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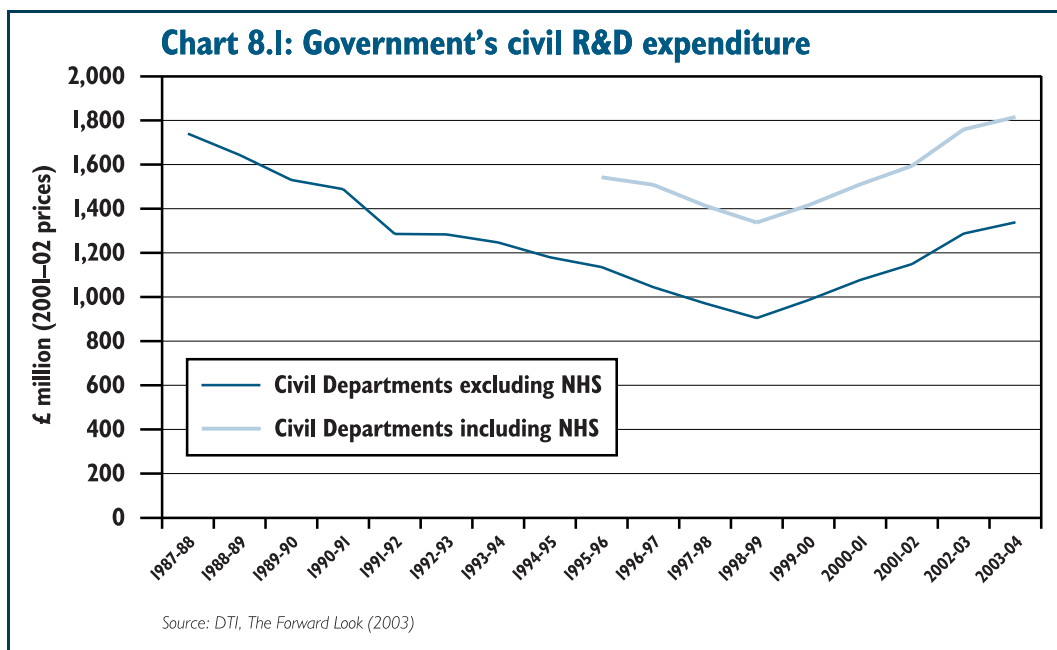
SCIENCE AND INNOVATION ACROSS GOVERNMENT

Summary

8.1 Science and innovation are not only key drivers of wealth creation, but also underpin evidence-based policy development and improved service delivery. Government therefore needs to use – and be seen to use – the highest quality science and research, as well as expert and independent advice as an input to policy formation and delivery. Government departments spent over £4 billion on R&D in 2002-03, significantly more than the total funding for the Research and Funding Councils. This chapter sets out how the Government will work, increasingly across departmental and public-private sector boundaries, to ensure that Government’s own R&D programmes deliver their public service goals and support the translation of research into economic benefits.

The Government’s record to date

8.2 In recent years, the Government has made firm commitments to evidence-based policy making and to improving the use of science and research by departments. This commitment has required a shift in the level of public investment. The historic decline in civil R&D expenditure that took place throughout the 1980s and 1990s has been reversed.



8.3 The Government has put in place measures to improve the way departments manage their own research and use expert advice. Drawing on key principles enunciated by Lord Phillips in his BSE Inquiry Report in 2000, the Guidelines 2000 and the 2001 Code of Practice for Scientific Advisory Committees provide guidance on how departments should obtain and use scientific advice in policy making, including the presentation of that advice and decisions based on it.

8.4 The Guidelines 2000 cover the processes of identifying issues requiring scientific advice, obtaining the best possible advice from a wide variety of sources and the handling of advice by departments. The 2001 Code of Practice provides a framework to ensure that high levels of openness and transparency are maintained throughout the network of relationships between Scientific Advisory Committees and Government. This guidance is currently being supplemented by more recent work by the Cabinet Office and others. Findings from the 2002 report *Risk: improving government's capability to handle risk and uncertainty*¹ by the Prime Minister's Strategy Unit have led to a cross-government programme to improve risk management. The *Principles of managing risk to the public*² currently being implemented within departments include recommendations for increased openness and transparency to improve communication with the public where there is scientific uncertainty, taking into account public perceptions in decision-making, and promoting the use of independent experts.

8.5 The Government is also taking steps to ensure that departments have the capability to manage properly the science and research they conduct or commission. A key milestone here was the 2002 Cross-Cutting Review of Science and Research. The Review recommended that all departments that rely on significant amounts of science have Departmental Chief Scientific Advisers (DCSAs), Science and Innovation (S&I) strategies that are properly costed and subject to external scrutiny, and appropriate arrangements in place to better manage their in-house expertise.

8.6 There has been good progress in implementing the Review's recommendations: most departments now have costed S&I strategies and many have appointed DCSAs. Some departments have also introduced review processes that evaluate the delivery, impact and value of research, and examples of good practice have been collated by the Government's Chief Scientific Adviser (GCSA). For example, MoD's move to outcome-based justification for research is an important development from which other departments may learn. Similarly DEFRA's processes for identifying priorities, managed by their DCSA and involving the OST, the department's finance team, stakeholders and Ministers, represent a good practice benchmark.

8.7 Government departments are encouraged to commercialise their research outputs, where appropriate. The 1999 Baker report³, on the economic potential of public-sector research, the Government response to this and subsequent guidance, for example from the Patent Office, set out a framework for promoting more effective exploitation of research from Public Sector Research Establishments (PSREs). Chapter 5 describes measures to stimulate knowledge transfer from the PSRE base, **including an increase in funding available through the PSRE Fund to around £20 million a year by 2007-08.**

Improving the use and management of research

8.8 There are a number of challenges remaining. The first is to ensure that all S&I strategies link the science that departments plan to commission to departmental objectives, set priorities, explain how the work will be commissioned, managed and used, be open to wide consultation, and be reviewed regularly.

¹ Strategy Unit Report, November 2002. <http://www.number-10.gov.uk/su/risk/risk/home.html>

² HMT/Cabinet Office Principles, September 2003. http://www.hm-treasury.gov.uk/media//8B2AE/risk_principles_220903.pdf

³ *Creating knowledge, creating wealth: realising the economic potential of public sector research establishments* – a report to DTI/HMT (1999)

8.9 The 2003 DTI Innovation Report highlighted the potential of Government departments to stimulate innovation and wealth creation in the wider economy, for example, by using best-practice procurement techniques to provide incentives for companies to develop new products, processes and services, or by increasing the proportion of R&D purchased from SMEs. S&I strategies need to take better account of the potential of innovation and wealth creation in departments' internal policy delivery work.

8.10 To address these issues, the Chief Secretary to the Treasury has asked the GCSA to review departments' S&I strategies following the 2004 Spending Review. **During the coming months, the OST will work together with the Prime Minister's Strategy Unit and the Ministerial Group on Innovation in the Knowledge Economy to assess strategies in respect of the following criteria:**

Strategies' input to policymaking and service delivery:

- whether spending plans are consistent with the strategy;
- the extent to which these plans and the strategy have been subject to appropriate peer review;
- whether the value added for new work is clear and credible;
- whether relevant proposals are in place to sunset programmes which have run their course;
- whether clear mechanisms are in place for setting objectives, evaluating results and ensuring accountability for performance; and
- whether sufficient mechanisms are in place to ensure investment in R&D is sustained throughout the economic cycle.

Strategies' contribution to innovation and wealth creation:

- whether they encourage the pull through of new technologies and techniques to industry and the wider economy;
- whether they facilitate the use of Government procurement to encourage innovation in the suppliers of research;
- whether they contribute to a regulatory framework which encourages innovative approaches to adherence;
- whether they contribute to delivery of the skills strategy; and
- the degree to which they involve the active participation of industry and in particular SMEs, including the share of externally-commissioned R&D funding awarded to SMEs, as part of departments' contributions to the government-wide Small Business Research Initiative.

Strategies' contribution to government-wide knowledge and cross-government challenges:

- the degree to which they take account of work in other Government departments;
- the degree to which they coordinate their work with that underway in the wider science base;

- whether there is potential to improve the Government's capacity to set clear government-wide objectives based on assessment of future strengths, weaknesses, opportunities and threats; and
- whether there is potential to improve the Government's capacity to deal with cross-departmental and multi-disciplinary challenges.

A vision for the management of science and research across Government

8.11 Completing the implementation of the recommendations of the 2002 Cross-Cutting Review and achieving further progress through review procedures on the issues identified above will enable and encourage departments to become increasingly sophisticated in their management of science and research, and their use of expert knowledge.

8.12 Looking beyond this, over the coming decade the Government aims to achieve the attributes described in Box 8.1 for managing science and research across Government. Many departments have already made substantial progress towards them. Going forwards, concerted and sustained effort will ensure that all departments build on recent progress in order to achieve these objectives.

Box 8.1: Attributes for the effective management of science and research across Government

1. The Government as a whole, and all Government departments, will have adopted a culture of using sound scientific advice to inform policy development, delivery and departmental decision-making. This should involve DCSAs in all major departments with direct access to Ministers and departmental managers, and with departmental managers involving DCSAs on all major policy issues, not just those with obvious scientific aspects.
2. All scientific work commissioned and used by Government will be of appropriately high quality, drawn from the best possible sources (including the science base and the private sector), commanding the confidence of Government Ministers and officials. Government departments will be paying the full economic costs of the research they commission from universities.
3. Priorities for research will be set at the strategic level, not just within departments as they are now, but also across government as a whole, taking account, for example, of the 2003 Strategic Audit from the Cabinet Office. CSAs – acting as a group – along with other bodies, such as the Council for Science and Technology, will provide advice on the prioritisation of strategic issues. The use of science in policymaking will be applied consistently across the board where an issue affects more than one department.

Box 8.1 continued: Attributes for the effective management of science and research across Government

4. All Government departments will be using sophisticated scientific horizon-scanning techniques, linked both to their own policy horizon scanning, that of other departments, and to the OST horizon-scanning centre (described in paragraph 8.18). This should involve departments drawing upon the science base to ensure they are informed about future risks and opportunities. Cross-departmental science initiatives, such as the Foresight programme and Prime Minister's Strategy Unit work, should develop and disseminate best practice guidelines and should provide capacity to deal with selected issues, working closely with other departments.
5. Scientific expertise will be used to the maximum effect possible, allowing greater use of Research Council, charity and private sector input to Government advice, and giving Government scientists greater opportunities to contribute to the work of the science base and the exploitation of their work in the wider community, industry and commerce. Analysts, including scientists, will be able to network more effectively – within their own department, across departments, Research Councils, the private sector and internationally – to ensure awareness not just of research results already generated but also active research underway elsewhere.
6. Knowledge transfer objectives will be fully incorporated into departments' S&I strategies, and scientific advice on procurement in Government departments will be seen as a natural and logical means of pulling through the development of new technologies.
7. The use of scientific knowledge will have been fully integrated into Government analytical and risk assessment processes, and risk assessment guidance will be consistent with the advice in Guidelines 2000. Science will be regarded as one of the key analytical inputs to decisions along with specialisms like economics, law and statistics, with policy staff at all levels aware of the need to seek scientific advice – in the same way as they incorporate economic and legal advice.
8. Scientific advice for the Government will be generated in a fully inclusive manner and command the support of the public and other stakeholders. Scientists, including Government scientists, will have the training and willingness to communicate openly with the public, including through the media. Politicians and the public will understand what science and research can and cannot deliver, in particular that science and analysis will provide information and knowledge to those who must take decisions, but that it is for politicians and for the public to take the decisions themselves.

8.13 Work on these objectives will be taken forwards through a variety of methods. Some fall within the remit of the ongoing work of the OST in scrutinising departments' S&I strategies, while others fit into existing work-streams elsewhere, such as the implementation of the DTI Innovation Report, the public engagement agenda, or the current cross-government programme on improving risk management. Others will require new interventions, such as additional training for scientists and policymakers, the formulation of best practice guidelines, or the creation of appropriate networks. **As part of the review of departments' S&I strategies later in 2004, the OST and Prime Minister's Strategy Unit will work together to assess what more needs to be done to achieve these goals.**

Departments' research programmes and future priorities

8.14 In examining departments' priorities for science and research over the next decade, a number of cross-cutting issues are apparent:

- the identification of policy objectives supported by research commissioned or conducted by several departments, for example, climate change and energy research (see Box 8.4) and security and anti-terrorism research;
- a common interest in research into future technologies and techniques that are required for progress with different policy challenges, for example: research into new sensors and imaging technologies using developments in materials technology for military, civil security, commercial and health applications; research into the methods that might be used in new supercomputing facilities for the analysis of huge volumes of data; and research to inform departments better as to the potential risks attached to policy options; and
- the increasing demand for social and humanities research to inform policymaking (see Box 8.2), for example on the way behaviour might influence health; the building of safe and sustainable communities and urban regeneration; and a better understanding of the factors that need to be taken into account by physical scientists and engineers in promoting public acceptance of new technological developments.

Box 8.2: Social research in Government

The Government's Chief Social Researcher, in consultation with departments, other stakeholders in Government and the wider research community, has developed a strategy for Government Social Research to enhance its impact and contribution to Government policy making and delivery.

Government social research uses the methods of social scientific enquiry – surveys, qualitative research, analysis of administrative and statistical data, case studies, controlled trials – to measure, describe, explain and predict social and economic phenomena, and subsequently uses this data to inform policy debate.

The Government Social Research Service provides objective, reliable, relevant and timely social research to support the development, implementation, review and evaluation of policy and delivery, and to ensure that policy debate is informed by the best research evidence and thinking from the social sciences.

8.15 In order to deal effectively with cross-governmental policy challenges, it is essential to ensure the coherence and strategic relevance of science and research across government, both across departments and across disciplines. Taking full account of the current and potential contributions of existing fora for coordinating science and research across government, such as the Cabinet Ministerial Committee on Science Policy (SCI) and the Chief Scientific Adviser's Committee (CSAC), the Cabinet Office is currently examining options for strengthening the determination of cross-cutting analytical and research priorities and ensuring the coordination of research and analysis to support policy development.

8.16 Complementarity between departments' own research programmes and those funded through the Research Councils is also crucial, not only to avoid potential gaps and overlaps in publicly funded research, but also to maximise the contribution of the UK science base to public service priorities. A number of departments already have research concordats in place with Research Councils, outlining areas for strategic cooperation or joint working, for example:

- the Medical Research Council has concordats with the Welsh Assembly, the Department for Environment, Food and Rural Affairs (DEFRA), the Department for International Development (DfID) and the Ministry of Defence (MoD), and bilateral links with the DTI, Food Standards Agency (FSA) and individual charities; and
- the Particle Physics and Astronomy Research Council has concordats with the MoD and Department of Health (DH) covering agreements to work together on technologies of common interest and promote effective interaction on these.

8.17 Excellent horizon-scanning of current science and technology, looking at opportunities and threats at least five to ten years ahead, and often considerably beyond that, is essential to the effective governance and direction of Government policy, publicly funded research and many of the activities of the private sector, and to the interactions between them. Horizon scanning currently takes place both within individual departments and the Office of Science and Technology's Foresight Directorate (see Box 8.3), as well as within the Research Councils (RCUK).

Box 8.3: Foresight

The Office of Science and Technology's Foresight programme carries out in-depth projects on issues where science and technology may create major future opportunities and challenges. Each project reviews the relevant science and creates visions of the future to help frame choices and debate. Foresight works with a wide range of stakeholders to identify areas for further action.

Recent projects are now contributing to wider engagement on the implications of potential developments in flood risk and climate change, human and artificial cognitive systems, and next generation information and communication technologies. Future projects will continue to explore selected areas with relevance for public engagement, longer-term regulatory environments and investment.

8.18 Building on the work already taking place in the Foresight Directorate, in Government more widely, and in RCUK, the Government's Chief Scientific Adviser will work with RCUK, the Prime Minister's Strategy Unit and Departmental Chief Scientific Advisers across Government to build up a single centre of excellence in science and technology horizon scanning. This will be co-ordinated by OST's Foresight Directorate and will bring together high calibre individuals provided and resourced by other Government Departments, Research Councils and the private sector. This will not replace the requirement for effective horizon scanning in departments, RCUK and elsewhere; rather, it will provide a higher-level strategic context to those other activities, interacting with and informing them. It will feed directly into cross-government priority setting and strategy formation, improving Government's capacity to deal with cross-departmental and multi-disciplinary challenges. It will also inform and be informed by the Government's strategy for public engagement with science.

Research in Government departments

8.19 In the following section, the research activities and future priorities of some of those departments with the highest levels of investment in science and research are highlighted.

Department of Health

8.20 The Department of Health (DH) invests in research to support Government objectives for health services, public health and social care, as well as contributing to the Government's overall science strategy. The DH spent approximately £540 million in 2002-03 through the NHS R&D programme and Policy Research Programme. The NHS R&D programme (around £500 million) provides two main streams of support:

- NHS Support for Science: used mainly to support clinical research, this budget meets the NHS costs of supporting R&D under agreed standards of strategic direction and quality assurance by the Research Councils and by other eligible funding partners.⁴ It includes an element for the costs of developing R&D proposals and for building work around research supported by the external funder; and
- NHS Priorities and Needs R&D Funding: this supports R&D required to underpin modernisation and quality improvement in the NHS. Among the NHS responsibilities that are supported are: clinical R&D; R&D to develop and apply new technology in the NHS; health services R&D, including work on service delivery; and public health R&D, including epidemiology. This support is given to those best able to undertake the research and achieve the results required. These include collaborations between the NHS, universities, local authorities and other bodies, and groupings outside institutional boundaries, across clinical specialisms, health communities and care pathways.

8.21 Additionally, some NHS R&D funds are used to help improve capacity to undertake research; for example, the Research Capacity Development Programme is a national programme that provides personal awards and funds academic infrastructure to support research capacity development within the NHS. The purpose of the programme is to build and support a skilled workforce capable of advancing high quality research with the aim of maintaining and improving health within a knowledge-based, patient-centred health service.

8.22 The Policy Research Programme (around £32 million per year) undertakes development and evaluation in public health, health services and social care in order to ensure that policy is based on reliable evidence of needs. The research portfolio covers healthy living and social wellbeing, disease prevention, the role of the environment in health, social care for adults and children, the organisation of the NHS, and strategies for treating particular diseases or conditions. The Department directly commissions research on major areas of public health, including lifestyle and inequalities.

8.23 The Government committed, in Budget 2004, to increase NHS R&D funding by £25 million per annum over each of the next four years, an additional £100 million by 2007-08 compared with 2003-04 levels. This new investment will underpin the creation

⁴ Including the Wellcome Trust, Association of Medical Research Charities (AMRC), EU, US National Institutes of Health (NIH) etc.

of a new UK Clinical Research Collaboration (UKCRC) for the effective and efficient translation of scientific advances into patient care. The UKCRC is a medical research partnership involving the Departments of Health in England and the devolved administrations, the Medical Research Council (MRC), the Wellcome Trust, the Association of Medical Research Charities, related industry sectors, the medical academies, the NHS and patients and carers. It will create and fund research networks, based on the successful model developed by the cancer research networks, to increase the number of patients involved in clinical trials in important disease areas. This will start with mental health, medicines for children, Alzheimer's, stroke and diabetes. It will develop and implement proposals to enhance research careers and streamline the regulatory framework governing research.

8.24 The UKCRC will work to transform the clinical research environment in the UK by:

- taking strategic oversight of clinical research;
- identifying gaps in clinical research capability and programmes and identifying opportunities for action;
- planning and co-ordinating approaches between funding bodies to fill gaps and take advantage of opportunities;
- monitoring progress in implementing agreed plans and in achieving agreed objectives; and
- giving leadership to develop the profile of clinical research and enhance the research culture of the NHS.

8.25 The creation of the UKCRC was strongly welcomed in responses to the consultation on this science and innovation investment framework as a major step forward. At the same time, a number of respondents identified further issues that needed to be tackled, particularly with regard to the strategic coordination of medical research between public sector funders: whilst it is clear that the MRC and the Health Departments already work well together across a range of areas, it was felt that this could be taken further.

8.26 The Government has therefore tasked the MRC and the Department of Health (DH) in England to create, together with the Health Departments in the devolved administrations if they wish to participate, a new joint body, the Joint MRC/DH Health Research Delivery Group. The Group, which will report to both MRC and DH through their normal reporting channels, will have a remit to:

- develop agreed positions on research issues to be discussed and developed into proposals at UKCRC;
- agree delivery timetables and performance indicators for the proposals to be taken forward by Government funders;
- pool funds for specific activities where appropriate (e.g. fellowships, clinical trials);
- organise delivery on a joint basis where required (rationalising the present position, and so improving operational efficiency);
- achieve greater cohesion in knowledge management and exploitation of research outputs from publicly funded medical research; and

- develop coordinated bids for medical research funding for future Spending Reviews for submission through the Health Departments and OST.

8.27 A review of progress will be carried out in advance of the 2006 Spending Review, in order to help inform decision-making on medical research funding. Its remit will include advising on the best way to use both existing and new resources to maximise the benefits of clinical research in the NHS and the wider economy.

8.28 Looking forward, the DH has identified a number of priorities that it intends to address over the next five years, subject to funding allocations:

- increased capacity, infrastructure and funding of clinical research in order to strengthen the effective and efficient translation of scientific advances into patient care;
- taking maximum advantage of new genetic advances and technologies, drawing on funding partners, for example in the DTI and the Welsh Assembly Government;
- public health research to support the identification and implementation of cost-effective approaches to improving population health, prevention and reducing health inequalities;
- work to implement the recommendations of the Healthcare Industries Task Force to maximise the benefit to patients from healthcare products, building on public procurement elements of the DTI Innovation Report; and
- moving to full transparency of the use of R&D funds allocated to NHS Trusts and achieving full sustainability for clinical research in the NHS.

8.29 Improving public health research capacity and links between public health academics and practitioners was identified as essential to delivery of the Government's long-term health policy aims in the February 2004 report by Derek Wanless, *Securing Good Health for the Whole Population*. A Wellcome Trust report, *Public Health Sciences: Challenges and Opportunities*, published in March 2004 also made a number of recommendations in this area. Responses to the consultation on this framework identified these and other wider issues in public health as priorities.

8.30 The Government will take these ideas and recommendations forward in a White Paper on improving health, which will be published later in 2004 and will address the Wanless and Wellcome recommendations on public health research capacity and infrastructure.

Department for Environment, Food and Rural Affairs

8.31 The Department for Environment, Food and Rural Affairs (DEFRA) spends some £325 million per year on science activities, including research, covering policy priorities such as climate change and energy, natural resource protection and animal health and welfare. DEFRA has developed its own ten-year perspective on its science needs in the form of its *Science Forward Look*⁵, to be published in July 2004, so that it can plan for appropriate investment in science and research up to 2013. This will be the subject of consultation and inform the development of DEFRA's next Science and Innovation Strategy (2005-08).

⁵ *Evidence & Innovation: Defra's Next 10 Years*, DEFRA, in press.

8.32 DEFRA plans to alter the balance of its current science programme towards its environmental priorities. Top priority will be strengthening science and innovation in support of policy on climate change and energy. Targets here include: the development of improved warning systems for severe weather, improved mitigation strategies and continued science support for DEFRA's leading international role in this area; improved understanding of factors influencing energy consumption leading to reduced CO2 emissions; and increased investment in the Renewable Energy and Energy Efficiency Partnership (REEEP), a unique programme for building capacity for renewable energy and energy efficiency market growth and innovation.

8.33 Furthermore, **the Carbon Trust will continue its support for developers and co-investors to tackle climate change through the discovery and development of low carbon technologies and business.** Its mission is to work with various communities (academic, early-stage, pre-commercial, corporate research and investors) to identify innovative technologies, test concepts, provide viability and define future markets that create real wealth. Expansion of the Carbon Trust's programmes in the business sector will introduce significant improvement in delivery of carbon savings, both in the short term and over a longer period, helping to meet targets in 2020 and beyond.

8.34 DEFRA will place increased emphasis over the next ten years on partnerships and strategic alliances, both with other Government Departments and with the UK science base, especially in environmental science, bioscience and the social sciences. The next S & I Strategy will also set out how DEFRA will promote innovation to support environmental and other policy priorities. Key components of DEFRA's approach include:

- technology foresight and horizon scanning to identify emerging technologies and the drivers for innovation and policy support;
- support for technology transfer and innovation by business, especially the development of sustainable technologies;
- direct funding for innovation to support policy needs and to develop new approaches to regulation that encourage innovative solutions; and
- policy on ownership of intellectual property to encourage the results of DEFRA-funded research to be brought to the market.

Box 8.4: Cross-cutting research: climate change and energy

Energy research, development and demonstration (RD&D) is diverse and fragmented, with a wide range of departments and other public bodies responsible for different aspects. This diversity brings benefits, but at the same time risks complexity in coherence and leadership. Currently the Sustainable Energy Policy Network (SEPN) network, the Chief Scientific Adviser's High Level Energy Group on R&D, and The Carbon Trust are the main vehicles active in coordinating efforts, with the High Level Group linking additionally with the Research Councils. Another relevant strategic body is the UK Environment Research Funders' Forum (ERFF), established by DEFRA, the Environment Agency and the Natural Environment Research Council in 2002 to coordinate national activities in environmental research and training.

Box 8.4 continued: Cross-cutting research: climate change and energy

Overall expenditure on energy research in the UK lies behind that of France and Germany. The gap with the US, scaled for relative size of the economies, is even more pronounced. The level of private sector funding for energy R&D has fallen significantly since the 1980s and privatisation of the utilities. Equally, the value of research into renewables by the major oil companies is a small fraction of that into fossil fuel-related research.

The combined expenditure by the UK Research Councils on energy research, including the two main programmes – SUPERGEN and Towards a Sustainable Energy Economy – currently amounts to around £14 million per annum, including the current provision for the establishment of the new UK Energy Research Centre. In the DTI, renewables research has amounted to around £20 million per annum, although larger sums have been allocated, for example, to support the development of offshore wind farms.

Over the coming decade, the Government will work with partners in the private sector to improve the effectiveness of UK energy R&D investments overall, and the scale of these investments relative to the economic and environmental challenge facing the UK. Better dialogue between key funders of energy RD&D – industry, Government and other public bodies, and academia – will be central to our future approach. The Energy Research Centre is a step forward in this respect, providing greater leadership and coherence to energy research, including a focus for wider international engagement. Energy innovation will remain of the highest priority and strategic importance for the UK, and globally, for many decades to come.

Three areas of activity the UK needs to engage in over the next ten years include:

- promoting collaboration between public and private sectors on energy RD&D, and transferring knowledge effectively into business;
- greater pull-through of innovative technologies to demonstration and commercialisation; and
- playing a stronger role in the large-scale technical research projects being undertaken in EU and other international collaborations.

Department for International Development

8.35 DfID has a specific remit to reduce global poverty. New science, technologies and ideas are crucial for the achievement of this aim, but global research investments are currently insufficient. DfID commissions research to help fill this gap, aiming to ensure effective outcomes for the world's poorest people. There has been notable success in these areas since the creation of DfID in 1997, and the Department is now recognised as an international front-runner in terms of development science, particularly on HIV/AIDS.

8.36 DfID also works with governments through projects and budget support programmes to help establish sustainable research and knowledge capacity. Capacity is on the increase in some regions, notably China and India, but remains weak across Africa. The advantages of building domestic capacity are twofold: country- or region-specific research has greater value for developing countries (for example in agricultural research); and a sustainable research base in a developing country increases the chances that research results will be taken up by policy-makers and entrepreneurs.

8.37 In response to the Government's 2002 Cross-Cutting Review of Science and Research and an independent review of DfID's research programmes⁶, DfID has prepared a long-term research strategy to establish a focus on areas where DfID and the UK can make a significant contribution to development science.

8.38 The strategy will serve to link DfID research to wider Governmental science priorities, and will include building research and knowledge capacity in developing countries to ensure that findings can be communicated effectively to those in need. The strategy will also seek to:

- link in with DfID's wider work with developing countries;
- increase the coherence of all UK Government departments' research spending on development issues;
- build closer working relationships with international bilateral and multilateral agencies; and
- identify a longer-term research and policy agenda.

8.39 Since 1997, DfID has increased its bilateral spending on HIV/AIDS from £38 million to more than £270 million in 2002-03. **Over the next three years, DfID will continue to increase funding for HIV/AIDS. In addition, DfID research spending will increase from £80m per year to at least £100m per year from 2006-07, demonstrating the commitment to making progress in this area.** Spending will focus on four key themes: African agricultural productivity; killer diseases such as HIV/AIDS, malaria and TB; states that work in the interests of the poor; and climate change.

8.40 To build on this additional investment, **DfID will set up a UK Funders' Forum that will for the first time bring together Government departments, Research Councils and the private sector to pool knowledge on the application of science and research to development goals.**

8.41 DfID is playing a leading role internationally in supporting the development of Public-Private Partnerships (PPPs) for the development of vaccines, drugs and microbicides. These include the Medicines for Malaria Venture (£1 million per year), the International AIDS Vaccine Initiative (£14 million over the period 2000-2004), and the Microbicides Development Programme of the Medical Research Council (£16 million over the period 2000-2005). A PPP on livestock vaccines is under development.

8.42 The Wellcome Trust is an important partner with DfID in meeting their shared public health goals to bring lasting benefits to the world's poor. **Working in partnership with DfID to combat malaria through research, the Wellcome Trust expects to commit around £10 million over the next five years, matched by DfID investment. The Trust are also exploring with DfID the joint development over the same period of capacity building for health research in sub-Saharan Africa.**

8.43 DfID also works with the Bill and Melinda Gates Foundation, which has provided over \$1.1 billion of grants for work on HIV, TB and reproductive health. The Foundation places particular emphasis on innovative approaches and greater coordination in research into new technologies for HIV/AIDS, including vaccines and microbicides. In particular, DfID is engaging with the Foundation on the establishment

⁶ Research for Poverty Reduction: DfID Research Policy Paper. http://62.189.42.51/DFIDstage/Pubs/files/pov_red_pol_paper.pdf

of the New Global HIV Vaccine Enterprise announced at the Sea Island G8 summit in June 2004.

Ministry of Defence

8.44 The Ministry of Defence (MoD) spends around £12 billion per annum on the procurement of fighting equipment for the UK's Armed Forces. Of this, around £2 billion is spent on the development of new equipment and a further £450 million on research for future capabilities and to provide wider technical advice across the Department. The vital role that science and technology can play in transforming the UK armed forces to meet the security challenges of the 21st Century was highlighted in the New Chapter to the 2002 Strategic Defence Review⁷ and reinforced in the recent Defence White Paper.⁸ Defence technology has also contributed to wealth creation in the wider economy through spin-off into the commercial sector; examples include thermal imagers, foetal monitors and liquid crystal displays.

8.45 The 2004 Spending Review will enable the MoD to drive through a series of reforms, including the establishment of a new Top Level Budget holder responsible for science and technology, to ensure that these resources are used in the most efficient way. The MoD is also working to widen its research supplier base with the part-privatisation of the Defence Evaluation and Research Agency (now trading as the private company QinetiQ), and an increased move towards the use of competition in contracting for research services. It is planned that by 2007-08 the entire research programme will be subject to open competition, with the exception of that which, for national security and other reasons, has to be undertaken within Government.

8.46 The combination of this move to expand the defence research base that the MoD has access to, whilst at the same time enhancing direct investment in technology and innovation in that supplier base, has necessitated the establishment of new partnerships between industry, public-sector research institutions and the academic sector. The Defence Technology Centre (DTC) initiative, which creates partnerships between Government, academia and business around specific technology themes, is the key action supporting this. **The 2004 Spending Review reaffirms the MoD's commitment to the DTC initiative, under which the MoD provides 50 per cent of the funding for a six-year competitively let contract, the remainder being provided by other consortium partners.** Innovative intellectual property rights (IPR) arrangements have also been negotiated that will secure those rights required for Government use while at the same time giving maximum freedom for industrial exploitation.

8.47 An initial tranche of three DTCs was successfully established in 2003 in the areas of Data and Information Fusion (£30 million over six years), Human Factors Integration (£7.6 million over three years) and Electromagnetic Remote Sensing (£15 million over three years, with options to extend to six years). A further DTC in the field of Systems Engineering is due to be launched by the MoD later in 2004, and soundings within industry indicate strong further demand for DTCs.

⁷ *Strategic Defence Review: A New Chapter*, MoD, July 2002.

⁸ *Delivering Security in a Changing World*, MoD, December 2003.

8.48 Looking further ahead, the MoD has identified seven priority areas for investment in underpinning technologies over the period to 2007-08:

- network-enabled capability for the armed forces;
- technologies for national security and to counter chemical, biological, radiological and nuclear (CBRN) threats;
- the development of unmanned aircraft;
- the production of non-lethal weapons and personnel protection;
- novel power sources;
- enhanced capabilities in the development of open computer architecture in new equipment; and
- technologies to ensure enhanced sustainability and affordability of complex defence equipment.

One of the challenges in the coming years will be to link, through joint programmes and co-funding arrangements, these emerging defence technology priorities and those applied science and business technology opportunities identified through the Research Councils' forward planning and the DTI's new Technology Strategy Board.

Home Office

8.49 The Home Office has a wide variety of research interests, from technologies for reducing crime to research on the economic consequences of migration, and currently spends some £50 million per annum on science and research. The fruits of this research are apparent in numerous areas, such as identification techniques, where the exploitation of DNA techniques through the National DNA Database has led to an increase from 24 per cent to 38 per cent in detection rates where DNA is used. In many cases such technologies are making direct contributions to efforts to achieve Home Office Public Service Agreement targets: for example, crime reduction best practice and toolkits based on authenticated evidence covering CCTV, and the application of problem-oriented policing techniques, have contributed to real reductions in burglary (down 40 per cent since 1997) and vehicle crime (down 34 per cent since 1997).

8.50 The Home Office's key science and technology priorities over the period to 2007-08 include:

- the creation of a new central intelligence hub;
- the development of a coordinated cross-departmental programme to develop the evidence base to deal with CBRN risks and other aspects of terrorism;
- the coordinated deployment of biometrics;
- the greater use of effective technologies for policing, such as tracking and surveillance technologies, and non-lethal technologies for police protection;
- targeted higher quality evaluations and modelling work to enhance and assess the efficiency and effectiveness of various Criminal Justice System agencies and interventions;
- the evaluation of effective drug treatments; and

- strategic research looking at crime, offenders brought to justice, longitudinal analysis of refugees and other recent migrants, and research to support civil renewal and increasing volunteering.

8.51 Building on significant recent developments in the way in which science and research are managed in the Home Office, such as the appointment of a Chief Scientific Advisor and the creation of a Home Office Science and Technology Reference Group of eminent independent scientists, **the Home Office will, over the years through to 2007-08, be putting in place an integrated approach to managing investment in science and research by creating an overarching science and technology strategy for the Home Office.** This will include: establishing a central mechanism for science planning, strategy, quality assurance and horizon scanning; restructuring and strengthening the Police Scientific Development Branch to become the Home Office Scientific Development Branch; a department-wide science and technology unit; and strengthening cross-departmental science links to ensure high standards and appropriate cross-departmental working on delivery issues such as CBRN, drugs and youth justice.

8.52 Looking forward over the next ten years, the Home Office has identified key areas of science and technology that will support its strategic aims: horizon and intelligence scanning, identification technologies, cross-disciplinary uses of science and technology, sensor technology, material technology, ICT, data analysis and mining, location technologies and intelligent imaging.

Summary

9.1 The Government's aim is that the UK should be a 'partner of choice' for global businesses looking to locate their research and development (R&D), and for foreign universities seeking collaboration with the science base or business. In a global economy, with healthy competition from both developed and rapidly emerging developing nations, and with the costs of 'big science' increasing, the UK needs to maximise the value of collaborations at an international level and in European fora, as well as maintaining a healthy competition with our European neighbours.

9.2 Given the devolved nature of a significant proportion of research funding and industrial policy, the Government also needs to connect international and national R&D networks efficiently with the economic plans of the UK's countries and regions. This chapter illustrates the science and innovation strategies adopted by the UK's devolved administrations. At a regional level, the importance of science and innovation in improving regional economic performance is increasing, highlighting the need for regional and national bodies to coordinate funding and strategies.

Effective international engagement

9.3 Science is an international enterprise, and increasingly so, both in its scale – for example, the human genome project or high-energy physics – and in addressing global challenges – for example, climate change, terrorism and infectious disease. Many areas that have been dominated by national networks and facilities will be replaced by international ones, and global competition to attract private sector R&D investment is rising strongly. Because of the UK's strengths, scientists here should increasingly be seen as the partners of choice and involved in international networks and collaborations. To develop further the UK as one of the world leaders in R&D, the nation needs to capitalise on international collaborations, working with major players such as the USA, European partners, Japan, Canada, China and Russia.

9.4 A survey of international opinion, canvassed in 2004 by the Foreign and Commonwealth Office's Science and Technology (S&T) network, found that the UK has a strong reputation for science, particularly for excellent basic science capabilities. These were generally seen as being on a par with France and Germany, and delivered through a more efficient and effective research management system. However, the breadth of UK strengths, across disciplines and in centres of excellence throughout the UK, is not fully appreciated in key markets such as the USA. The UK could further improve the attraction for inward investors of its world-class researchers and universities which are now more actively engaged in collaborations with business R&D.

9.5 Ninety per cent of the world's R&D takes place outside the UK. The UK can benefit from this by linking into international networks or building international collaborations. Providing UK researchers and businesses with access to the world's best science, scientists and facilities, wherever they are located, is key. This is essential if the UK is to stay at the forefront of leading fields and to provide access to large EU or global-scale facilities (such as telescopes, particle colliders and large datasets) that are too expensive to develop alone. Collaboration and engagement at an international level also has the potential to increase the UK's global influence and reputation in R&D and

attract more inward investment, visiting workers, and students to UK higher education. Box 9.1 illustrates two current examples of fruitful international collaboration.

Box 9.1: International science partnerships

The benefits of partnership between world-class researchers are already being demonstrated, for example:

- in the UK and the US, the initial phase of the UK/Texas Bioscience Collaboration Initiative, launched in 2002, focuses on key areas of bioscience, medicine and biotechnology, where there are complementary strengths in the UK and Texas, and potential for commercialisation. Texas was chosen because of the strength of its bioscience and medical research centres, the openness of its research community and a readiness to partner with the UK. This initiative could prove a useful model for developing collaborations with other parts of the US, which offer complementary scientific excellence and eagerness to work with the UK; and
- the development in Japan of the world's most powerful super computer – the Earth Simulator – which allows the global climate to be modelled at much higher resolution. UK and Japanese scientists were brought together by the FCO, resulting in UK experts in climate prediction modelling gaining unprecedented access to the Earth Simulator, to support the further groundbreaking insights by UK scientists into the complex interactions of climate change.

9.6 The Government already facilitates these aims in a number of ways:

- The FCO's network of science and technology (S&T) attachés in key countries around the world, working closely with the DTI, UK Trade and Investment, British Council, Research Councils and others, helps inform policy making on science and innovation, and uses science in support of foreign policy objectives, for example on climate change. The network promotes the UK as a partner of choice and facilitates collaboration to enhance the UK science base, helps companies access overseas innovation and technology, facilitates technology-based trade and inward investment, and uses science and technology as a vehicle to maximise the UK's influence and impact abroad.
- The DTI's GlobalWatch service offers a range of practical help to UK-based firms, which wish to acquire knowledge of technological developments, advanced skills and scientific advances in other countries, to help develop their businesses. This includes facilitated technology partnering through the International Technology Promoters (ITPs).
- UK Trade and Investment (UKTI) provides support for companies across the range of international business activities, encompassing inward investment and export promotion. Through its Global Partnerships Service, UKTI enables potential inward investors to identify technologically-advanced UK firms with which they may wish to build strategic collaborations.
- The British Council promotes UK culture and creativity, and has a unique role to play in sustaining communications for and about the UK system of innovation as a whole, acting to support both wealth creation and social well being. The Council has two main science programmes worldwide: to engage

and influence scientific communities, and to spread awareness and appreciation of the UK with wider international audiences.

9.7 The Government recognises the need for an overarching national strategy for international engagement in R&D and access to large facilities, to bring together the main UK players in international R&D, including Government departments, the FCO network of S&T attachés, scientific societies and the Research Councils. The strategy should develop a more evidence-based approach to international engagement, in line with the approach to performance metrics developed for UK-funded research that will monitor UK strengths and weaknesses compared with the rest of the world, examine barriers to progress and identify appropriate actions. This should ensure that UK actions take account of the changing international economic and research environment, that key initiatives and opportunities are identified, and that UK priorities are agreed to ensure that international research structures meet our needs.

9.8 A cross-government group – the Global Science and Innovation Forum – led by the Government’s Chief Scientific Adviser, will develop this strategy. The strategy will include:

- the FCO, DTI and UKTI pro-actively promoting the UK as the partner of choice for international R&D and facilitating inward investment and outward trade;
- coordinating cross-government work on the S&T aspects of major global issues, such as climate change and S&T capacity building in developing countries;
- identifying main strategic partners for international facilities and collaboration and using networking and other programmes more strategically to make these partnerships happen;
- presenting an interface between UK activities and individual researchers and businesses that is coherent and simple to access;
- identifying and prioritising EU and global large facilities which the UK will want to contribute to or host; and
- using EU R&D programmes to the best advantage, particularly taking into account EU enlargement to 25 Member States.

Facilitating global links

9.9 To help deliver its broader goal of raising the UK’s R&D and innovation performance, the Government will develop a higher impact approach (delivered through the bodies described above) to raising the UK’s reputation as a leading partner for science and business R&D collaboration and inward investment. Based on clearer targeted information to scientific and business audiences in key markets, and monitored regularly for effectiveness, the Government will aim to raise the reputation of the UK over the next two years as a partner of choice in Europe and the rest of the world.

9.10 The UK Government – through key stakeholders (Office of Science and Technology (OST), International Technology Service of the DTI, the FCO’s Science and Technology network, the British Council and the Research Councils) – will also need to continue to make an important contribution to the Government’s wealth creation

agenda by coordinating cross-departmental approaches to key overseas markets (e.g. China, India and the USA); coordinating cross-departmental initiatives on important international issues (e.g. climate change); and ensuring that national science and technology initiatives contain an international component, reflecting the full business potential – and influence – of UK science and technology.

9.11 The UK will need to build on international agreements with both developed (e.g. US / Japan) and emerging (e.g. China / India) economies through international networking agreements that identify research partnership opportunities, develop areas of mutual interest, and optimise synergies. Through promotional activities, the UK can showcase what it has to offer in science and technology: global campaigns presently running include an FCO and British Council sponsored North American campaign 'UK Science and Technology for a New World', which focuses on biotechnology, energy and the environment – areas where British science, innovation and policy lead the world. In 2005, a 'Year of Science' campaign is planned in China.

9.12 The UK needs to ensure that the right opportunities exist, and are taken up, for collaboration with leading states both bilaterally and through EU programmes, that there is the right balance between EU and non-EU collaboration and that there are effective links with leading US regions, expanding the approach which is working so well in Texas (see Box 9.1). In this context, the Research Councils should look to build on existing support for international collaborations.

9.13 The UK will also need to influence international policy in critical areas of global concern. UK researchers and businesses are well positioned to lead on finding solutions to global problems, which in turn will provide business opportunities, better security and an improved quality of life. Two important examples of areas where international efforts will be necessary are climate change and sustainable energy, and capacity building in developing countries. On the former, the UK has provided international leadership on climate change and is well placed, including through the forthcoming G8 and EU Presidencies, to promote further international research and technology cooperation and information sharing. On the latter, the UK scientific community has strong technical experience and research leadership in critical disciplines, and the UK can work, through the G8 Presidency, towards a more coordinated and sustainable international effort in tackling development issues. These policy areas are covered in more detail in Chapter 8. Through knowledge transfer and capacity building, the UK can make a significant contribution to addressing global issues of sustainable development, poverty and poor education, killer diseases, lack of clean water provision and access, and the consequences of global warming.

Large research facilities

9.14 Maintaining access to leading edge experimental facilities is a key element of keeping UK scientists competitive and at the forefront of their fields of research. In many cases the responsibility for the investment needed to maintain this access should properly fall to the universities and institutes in which the scientists are employed. However, there are a range of facilities that may, for a number of reasons (e.g. size, cost, interdisciplinary scope), fall outside the funding remit, or capability, of any individual authority.

9.15 The UK currently spends about £230 million per annum on the capital expenditure of large facilities projects, through Research Council baseline expenditure, international subscriptions, and from the Large Facilities Capital Fund held centrally by the OST. Funding is allocated on the basis of excellence, scientific need based on

prioritisation, and best value, using whichever of these funding mechanisms best suits the project.

9.16 The breadth and quality of science possible in large facilities is rising as new technologies emerge. New facilities are more technologically complex and hence more expensive than the facilities they are replacing. Hence, many areas which have up until now been dominated by national facilities will be replaced in the next generation by international facilities. New technologies such as grid computing will have a major impact on the nature of the facilities which are needed and generate major new challenges, such as exponentially increasing amounts of data to store and curate. At the same time, new potential funding partners for investment in large facilities are emerging (for example, research charities, Regional Development Agencies, and the EU).

9.17 In such an environment, the UK needs to take a strategic position as to the best way to maintain access for researchers and to manage and fund new investment. The Large Facilities Road Map¹ sets out the key facilities of the future, both in the UK and overseas, which the Government and Research Councils see as potentially strategically important for UK researchers to be involved with. It gives a 15-year forward look of priorities, and helps with periodic prioritisation exercises to ensure that the funding available is focussed on the highest priorities, based on the following criteria:

- the scientific excellence of the research delivered from the facility and the importance of that facility in delivering that science;
- the timeliness of the investment and the impact on the UK of potential delay;
- the extent to which the project would meet other national and international needs, and hence the interest and possible leverage from other potential funders;
- the strength of the potential research user group in the UK and its breadth across subject areas and Research Councils; and
- the overall financial scale of the project.

9.18 These criteria apply to investments in both national and international large facilities, located in the UK and elsewhere. There are additional factors to be considered if the UK wishes to host an international scientific facility on UK soil. There is the potential for the UK to secure further benefits from hosting an international large facility, through gaining scientific leadership and leverage, and attracting international research talent. There may also be secondary industrial benefits, from winning a greater proportion of technology contracts for the facility itself, and the development of clusters around the site. However, there are obviously additional costs to the UK of hosting such a facility; typically the host country pays a premium.

9.19 In many cases, UK interests will be well served by participating in a facility overseas, for example through international subscriptions or bilateral arrangements with the host country. In a few cases there may be a strong case for the UK to host such a facility, and where this is the case the UK Government will be actively involved in the international discussions to maximise the chances of a potential UK bid. The UK also

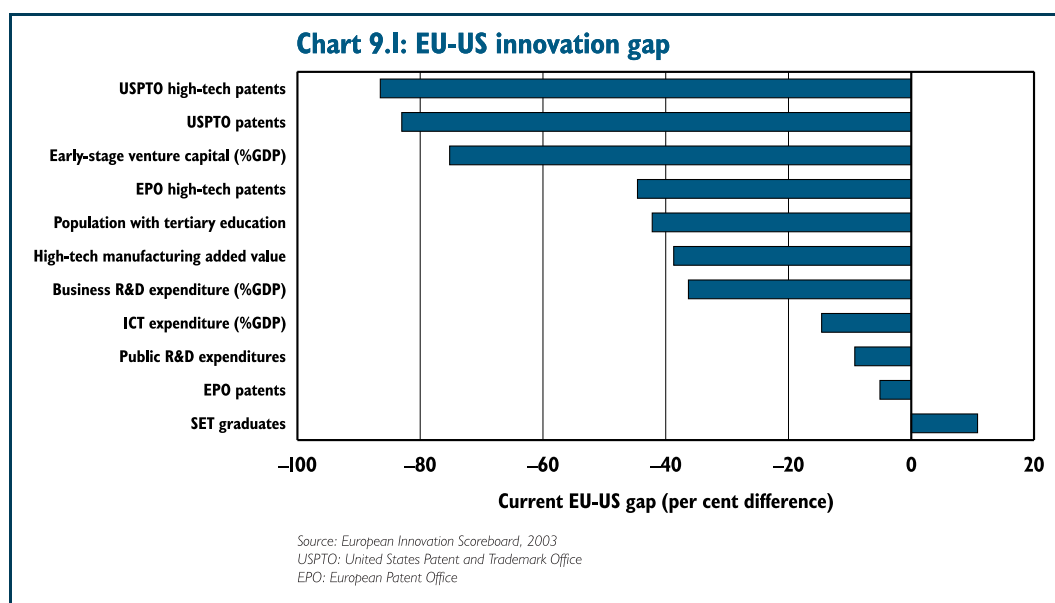
¹ <http://www.ost.gov.uk/research/funding/lfr roadmap/index.htm>

needs to become more strategic in negotiating access for UK scientists to overseas facilities. Research Councils will work together through Research Councils UK to ensure that needs and opportunities are identified across the spectrum of large-scale facilities. Where substantial UK investment is required for this, priorities will be guided by the Large Facilities Road Map, and funding committed only where there is a good value for money case for investment, as balanced against other research priorities.

European Union research and innovation

9.20 At the Lisbon European Council in 2000, Europe's leaders set the strategic goal for Europe 'to become the most competitive and dynamic knowledge-based economy in the world by 2010'. To achieve this goal, Europe must improve its R&D and innovation performance.

9.21 Despite the importance of R&D to growth and productivity, the performance of the European Union lags that of major competitors such as the US or Japan. Furthermore, EU expenditure on R&D amounts to just 2 per cent of GDP, compared with 2.7 per cent in the US and 3.1 per cent in Japan. Many European countries also fail to translate promising research into innovation. The most recent (2003) European Innovation Scoreboard shows the EU trailing the US on 10 out of the 11 indicators available for both, particularly in patenting, tertiary education, and the provision of early-stage venture capital (see chart 9.1). The Scoreboard also suggests that, on current trends, none of the gaps will be closed by 2010 without additional effort.



9.22 The 2002 report to EU Economic and Finance Ministers on research and development emphasised the importance of ensuring supportive framework conditions for innovation to thrive. It also identified several key barriers to innovation in the EU – many chiming with the UK's national policy priorities – including: ineffective intellectual property regimes; weak science-industry links and insufficient exploitation of public research; a lack of risk capital, particularly at the early stage; the regulatory burden for start ups; and punitive bankruptcy laws.

9.23 A combination of measures – at the regional, national and Community levels and including partnerships with the private sector – are required to address these problems and improve Europe's innovation performance. National-specific policies can be directed at tackling national/regional problems. To enable this to happen, EU

frameworks need to be sufficiently flexible to allow Member States to develop policy that is tailored to their own economic and social circumstances. In this respect, application of the Open Method of Coordination offers the opportunity for Member States to develop policies that are, at the same time, consistent with common European economic goals and tailored to domestic economic environments. This approach, consisting of mutual learning and peer review, has been recently applied to the shared political commitment of increasing investment in R&D in Europe. Box 9.2 gives an overview of recent innovation policy in France, Germany and the Netherlands.

Box 9.2: Innovation policies in other EU Member States

In **France** a new innovation plan was announced in March 2003 for implementation in 2004. The action plan addresses four specific issues:

- creating an attractive legal and fiscal status for business angel investors;
- support to innovative start-ups, including exempting young research-intensive firms from some social security charges and taxes;
- a new R&D tax credit, from which all firms can benefit; and
- strengthening the partnership between the public research and the industrial research community, for example, through incentives to increase the recruitment of graduates.

In **Germany**, innovation policy includes a range of targeted support programmes to tackle market failures; due to Germany's federal system, such programmes exist both at the national and state level, with coordination between the two. Some examples of current initiatives include:

- Information Society Germany 2006, a plan to support different activities in business, research, government and society to further improve ICT penetration and use;
- a strategy for high-tech start-ups and SMEs, introducing new measures to support such firms and improving existing measures to facilitate cooperation between innovative SMEs and research institutions; and
- developing a new, comprehensive innovation strategy to push innovation in all areas of business, research, government and society.

In the **Netherlands**, the Government launched an 'Innovation Platform' – a council of experts chaired by the Dutch Prime Minister – in September 2003, with a budget of €185 million. This was followed in October 2003 by a government policy commitment to three main goals:

- to promote innovation by expanding the tax incentive for private sector R & D (with a proportion aimed specifically at SMEs), introducing a new mechanism to stimulate collaborative R&D projects, and tackling the shortage of knowledge workers;
- to increase the number of innovative companies by improving the climate for technology-based start-ups, focussing assistance on SMEs which are motivated to innovate, and attracting knowledge-intensive entrepreneurs to the Netherlands; and
- to ensure better exploitation of opportunities to innovate, for example through policies for exploiting university knowledge and changes to university financing.

9.24 EU interventions can be valuable in helping create framework conditions that provide firms with both the incentives to invest in R&D and the ability to reap the rewards of their investment. These conditions include a stable macroeconomic

environment, open and competitive product, labour and capital markets, sensitively designed regulation, a favourable tax climate, and a responsive intellectual property regime.

9.25 The European Commission is working towards an Innovation Action Plan, currently under consultation, which will provide strategic direction and specific recommendations for improving the innovation performance across Europe. The Action Plan will include actions both at Member State and at European Community level. The Government believes that any Action Plan must consider the steps that can be taken at the Community level to promote innovation. They are:

- a review of the State Aid Framework. The Commission has said it will draw up, by 2005, a Communication on state aid for innovation, and produce by the end of 2004 a users' guide to the state aid rules applicable in the field of innovation. These welcome announcements provide a valuable opportunity for reform to ensure that Member States have sufficient flexibility to use state aid to promote innovation. It will be important to ensure that the state aid rules allow support to be given to tackle market failures in all phases of the innovation process;
- improvements in the regulatory process to reduce the burdens on innovative firms. Regulation can both provide incentives for and inhibit innovation. Improving the regulatory framework is therefore a key element of efforts to boost innovation in the EU;
- steps to build better cross-border university-business networks, such as international partnerships, and to improve the mobility of researchers, including, as described below, through the use of Framework Programmes;
- rapid progress on improving the patenting system in Europe, alongside relevant directives, to ensure that the outcomes strike the right balance between the needs of businesses and consumers; and
- an examination of the prospects for more specialised financing instruments to support particular modes of research exploitation, utilising opportunities within the European Investment Bank's (EIB) *Innovation 2010 Initiative* funding stream.

9.26 The forthcoming UK Presidencies of the EU and G8 in 2005 will provide further opportunities to promote this agenda.

EU expenditure: the 2007-2013 financial perspective

9.27 Although these innovation challenges must primarily be addressed through national policies or the improvement of the European framework conditions, there is also scope for using the EU budget to help improve the R&D and innovation performance of the EU as a whole.

9.28 The Agenda 2000 negotiations in Berlin in March 1999 determined the expenditure ceilings for the EU budget for the period from 2000 to 2006. The next financial perspective will be the first one decided by an enlarged Union of 25 Member States. Although the challenges faced in negotiating the next financial perspective will be considerable, it represents a unique opportunity to increase both the effectiveness and transparency of expenditure and to consider how allocations within a limited EU budget, stabilised at around one per cent of EU gross national income, can best be

refocused in support of the Union's priorities, including economic reform and the Lisbon agenda, rather than simply increased.

9.29 A principled budgetary framework would be based on the best of the current strategic planning arrangements, but would also draw lessons from the Lisbon process. A more developed policy framework for EU expenditure should:

- be **objectives-focussed** with the emphasis on outcomes not inputs; there should not be an automatic assumption that a certain level of spending is needed to meet the Union's objectives;
- be **evidence-based** by evaluating the impact of budgetary policy; strategic planning should be based on what works, and poorly performing programmes should be displaced or redirected;
- examine, particularly where a new area of spending is proposed, whether the Union Budget is the best instrument for **adding value** or whether action would be better addressed at Member-State level or through other, non-spending, policy measures;
- ensure sound financial management and budgetary discipline; and
- ensure an equitable distribution of spending across the EU, consistent with value-added principles.

9.30 A key criterion for determining the appropriateness of EU spending is value added. For EU level spending to be justified, there has to be tangible added value from giving the competence to the supranational level.

9.31 R&D is the third largest area of expenditure in the European budget. Current negotiations provide a real opportunity to ensure setting of strategic goals, achievement of value added and improved evaluation and handling of funds. On the basis of the Commission's proposals and previous levels of participation, EU Programmes have the potential to increase the levels and effectiveness of UK R&D investment, with consequent increases in annual UK industrial output of the order of several billion pounds.

R&D Framework Programmes

9.32 EU R&D expenditure is channelled through the multi-annual Framework Programmes provided for in the Treaty and implemented by the European Commission. The EU R&D programme is just 5 per cent of European public sector civil R&D spend, so funding needs to be targeted, consistent with overall budget ceilings, towards those areas where the case for European action is strongest:

- the Programme should demonstrate its impact against clear **strategic objectives**, addressing EU weaknesses and challenges. These should promote the key outcomes of improving competitiveness and high-technology inward investment, raising the quality and scale of public and private research capacity and supporting EU policy objectives;
- it should provide clear **European added value**, in accordance with the subsidiarity principle. International collaboration brings an additional overhead, and the UK may already have a 'critical mass' of research efforts in many areas. The EU must focus on where this level of action is really needed;

- the Programme needs **effective delivery mechanisms**, based on evaluation evidence and addressing the drivers of the intended participants. Bilateral programmes or intergovernmental collaborations may provide a more effective route to the same goal.

9.33 The Framework Programme is the EU's third biggest funding mechanism: the Sixth European Framework Programme, running from 2002-06, has a budget of €19 billion. However, the Programme currently lacks an effective system of performance measurement. Progress is being made to improve the monitoring and assessment of the programme's delivery processes, but there is a bigger challenge of tracking the longer-term impact of the programme as a whole. It can take many years before projects have quantifiable outputs, and often the contribution of a project to a new product or service is lost due to the complex evolution of a project and the timescales involved. It is important, nonetheless, to increase efforts to perform strategic evaluations and assess the long-term impact of the programme on European science and technology.

9.34 It is vital that the UK makes best use of the opportunities offered by the programme and influences the priority areas for support. However, many participants, in particular SMEs, have difficulties engaging in it. The UK is a major player in this area, with more participation in the recently completed Fifth Framework Programme than any other Member State. So the Government has an important role to play in ensuring there is effective promotion of the programme and appropriate support for organisations looking to participate. The current system has evolved over a number of years and has several different components and points of delivery. While a good level of service is offered in many areas, the Government will work to raise the visibility of the support available, ensure that the service is easy to navigate and that an appropriate level of support is provided across all areas, in addition to national programmes for collaborative research.

9.35 The accession of the new Member States brings a number of opportunities such as access to well-educated scientists, exposure to fresh ideas and new markets, as well as the lower costs associated with working in these countries. The UK is well placed to make the most of these opportunities due to our excellent S&T reputation and the widespread knowledge of the English language in the new Member States, and is already developing a stronger S&T presence in these countries through a wide range of activity. It is, however, important that the development of good S&T working relationships between organisations in the new Member States and the UK is based on mutual benefit.

9.36 The Seventh Framework Programme (FP7) will cover the period 2006 to 2010-11. In April 2004, the Government launched a public consultation, which will help to develop a UK position paper in autumn 2004. This will be used to influence the Commission's formal FP7 proposals, expected in the first half of 2005.

9.37 The Commission's early thinking suggested that the budget be doubled to around €40bn.² The UK initial view is:

- a higher proportion of the EU budget should be allocated to research, within overall budget constraints, recognising the added value of appropriate international public funding of research;

² Commission Communication: *Science and technology, the key to Europe's future – Guidelines for future European Union policy to support research*, COM (2004) 353, http://europa.eu.int/comm/research/future/pdf/com-2004-353_en.pdf

- the priorities should be to promote cooperation between business and research and boost future technologies. The key challenge is to increase private sector investment in and exploitation of R&D;
- the programme has to be simplified to make it more user-friendly for industry and science;
- the programme needs clearer, more outcome-focused objectives and delivery mechanisms focused on raising research excellence and quantity to global standards, translating research into high value products and services, and increasing industrial R&D investment, with any increased support for basic research based solely on excellence; and
- the EU should pay an increased proportion of costs of the research it funds in the science base, to support financial sustainability.

Box 9.3: A European Research Council?

A key driver of research excellence is competition – competing for funding, for recognition and for the best researchers in an open system drives up the quality of the research undertaken. The European Commission, in its June 2004 Communication on guidelines for future EU policy to support research³, has recognised that the limited scope for competition within Member States could have a negative impact upon research excellence when compared with major global competitors.

The Commission's main proposal for action at this stage is the establishment of a new European support mechanism modelled on the US National Science Foundation's Individual Grants Scheme, that is, comprising grants to individual teams chosen through competition on the basis of scientific excellence, without any cross-border or mobility requirements. Substantial new EU funding is proposed for this scheme, which could be administered by a new delivery agency or a 'European Research Council'.

The UK Government has welcomed this new proposal, making clear that research funding must be awarded on the sole basis of scientific excellence as judged by rigorous international peer review, and that such funding would need to be awarded through a delivery mechanism that minimises bureaucracy, encourages the very best to apply and meets the full cost of the research undertaken.

European Investment Bank

9.38 The European Investment Bank (EIB) is playing a growing role in financing applied R&D and other measures to support business innovation. The EIB's actions under the *Innovation 2010 Initiative* concentrate on three areas: education and training; R&D and downstream investment; and, creation and dissemination of information and communication technologies. The EIB will also give priority to projects involving synergies between the public and private sectors. In particular, the EIB looks to support facilities such as science parks and business incubators; and the development of micro credit. The European Investment Fund (EIF), the risk capital arm of the EIB group, is working to develop further venture capital markets in the EU, focussing on providing support for new technologies.

³ *Science and technology, the key to Europe's future- Guidelines for future European Union policy to support research*, COM(2004) 353, June 2004.

9.39 The UK is encouraging the EIB to: consider the additionality of the finance it provides; to take more risk than the market is willing to, providing finance to new innovative businesses which would otherwise not have received financing; and to develop instruments to leverage in greater amounts of private sector capital, as well as creating funding mechanisms to provide additional finance to innovative businesses in disadvantaged areas.

Science and innovation in the devolved administrations

9.40 Whilst this framework sets out a vision for the UK as a whole, supported by significant UK-wide funding, such as that flowing through the Research Councils, the devolved administrations have lead responsibility in their own countries for funding a number of key areas in relation to the science base, such as research and knowledge transfer funding at universities. The devolved administrations have their own economic development bodies, with remits similar to those of the English Regional Development Agencies. This section highlights the contributions of the Scottish, Welsh and Northern Irish administrations to UK science and innovation.

Box 9.4: Scotland

The Scottish Executive is committed to enhancing the role of the science base in Scotland and to playing a full part in the UK's ten year investment framework for science and innovation. Scotland has an excellent science base in its universities, Research Institutes and Centres, and in the NHS with many leading in UK wide programmes and objectives. Scotland's HEIs in recent years have won around 12 per cent of UK Research Council awards and, in the last Research Assessment Exercise nearly 50 per cent of submissions were rated as internationally competitive. The need to maintain a fully competitive HE research base in Scotland is emphasized strongly in the Executive's Review of Higher Education in Scotland⁴ and in subsequent policy statements. A current initiative is examining proposals from the HE sector to pool the research strengths in certain subject areas across several institutions and so form critical masses of internationally competitive research.

The 2001 Science Strategy for Scotland⁵ sets the framework which informs the detailed development of policy for the support and use of science to achieve the Executive's objectives, including development of the science base, increasing the effective exploitation of scientific discovery, science education, public understanding of science and use of science by government.

Scotland's research base continues to provide a lead for the UK in several areas, including the work at the Roslin Institute on cloning, the UK's National e-Science Centre at the University of Edinburgh in partnership with Glasgow University; the Wellcome Trust Biocentre at Dundee University; and Mineral and Mining Engineering at Heriot-Watt University. The planned £200 million biomedical research centre in Edinburgh will create the UK's largest research site in this field. A major international collaboration, the Edinburgh and Stanford Link project, aims to establish Scotland as a global leader in the commercial development of language technology.

⁴ <http://www.scotland.gov.uk/library5/education/fhes-00.asp>

⁵ <http://www.scotland.gov.uk/library3/education/ssfs-00.asp>

Box 9.4: Scotland continued...

Research in the biological sciences in Scotland is internationally recognised, and the Scottish Agricultural and Biological Research Institutes, funded by the Scottish Executive, contribute to this. The strategic work in these organisations will increasingly focus on the needs of the Scottish population, and they will also pursue closer collaborative links with universities and other research providers in Scotland in order to tackle bigger and more complex questions.

On human health, the Scottish Longitudinal Study, a collaborative venture involving four Scottish universities, will pioneer new ways of making data accessible for both scientific and policy-related research. Collaboration with European science is also high on the Scottish agenda with a strong participation in Framework Programme 5 projects. Scotland is now well placed to take advantage of the Genomics and Biotechnology for Health funding stream presented by the EU Sixth Framework Programme.

Harnessing the benefits of research through commercialisation and knowledge transfer is a key part of the Scottish Executive's science and enterprise strategies. Scotland does relatively well in UK terms on measures of business-university interaction, but levels of business R&D and innovation are relatively low. A range of measures have been put in place in to help boost this, including proof of concept funding; support for commercialisation of research from the NHS in Scotland; and the £450 million investment over ten years in three Intermediary Technology Institutes to support new market-driven R&D opportunities in life sciences, energy and communications technology/digital media.

The Scottish Executive has taken a strategic approach to address some of the challenges facing science education, providing specific funding to Local Authorities to raise teachers' science skills and modernise science laboratories. It recognises that science teaching has to be more innovative, that science equipment and the curriculum must be kept up-to-date and continued effort is required to ensure that young people are enthused by science. The Executive has recently provided financial support to four of the science centres in Scotland to ensure that these valuable assets are secured for the future.

Box 9.5: Wales

In Wales, the Welsh Assembly Government – in conjunction with its agencies, notably the Welsh Development Agency and Higher Education Funding Council for Wales (HEFCW) - is strongly driving the knowledge exploitation agenda forward as part of ‘Wales: A Better Country’, the strategic agenda of the Welsh Assembly Government.⁶

The Welsh higher education sector has a key role to play in promoting knowledge exploitation and the development of a skilled workforce. The latest UK-wide higher education business interaction survey shows that Wales is punching above its UK economic weight in a number of key knowledge transfer activities. For example, in 2001-02 Wales accounted for: over 10 per cent of all spinout activity from UK HEIs; 19 per cent of all graduate business start-ups; 11.6 per cent of all HEI contracts signed with SMEs; and 6.9 per cent of all UK Research Council grants involving business co-funding.

In addition, the quality of research undertaken by the higher education sector in Wales has improved markedly over the past decade. The results of the 2001 RAE demonstrated that the quality of research in Welsh institutions now stands comparative with the rest of the UK.

In response to relative weaknesses in some science areas, HEFCW established a research capacity development fund to provide some £8.5 million over three years to build research capacity in key topics, including nanotechnology and biosciences. Further, the Assembly Government aims to strengthen the research base in the Welsh HE sector by selective funding to build world-class capacity, and in particular to encourage collaborative bids and collaborative effort. The Wales Cancer Bank, the Cardiff Gene Park, the Brain and Repair Imaging Centre and the merger of Cardiff University with the University of Wales College of Medicine are all notable examples of what can be achieved through collaboration and partnership funding.

High impact innovation initiatives from the Welsh Assembly Government and its agencies (summarised in the Wales for Innovation Action Plan⁷) include: making full use of available European Structural Funds on a wide range of innovation related projects; the unique Welsh Centres of Excellence; and Technium programmes and the Knowledge Exploitation Fund.

Looking forward, the Welsh Assembly Government’s recent policy review in this area, ‘Knowledge Economy Nexus’⁸, has concluded that the bonds between excellence in higher education and high added-value companies could be strengthened, by ensuring that:

- good companies around the world are more aware of Welsh research excellence;
- companies in Wales readily access excellence within both HEIs in Wales and those further afield;
- collaborative research opportunities are identified which are in line with marketplace drivers and which will significantly enhance the excellence of the Welsh research base;
- all parts of the national innovation system in Wales are more involved in its future, holistic development;

⁶ <http://www.wales.gov.uk/themesbettercountry/strategic-e.pdf>

⁷ <http://193.113.180.44/resources/action-e.pdf>

⁸ <http://wales.gov.uk/subtradeindustry/content/known-econ-nexus-e.pdf>

Box 9.5: Wales continued...

- within Welsh higher education and the Welsh NHS, opportunities for direct knowledge transfer and commercialisation are maximised;
- success from generating and implementing new ideas is increasingly celebrated in all walks of life; and
- the performance of the knowledge economy in Wales is measured objectively.

Underpinning all this, the value of public understanding of the importance of science and technology has long been recognised in Wales and Techniquest, headquartered in Cardiff, is now of world renown in this field.

Box 9.6: Northern Ireland

In Northern Ireland science, technology, R&D and innovation are recognised as vital contributors to economic prosperity. Over the last ten years both the public and private sectors have invested heavily in key technology areas, including biotechnology, communications engineering, polymer processing and nanotechnologies. In that period, Government support for industrially relevant R&D was £182 million, in a total investment of £565 million. In June 2003 The Department of Enterprise Trade & Investment (DETI) launched 'think|create|innovate: The Regional Innovation Strategy for Northern Ireland', marking a step change in Northern Ireland's commitment to R&D, innovation, and the wider science and technology agenda. It sets out the blueprint for a coherent regional R&D and innovation infrastructure involving government, academia and the private sector, with an action plan designed to make Northern Ireland an internationally competitive innovating region.

A major addition to the R&D infrastructure is the Northern Ireland Science Park (NISP), established in March 1999 by DETI and its economic development agency Invest NI. Based in Belfast, with linked facilities in Coleraine and Londonderry, it should create over 3000 high-quality jobs. NISP embodies the view that leading-edge centres for research have a critical role to play in establishing the region's reputation for technological excellence. In addition to the NISP, there are more than 40 research centres of excellence, across a number of key technologies, established with support from regional industry and higher education since 1995. Further to this, Invest NI has developed the Research and Technological Development (RTD) Programme to add value to Northern Ireland's R&D infrastructure and capability, with a focus on commercial and industrial research. DETI and Invest NI have also developed a £3 million pilot Proof of Concept Fund, aimed at academics, to provide pre-seed funding to prove commercial potential of a product of research.

At the heart of Northern Ireland's science, technology and R&D base are its two universities. Between 2001-03, 34 high-technology based companies were spun out from university initiatives. Queen's University Belfast (QUB) and the University of Ulster (UU) have established international reputations as centres of research excellence. The Department for Employment & Learning (DEL) is the principal funder of university research (£35 million for 2003-04). DEL also operates the Support Programme for University Research (SPUR), a public-private partnership to develop a high quality research capability in Northern Ireland, investing up to £44 million in the universities' research infrastructure between 2000-04, with a second round of £50 million investment between 2004-07. Additionally, under the UK wide Science Research Investment Fund (SRIF), between 2004-06 Northern Ireland will secure a total investment in the universities in excess of £21 million.

DETI, DEL and Invest NI have also jointly established the Northern Ireland Higher Education Innovation Fund (HEIF), a £9 million initiative which will run from 2004-07, and will provide financial incentives to the universities to transfer their knowledge to industry. Also working closely with the universities, the R&D Office for the Northern Ireland Health and Personal Social Services supports £12 million of R&D each year. Northern Ireland's Department of Agriculture & Rural Development (DARD) also invests approximately £6 million per annum to support the sustainable development of the region's agri-food industry through excellence in analytical and diagnostic services, education, research and technology transfer.

Science and innovation at a regional level

9.41 Science and innovation have the potential to play an important role in achieving the Government's objectives of increased prosperity and reducing the current disparities between regional economic performances. The English Regional Development Agencies have seized on this role as a key part of their economic development mission in response to the aims of UK Government science and innovation policy (following a pattern set by the Scottish, Welsh and Northern Irish development bodies and administrations). The RDAs' Regional Economic Strategies outline measures designed to increase the level of innovation in their regions, and many are now backing this up with significant investments in science and innovation. Collectively, RDAs invested some £240million in science, engineering and technology-related activities in 2002-03, some 15 per cent of their total budgets. Following the lead of the North West Development Agency and One NorthEast, which established Science and Industry Councils to provide high-level advice from businesses and universities on regional science priorities, by the end of 2004 all RDAs will have established their own models of Science and Industry Councils.

9.42 The process of knowledge transfer to business and the encouragement of innovation in business requires a combination of national and regional input to ensure that business has ready access to the expertise it requires, and is encouraged to seek it out. Partnership working between regional and national bodies is key to maximising the value and complementarities of strategies and funding at both levels. The RDAs themselves have identified three modes of partnership between national and regional bodies to deliver Government policy in this area:

- regional delivery with national advice and direction, for example, grants for R&D for SMEs; improving the capacity of universities to collaborate productively with business, as recommended by the Lambert Review on business-university links;
- national delivery, but which depends on regional advice and input, for example, in the Higher Education Innovation Fund, where RDAs played a role in assessing submissions for HEIF2, and the roles of HEFCE regional advisors; and
- inter-regional partnership, in which the RDAs work together.

9.43 The Research Councils, devolved administrations and the RDAs are currently working together to explore how the funding of research on a predominantly national basis can be better aligned with the development and delivery of Regional Economic Strategies. At a strategic level, activities are underway to build on the existing work initiated via the Research Council and RDA Chief Executives. For example, Research Councils worked with the RDAs on the development of research priorities and proposals during the current and previous Spending Reviews. At an institutional level, there is increasing cross membership of the decision-making bodies.

9.44 There is also extensive interaction at operational level, particularly with regionally-based Research Council Institutes (RCIs), which have a working partnership on a range of regional initiatives, collaborations and facilities. In total, there are some 77 RCIs across the UK, of which 50 are outside London and the South. Some of the several examples of recent collaborations between Research Councils and RDAs include:

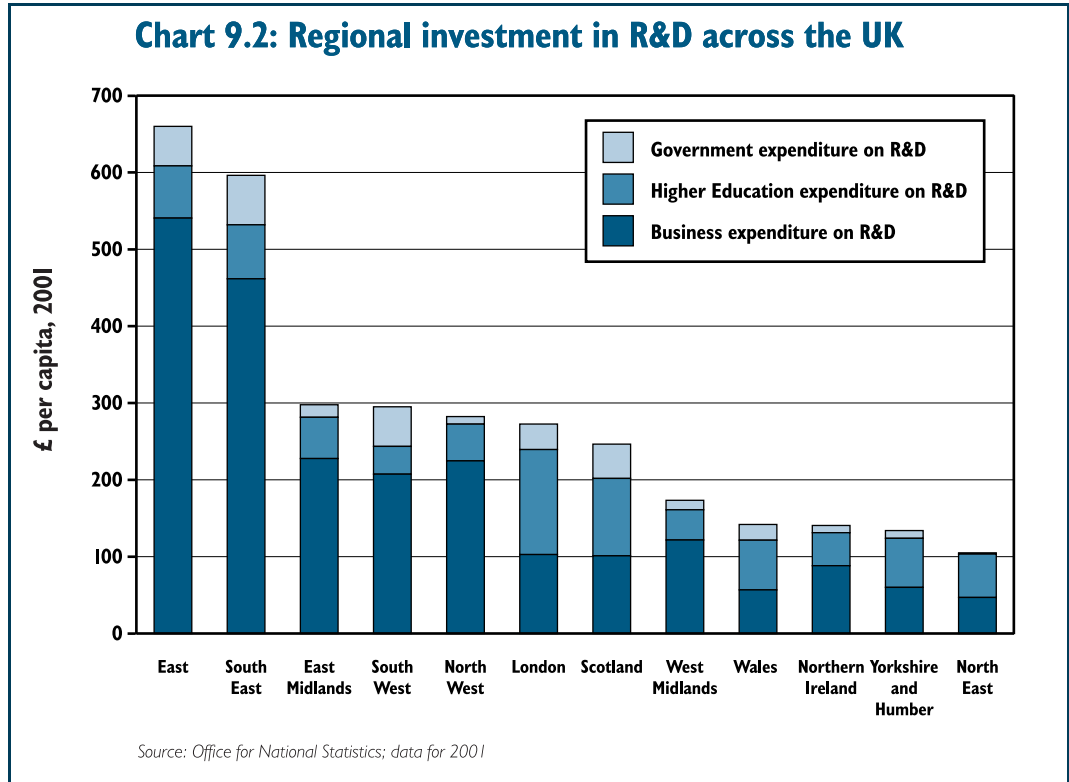
- the creation of the North West Science and Innovation Park alongside the Daresbury Laboratory of the Council for the Central Laboratory of the Research Council (CCLRC);
- a £1 million investment by the East of England Development Agency (EEDA) to establish a bioincubator at the Biotechnology and Biological Sciences Research Council's (BBSRC) John Innes Centre;
- a BBSRC collaboration with Yorkshire Forward to promote entrepreneurship training for postgraduate and postdoctoral bioscientists in the region; and
- the establishment of the Centre for Integrated Genomic Medical Research as part of the North-West Science Initiative, with £3 million of Medical Research Council (MRC) funding over three years.

9.45 To help strengthen further the regional contribution to broader UK-wide science and innovation policy and delivery over the next three years, **the Research Councils will enhance the scale of their support for developing the RDAs' professional capabilities in science and technology issues, including through secondments of experienced staff into the RDAs and through representation on the advisory boards of the newly-established Regional Science and Industry Councils.**

9.46 The RDAs have expressed strong support for the Government's ambition for the better exploitation of national funding of research into economic advantage. All Regional Economic Strategies highlight the importance of innovation to wealth creation, and make a commitment to raising skill levels and exploiting the science base. The RDAs concur with Government's view that a strong, user-facing and responsive UK science, engineering and technology base working effectively with business is vital to the future well-being of the regions and the UK as a whole.

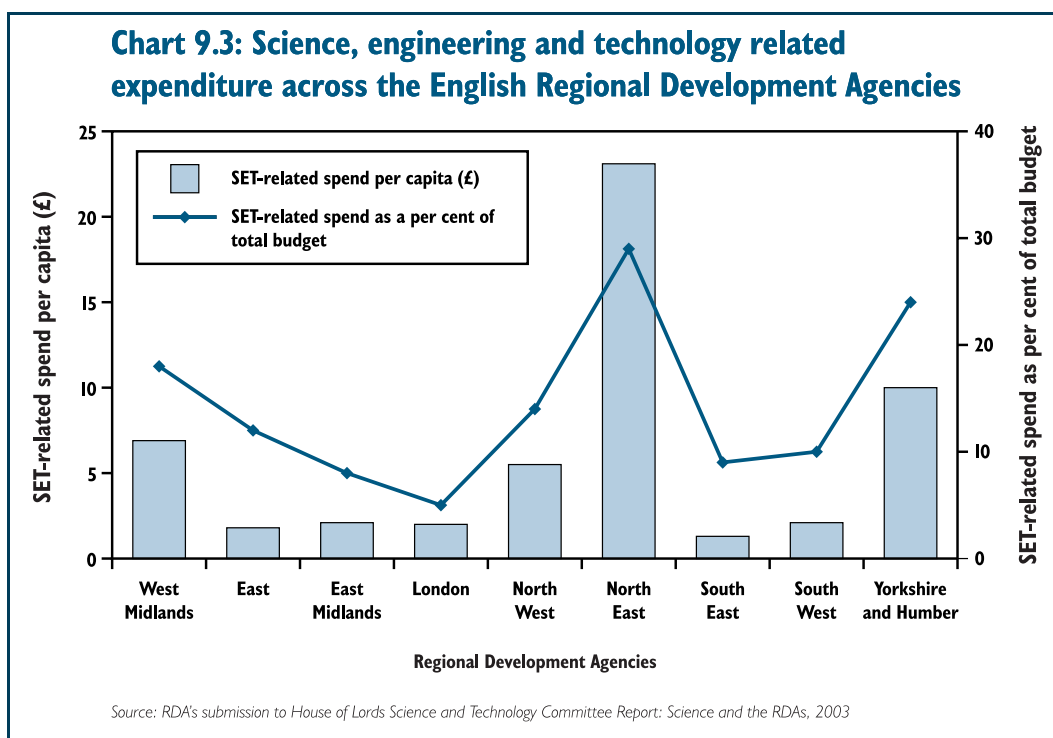
9.47 The Government and the RDAs are working towards a practical partnership to ensure that the aim of reducing regional disparities in prosperity is compatible with the pursuit of scientific excellence on a UK-wide basis.

9.48 Technology-based innovation by business holds out the prospect of contributing significantly to the challenge of narrowing gaps in regional economic performance, by enabling regions to renew their industrial base over time. Indeed, the key challenge for regions in improving the level of R&D expenditure in each region – as with the UK as a whole – lies in raising the level of business R&D expenditure. Differences in R&D expenditure in each region are mainly a result of business investment, as illustrated in Chart 9.2 below. Every region has a number of universities containing truly world-class departments and disciplines. Facilitating collaboration of these world-class departments within and across regions can promote networks of real excellence.



9.49 As Chart 9.3 below illustrates, those regions with low levels of business R&D expenditure are making particularly sizeable investments in SET-related activity. Examples include:

- Advantage West Midlands’ investment of £40 million in the International Automotive Research Centre; launched in 2003, the Centre is a £70 million initiative that aims to support 50,000 jobs by helping companies in the automotive sector improve product development through skills training and R&D; and
- One NorthEast’s investment of £200 million over five years to develop five sector-based research centres of excellence to capitalise on strengths of the existing research base and current levels of business demand.



9.50 Chapter 5 on knowledge transfer sets out the Government's overall approach towards encouraging a stronger business innovation performance through strengthening links with the research base. This sets out, in response to the 2003 Lambert Review on business-university collaboration, the Government's positive response to the proposal that the English RDAs be given a greater remit and more strongly focused targets in order to strengthen productive links between business and the universities within a given region, with consequent implications for the RDAs' resource allocations and performance measurement.

9.51 In developing their roles in knowledge transfer in support of regional growth, it will be important for the RDAs and DTI to develop a cross-regional, national and international perspective, and prioritise accordingly. Facilitating inter-regional knowledge transfer can help reduce regional disparities: geographical variations in the creation of knowledge will matter less if knowledge can be transferred effectively to firms in other regions. The RDAs have also emphasised the need to encourage and assist regional businesses to engage with the nationally-funded research base, wherever the research is done. There are already some successful examples of schemes that facilitate cross-regional knowledge transfer and collaboration. The DTI, through the Technology Strategy, will work to strengthen the national gains from synthesising capabilities across the country, to create UK-wide collaborative R&D programmes linking business and the science base across the UK.

Regional distribution of national research funding

9.52 Public funding of research at a national level, through the Research Councils and funding bodies, is dedicated to supporting excellent research, irrespective of its UK location. The 'excellence principle' is fundamental to safeguarding the international standing and scientific credibility of UK science and research and supporting an excellent, diverse, expanding and dynamic science base, providing value for money for public investment.

9.53 There is at least one leading university in each region of the UK, and every region has a number of universities containing world-class departments. Regional Development Agencies (RDAs) are increasingly focussing on the role these departments can have as centres of excellence, and the contribution they can make to regional economic growth, not simply through their own direct contribution as employers, but also through their roles in stimulating innovation through links with business and attracting industry and commerce.

9.54 Given the location of the UK's major research universities (which owes much to history, over centuries in several cases), this principle of funding research by excellence, irrespective of its location, results in geographical disparities in research funding. On the surface, for example, the DTI's Science Budget spend is heavily skewed towards London, the South East and East of England, although when rebalanced for the number of higher education institutions (HEIs) in each region which are eligible to apply for RC grants, the picture is somewhat more evenly balanced across the country.

9.55 However, looking at regional benefit from the Science Budget shows a much wider distribution of resources than would be suggested simply by examining the regional spend by location of the host institution. For example, some funding goes to collaborative projects, such as collaboration between HEIs in one RDA region and businesses in another. Approximately 40 per cent of all projects funded by the Engineering and Physical Sciences Research Council (EPSRC) are in collaboration with industry and, depending on the English region in question, between 60 per cent and 85 per cent of the collaborative projects are with industries in a region other than the HEI 'host' region. In Scotland, Wales and Northern Ireland, the equivalent figures are between 25 and 60 per cent. Recent research⁹ has highlighted the important role that inter-regional knowledge transfer (of which collaboration is one example) can play in reducing regional economic disparities.

9.56 National funding streams also exist that can help universities improve their capacity to compete on the basis of excellence. The second round of the Science Research Investment Fund (SRIF2), for example, included a capital stream to support strategic rationalisation and restructuring of the university science base. This is currently supporting mergers between UMIST and the University of Manchester, and between Cardiff University and the University of Wales College of Medicine. Furthermore, HEFCE provides strategic funding each year (£217 million in 2003-04) to support HE institutions' priorities in, for example, developing learning and teaching, widening participation, and developing capabilities to respond to the needs of business and the community.

9.57 Restructuring processes such as the mergers described above can produce a critical mass of research excellence that cannot be achieved by individual institutions using their individual funding allocations, thus enabling the universities in question to make a more significant contribution to economic growth in their regions. The University of Manchester-UMIST merger, for example, is also being supported by a significant investment from the North West Development Agency, reflecting their view that it has the potential to deliver real economic benefits to the region.

9.58 The Government believes that sharp falls in science teaching capacity may adversely affect student access to provision in particular regions, and may reduce the responsiveness of the overall HE teaching base in meeting future changes in student

⁹ Frontier Economics (forthcoming), commissioned to inform evaluation of policies addressed at closing regional economic performance gaps.

demand over the longer-term. As outlined in Chapter 6, HEFCE will therefore take a more active role working with RDAs and other stakeholders to evaluate the implications that falling science provision may have for student access at the regional level, and HEFCE will consider providing additional funding to particular departments if there is a powerful case for doing so.

Future directions

9.59 Science and innovation policy is increasingly a priority at regional level, as Government and regional bodies seek to drive up regional economic performance. The RDAs fund a significant and increasing amount of SET-related activity. Their new role in funding business-relevant research, as recommended by the Lambert Review of business-university collaboration and endorsed by the Government, builds on this developing capacity.

9.60 The Government has successfully fostered business-university collaboration at national and international levels, but agrees with the Lambert Review's analysis that a greater engagement of business could be achieved by building up a regional knowledge transfer agenda to complement the national one. The Government recognises the value that RDAs can add to national decisions on funding and strategies. The Government will work with the RDAs to continue to build their capacity in knowledge transfer and business/HEI interaction, both within and across regions. This will make a direct and important contribution to the delivery of regional economic strategies.