully received. These will be used as evidence in the formal consultation being undertaken by an independent review team working to Sir David Cooksey[2].

[1] "Reform of higher education research assessment and funding",DfES http://www.dfes.gov.uk/consultations/conDetails.cfm?consultationId=1404 .

[2]Cooksey Review, HMT, http://www.hm-treasury.gov.uk/independent_reviews/cooksey_review/cookseyreview_index.cfm

IMPROVING THE SUPPLY OF SCIENTISTS

8.8 Whilst there was no formal consultation on this section of the document, the Government is grateful for those respondents submitting views on this issue.

9 GLOSSARY

AHRC	Arts and Humanities Research Council
BBSRC	Biotechnology and Biological Sciences Research Council
CCLRC	Council for the Central Laboratory of the Research Councils
CMI	Cambridge-MIT Institute
CPD	Continuing Professional Development
CRAG	Coordination of Research and Analysis Group
CSAC	Chief Scientific Advisers' Committee
CSR	Comprehensive Spending Review
CST	Council for Science and Technology
DCLG	Department of Communities and Local Government
DEFRA	Department of the Environment Food and Rural Affairs
DELNI	Department for Employment and Learning Northern Ireland
DfES	Department for Education and Skills
DTI	Department of Trade and Industry
EPSRC	Engineering and Physical Sciences Research Council
ERC	European Research Council
ESRC	Economic and Social Research Council
FP	Framework Programme
FEC	Full Economic Cost
GERD	Gross Domestic Expenditure on Research and Development
GSIF	Global Science and Innovation Forum
GTP	Graduate Teacher Programme
HEB-CI	Higher Education – Business Community Interaction Survey
HEFCE	Higher Education Funding Council for England
HEFCW	Higher Education Funding Council for Wales
HEI	Higher Education Institution
HEIF	Higher Education Innovation Fund
HESA	Higher Education Statistics Agency
HLTA	Higher Level Teaching Assistant
HMRC	HM Revenue and Customs
HoSEP	Head of Science and Engineering Profession
HSC	Horizon Scanning Centre
HSE	Health and Safety Executive
IPO	Initial Public Offering
JCPSG	Joint Costing and Pricing Steering Group
KIC	Knowledge Integration Communities
KTN	Knowledge Transfer Network
KTP	Knowledge Transfer Partnership
LFCF	Large Facilities Capital Fund
MRC	Medical Research Council

NEG	Nanotechnologies Engagement Group
NERC	Natural Environment Research Council
NIDG	Nanotechnology Issues Dialogue Group
NPL	National Physical Laboratory
OFGEM	Office of Gas and Electricity Markets
OSI	Office of Science and Innovation
PGA	Partial General Approach
PPARC	Particle Physics and Astronomy Research Council
PSA	Public Services Agreement
PSRE	Public Sector Research Establishments
QR	Quality Related Block Grant
R&D	Research and Development
RAE	Research Assessment Exercise
RCUK	Research Councils UK
RDA	Regional Development Agency
RES	Regional Economic Strategies
RESUK	Research Establishment Sustainability Forum
SBRI	Small Business Research Initiative
SEEDA	South East England Development Agency
SET	Science Engineering and Technology
SETNET	Science Engineering and Technology Network
SFC	Scottish Funding Council
S&I	Science and Innovation Strategy
SI	Cabinet Committee on Science and Innovation
SRIF	Science Research Investment Fund
STEM	Science, technology, engineering and mathematics
SWAN	Scientific Women's Academic Network
TDA	Training and Development Agency for Schools
TQI	Teaching Quality Information
TRAC	Transparent Approach to Costing
TSB	Technology Strategy Board
TTA	Teacher Training Agency
UCL	University College London
UKAEA	UK Atomic Energy Authority
UKRC	Women's Resource Centre
UKSCI	UK Stem Cell Initiative
UKTI	UK Trade and Investment

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