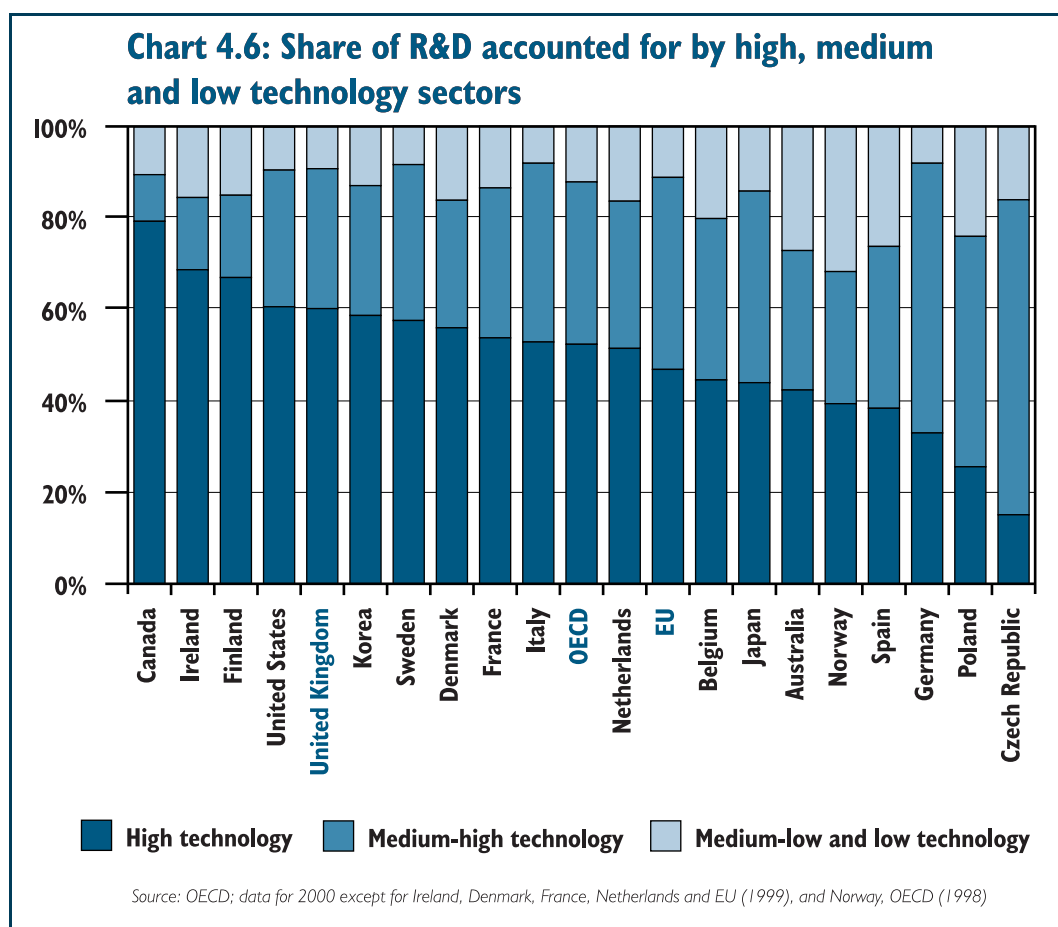


**4.26** The share of business R&D accounted for by small and medium sized enterprises (SMEs) is also high in the UK compared to other major OECD economies. In this regard the UK is similar to those smaller economies that tend to spend less on R&D as a percentage of GDP. Analysis by the OECD suggests that R&D intensity is correlated with the size distribution of R&D performing firms.<sup>10</sup> This suggests that the UK's lower R&D intensity is, at least in part, due to lower levels of R&D amongst larger UK firms besides the top ten or so who are major investors.

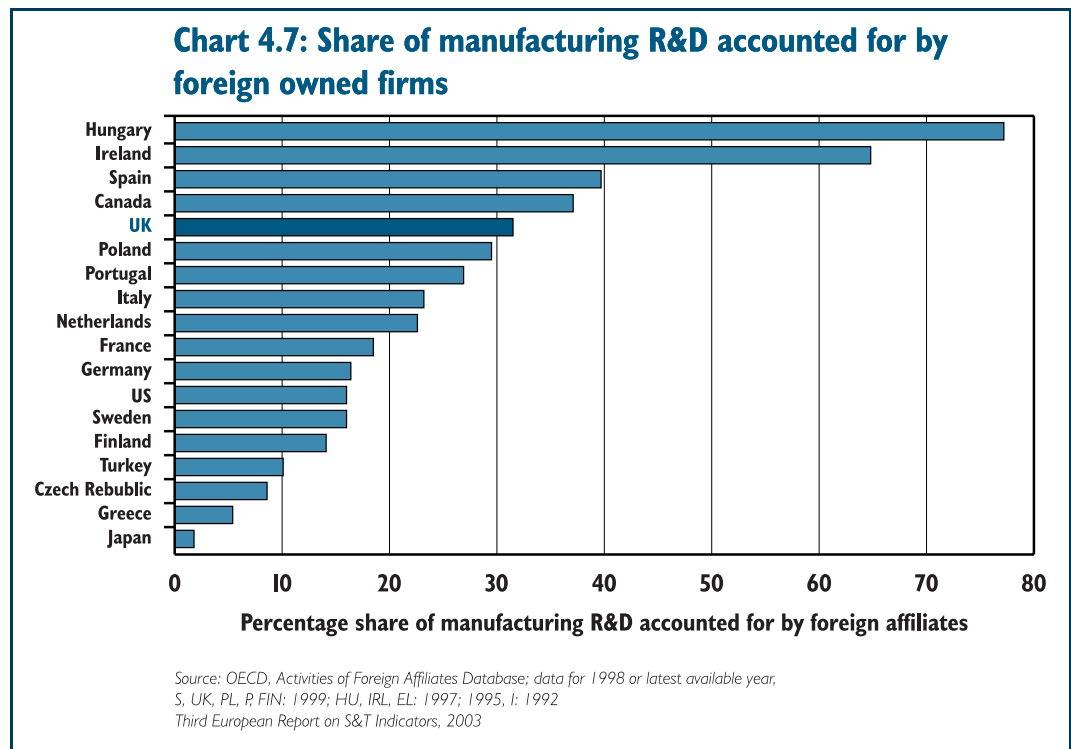
**4.27** Manufacturing R&D in the UK is also heavily skewed towards high tech sectors compared to the OECD average.<sup>11</sup> Again this reflects the UK's concentration on pharmaceuticals R&D and the relatively smaller contribution from other sectors.



<sup>10</sup> OECD, Targeting R&D: Economic and policy implications of increasing R&D spending, STI Working Paper 2003/8.

<sup>11</sup> High tech sectors include: aircraft and space craft; pharmaceuticals; office, accounting and computing machinery; radio, TV and communications equipment and medical, precision and optical instruments. Low tech sectors are: food, beverages and tobacco; textiles; textile products; leather and footwear; wood, pulp, paper, paper products, printing and publishing; manufacturing and recycling. All other sectors are classified as medium technology.

**4.28** UK BERD is heavily dependent on the activities of foreign firms. Research suggests that firms’ decisions to locate R&D facilities abroad are mainly driven by the desire to access foreign sources of knowledge or to customise products and services to the needs of foreign markets.<sup>12</sup> The strength of the UK’s science base is a source of attraction for foreign firms. In addition, the costs of research in the UK are quite competitive, although there are signs that this advantage has eroded over time. UK firms are also major investors in R&D overseas – for example they are the second largest investors in the US.

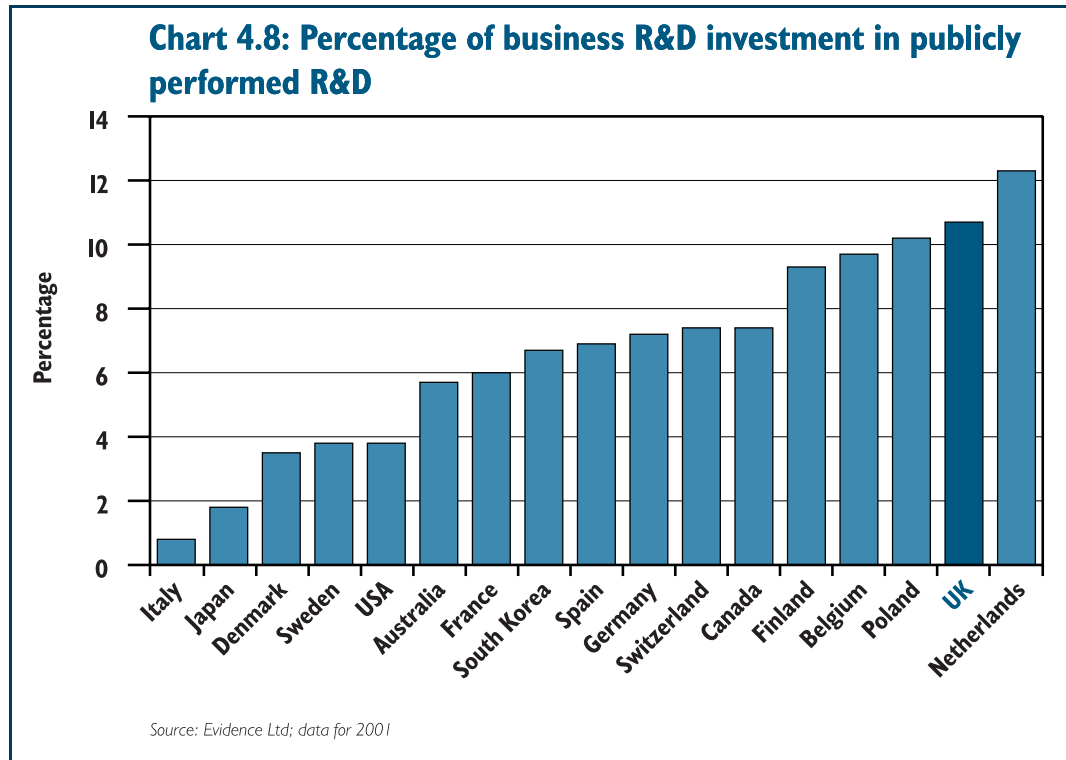


**4.29** Changes in technological and business trends have encouraged UK based firms to extract greater value from their research budgets by engaging in collaborative research with universities<sup>13</sup>. UK firms fund a significant proportion of university research compared to companies in other major OECD countries, as shown in chart 4.8 below.<sup>14</sup>

<sup>12</sup> Edler J, F Meyer-Krahmer and G Reger, *Changes to the Strategic Management of Technology – Results of a Global benchmarking study*, v 32 no 2 pp 149-164, R&D Management Journal, 2002

<sup>13</sup> Coombs R, R Ford and L Georghiou, *Generation and selection of successful research projects: a research study for the UK technology strategy forum*, 2001

<sup>14</sup> Evidence Ltd, *PSA metrics for the UK Research Base*, 2003



#### Box 4.1: The creative industries

Beyond manufacturing, the UK is well served by the wealth creation of other innovative sectors whose investment in new knowledge shows up less readily in R&D statistics. The creative industries are amongst the most dynamic and fast-growing sectors of the UK economy, accounting for some 8 per cent of total value-added and growing at an average of 8 per cent per annum between 1997 and 2001.<sup>15</sup> Much of their vitality rests on the bringing together of the creative and performing arts, cutting-edge technologies, and innovative forms of business organisation, often facilitated in regional clusters.

In areas as diverse as design and music, computer games and animation, film and new media, intelligent textiles and fashion, UK business has demonstrated its potential to become a world-class player. Indeed in some – such as computer games and new media – it is already a world leader and major exporter.

The Arts and Humanities Research Board (soon to become a Research Council) is taking the lead in supporting high-quality research to underpin the expansion of the creative industries. It has established a Task Group (working with the Department for Media, Culture and Sport) to identify the forms of knowledge engagement and transfer that are needed for the creative industries, and to ensure that policies are developed to maximise the engagement between researchers and industry in this dynamic area.

<sup>15</sup> *Creative Industries Economic Estimates*, DCMS, 2003

## Prospects for business R&D in the UK

**4.30** The required growth in business R&D - implied by the target to reach 2½ per cent R&D intensity in the UK - will need to be delivered through a range of different business responses across a wide range of sectors. These can be characterised as:

- maintaining or growing R&D in sectors where the UK is strong (e.g. pharmaceuticals);
- attracting investment into the UK from multinationals in an already highly internationalised system;
- increasing R&D intensity in firms or sectors that are lagging behind their peers; and
- developing new R&D intensive sectors and the creation of R&D intensive SMEs.

**4.31** The Government's primary responsibility is to deliver conditions of macroeconomic stability and the right regulatory frameworks for labour, product and capital markets which are conducive to business investment in R&D and the creation of wealth from innovation. Beyond this, the Government has an important role to tailor regulation, tax, procurement, competition and business support policies to help overcome particular barriers which might otherwise inhibit business R&D growth in the UK. Different sets of policies will be relevant to tackling the four different dimensions of raising business R&D highlighted above.

**4.32** A series of connected market failures provide a strong locus for the Government to intervene to help incentivise business R&D and the financing of some technology-based firms. Firms are likely to under invest in R&D, particularly at the earlier stages, compared with an economically-desirable level, because benefits spill over to other companies and cannot be fully captured by the investing firm. The same issue arises with establishing networks, which also exhibit 'free rider' and information market failures. Capital markets may also provide insufficient opportunities for companies to shift risk, owing to the asymmetric information between investor and company, and the difficulty of securing finance on intangible knowledge assets. Government instruments such as R&D tax credits, R&D grants and infrastructure measures such as the patent system are used to narrow the difference between social and private benefits, and to bear risk.

## DTI Innovation Report

**4.33** In December 2003, DTI published the Innovation Report, 'Competing in the global economy: the innovation challenge', which was the result of a joint HMT/DTI-commissioned innovation review. Following wide consultation with stakeholders, the Innovation Report set out an Action Plan containing proposals for Government to take forward in key areas that will have the greatest impact on increasing the levels of innovation in the UK.

**Box 4.2: Innovation Report Action Plan**

A **Technology Strategy** will concentrate Government funding on key technologies identified through consultation with business and other stakeholders. The Technology Strategy aims to support business 'pull through' of new ideas emerging from the UK's world class science and engineering base, will be coordinated by a Technology Strategy Board, comprising mainly senior business leaders, and is underpinned by an initial investment of £150 million over the first three years from 2004. The Technology Strategy and accompanying business support products are covered in more detail in Chapter 5 on knowledge transfer.

New **procurement** guidelines will be designed to make Government a more 'intelligent customer' by using its huge - £109 billion a year – purchasing power to drive innovation through public procurement. The Secretary of State for Trade and Industry and the Chief Secretary to the Treasury have endorsed the new Office of Government Commerce (OGC) guidance, 'Capturing Innovation from Suppliers'. DTI is working closely with OGC, other Government Departments, and with business, to promote and embed innovative procurement practices.

Tailored help for **small businesses** to innovate will be developed, including advice on intellectual property and design; greater access to R&D grants, university and national measurement system research; greater access to public research procurement opportunities, and a programme to develop leadership and management skills at all levels within SMEs.

The **Patent Office**, in conjunction with other partners, will lead the development of a range of measures to increase awareness of the importance of intellectual property (IP) by SMEs and improve confidence in IP protection. It will also develop a new national strategy for dealing with IP crime.

The **Design Council** are leading demonstrator projects on manufacturing and commercialising technology, with the support of RDAs, with the aim of showing how design can help deliver tangible innovation benefits.

Detailed formulation work is now underway on a new programme on **Measurement for Emerging Technologies** to support future technology exploitation. New programmes to increase knowledge transfer commencing in mid 2004 include: 15-25 Joint Industry Projects (involving 50 per cent industry co-funding); up to 250 product development projects for SMEs; and 20 exchange secondments between National Measurement Institutes and industry.

Delivery of the **DfES Skills Strategy** will also be important – the strategy is designed to inject business demand for skills into skills provision, recognising skills as a major contributor to improving levels of innovation and productivity.

There will be a new **regional** focus on innovation. Every English region is to have a Science and Industry Council or equivalent; the new business support product, Selective Finance for Investment in England, has been redesigned to focus on the creation of sustainable, high value added jobs; and regionally-based companies will gain improved access to the national science base, as described more fully in the knowledge transfer Chapter 5.

The Secretary of State for Trade & Industry is leading a Ministerial team to identify and develop further joint actions that will take forward the innovation agenda, including developing in the coming year a forward-looking strategy for supporting innovation and the knowledge economy on a ten year horizon.

## Knowledge transfer funding

**4.34** As set out in Chapter 5, these mechanisms for increasing business demand for and investment in science and technology are complemented by funding for knowledge transfer out of the science base and into business. The Higher Education Innovation Fund will provide £187 million over 2004-06 for knowledge transfer activities in universities, with the Public Sector Research Establishment Fund doing the same for PSREs, with funding of £15 million over two years. The 2004 Spending Review provides increases to these funds, as set out in chapter 5.

## Working with business sectors on innovation

**4.35** Innovation and Growth Teams (IGTs) are brought together by the DTI to look strategically at a specific sector, with the top-level commitment of industry and drawing on the expertise of the major stakeholders. The aim is to identify the key issues which will shape the future of a particular industry and how the UK can best respond to the competitive challenges which it will face.

**4.36** To date nine IGTs have been created<sup>16</sup>, making recommendations on the future strategic issues for their sector. Many have highlighted the need to focus more on innovation for the future success of business in the UK. For example, the Bioscience IGT identified the need for a National Clinical Trials Agency to permit effective, early trialling of new diagnostics and drugs. Following this, in the 2004 Budget, the Chancellor announced the creation of the UK Clinical Research Collaboration (UKCRC), underpinned by new funding of £100m by 2007-08. The DTI Technology Strategy complemented this approach by giving a focus to bioprocessing when it launched the Technology Programme in April 2004.

## Fiscal measures

**4.37** As a complement to other forms of business support and regulatory intervention, the Government will continue to deploy fiscal measures, where appropriate, to help businesses overcome barriers which inhibit innovation and growth.

**4.38** There is strong academic evidence that tax incentives can increase R&D spending by an amount equal to the loss in tax revenues – every pound spent in tax support is invested by companies in additional R&D.<sup>17</sup> Like many other leading economies, the UK has introduced fiscal incentives to support companies' R&D and incentivise them to do more. **R&D tax credits** were introduced for SMEs in 2000, including a payable element which allows the credit to benefit loss-making early stage companies, that are most in need of the cash-flow boost the credit provides. In 2002 the credits were extended to large companies and subsequent Budgets have announced further improvements to the schemes, resulting from Government's continuing dialogue with business.

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<sup>16</sup> Automotive, Software and Digital Content, Chemicals, Environmental Goods and Services, Aerospace, Retail, Construction, Biosciences and Electronics.

<sup>17</sup> Bloom, Griffith and Van Reenen 'Do R&D Tax Credits Work?' IFS Working Paper, 2001

**4.39** Over 10,000 tax credit claims were received from SMEs up to 6 May 2004, with £570 million of support provided since the inception of the credit. For the year 2002-03, 95 per cent of eligible SMEs made a claim.<sup>18</sup> Early indications show significant interest in the credit by larger companies, making the UK an attractive base for multinationals to base their R&D.

**4.40** The Government has also reformed **the taxation of intangible assets** – including patents, trademarks and copyrights – to encourage UK companies to take advantage of new opportunities in the knowledge-driven economy and compete internationally.

**4.41** For those smaller companies seeking to exploit scientific and technological advances, lack of **access to finance** is often a key factor that holds back their growth. The Government has introduced several measures to promote equity investment, including the Capital Gains Tax business asset taper relief and enhancements to the Enterprise Investment Scheme (EIS) and Venture Capital Trusts (VCT). Since the inception of EIS, over 9,000 companies have raised £3.5 billion of venture capital and VCTs have raised over £1.6 billion, investing in more than 850 companies.

**4.42** To enable smaller high-tech companies to recruit and retain talented employees, the Government has also introduced the **Enterprise Management Incentive** share option – rewarding employees for investing their time and skills in helping small companies achieve their potential. Employees can receive options of up to £100,000 that benefit from tax and National Insurance advantages. Early evidence suggests that SMEs have found this to be a valuable help in securing the personnel they need to develop, with around 1,900 companies granting EMI options each year since 2001-02.

**4.43** In 2003 the Government brought in new rules to clarify the **tax treatment of shares** issued to employees (primarily designed to protect income tax and National Insurance revenues against aggressive tax planning). Concerns have since been raised by the university sector on the potential adverse effects of these rules on university spin-out companies. UNICO (the University Companies Association) and the Inland Revenue have worked closely together and have identified a ‘safe harbour’ which will allow university academics to become shareholders in start up companies, now knowing with certainty that tax on share gains will be payable only when they cash-in their shares.<sup>19</sup> The Government will actively review, with universities and their tax advisers, the impact of the new ‘safe harbour’ arrangements on the ability of universities to create spin-out companies where there are commercial opportunities to do so.

## Regulation and innovation

**4.44** The Government and sectoral regulators are becoming increasingly aware of the incentive effects of regulation on R&D activity. In sectors where regulators directly control the prices of monopoly service providers – for example in water and energy distribution – companies do not have the normal competitive incentives to improve their products and services in order to gain market share. Instead, incentives have to be provided through the regulatory settlement between the firm and the regulator. There is some concern that the five-year price control periods typically used by the economic regulators do not give efficient incentives to undertake R&D that will reduce costs beyond the five-year price horizon.

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<sup>18</sup> [http://www.inlandrevenue.gov.uk/stats/corporate\\_tax/menu.htm](http://www.inlandrevenue.gov.uk/stats/corporate_tax/menu.htm)

<sup>19</sup> The April 2004 Memorandum of Understanding between the Inland Revenue and UNICO can be found at [www.inlandrevenue.gov.uk/shareschemes/agreement-with-unico.pdf](http://www.inlandrevenue.gov.uk/shareschemes/agreement-with-unico.pdf)

**4.45** Regulators have sought to encourage R&D firstly by introducing competition in previously regulated parts of their markets. For example, energy supply competition was introduced during the late 1990s, and telecoms services have been progressively liberalised over time since the privatisation of British Telecom in 1984. The Government and regulators are continuing to pursue opportunities to open up markets to competition. For example, Ofcom is currently consulting on the scope for introducing tradable spectrum rights, and the Water Industry Act 2003 introduced a framework for competition to supply large water users.

**4.46** Regulators have also sought to ensure that the remaining regulated monopoly businesses have efficient incentives to engage in R&D activity. Generally within the price control framework there have been moves to reduce distortions in investment incentives. Regulators have also considered specific measures to encourage R&D; for example Ofgem is currently considering two incentive schemes for electricity distribution companies:<sup>20</sup>

- Innovation Funding Incentive – a mechanism to encourage distribution companies to invest in appropriate R&D activities, focusing on the technical aspects of network design, operation and maintenance. The principal objective is to deliver benefits to consumers by enhancing efficiency in operating costs and capital expenditure.
- Registered Power Zones – intended to develop a mechanism to encourage distribution companies to develop and demonstrate new, more cost effective ways of connecting and operating generation that will deliver specific benefits to new distributed generators and broader benefits to consumers generally.

**4.47** Aside from direct economic regulation, environmental regulation also provides an opportunity to encourage R&D and innovation in addressing environmental problems. For example, under the Government's Renewables Obligation, electricity suppliers have to source at least ten per cent of their electricity from renewable power sources by 2010. This is having a direct impact in stimulating innovation and research into new energy sources such as offshore wind turbines.

**4.48** The Government has also used fiscal measures in a way that encourages innovation in the environmental field. In particular the use of enhanced capital allowances through the Green Technology Challenge process has encouraged the uptake of new and emerging technologies which aim to save energy and water. These incentives send strong signals to encourage the market to invest in the latest environmental technology and will consequently drive a degree of innovation as the market develops faster than it might have done.

**4.49** As highlighted by the DTI Innovation Report, there is also an opportunity to increase innovation through increased use of outcome-based regulations. DTI are leading a cross-Government project team including DEFRA, DfT, Cabinet Office and the Environment Agency, and working in consultation with business and other stakeholders, to look at three areas of environmental policy to assess how the regulations are designed and whether there are effective alternatives to regulation.

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<sup>20</sup> Ofgem (2004), 'Electricity Distribution Price Control Review: Regulatory Impact Assessment for Registered Power Zones and the Innovation Funding Incentive', March 2004

## Inward investment and R&D

**4.50** The UK has for some decades been viewed as an attractive location for overseas companies seeking to establish an R&D facility in the EU. The UK has one of the highest shares of foreign affiliated R&D in manufacturing across Europe. To raise the R&D intensity of the UK in the coming decade, it is vital that the economy continues to attract substantial inward investment in R&D, both on its own and linked to other manufacturing and service activities. The strengthening of the UK's science base through the Government's medium term commitment to substantial growth in funding will help underpin continued excellence in UK science which is itself a major attractor for many high technology companies.

**4.51** The Government will continue to develop its approach to inward investment, through UK Trade & Investment, the Regional Development Agencies, and devolved administrations acting in partnership to raise the profile of the UK as an attractive location for globally mobile R&D investments. This is a focus of the recent White Paper on trade and investment.<sup>21</sup> Chapter 9 on UK science in the global context sets out how the Government will work to make the UK a stronger partner of choice for inward investment by technology businesses into the UK.

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<sup>21</sup> *Making Globalisation a force for good*, DTI, 2004