

The 2001 R&D Scoreboard

Commentary and Analysis

dti

Department of Trade and Industry

The following organisations have kindly agreed to endorse the Scoreboard as a source of information for companies and their shareholders when considering the amount invested in R&D as part of the innovation process and business strategy.



Association of British Insurers



This is the commentary and analysis section of the 2001 R&D Scoreboard, the eleventh annual report in the series. It looks at the key messages arising from the R&D investments reported in the audited annual reports and accounts of the 597 UK and 500 international top R&D investing companies. The commentaries focus on key strategic issues related to R&D as part of the innovation process & business strategy and to the relationship between R&D-heavy companies and investors. An extract from the full Scoreboard database showing the top 500 R&D investing UK companies and the top 500 R&D investing international companies is also included with the full database reproduced in part 2.

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Highlights

What the Scoreboard contains:

- ◆ Details of the R&D¹ investment, sales, growth, profits and employee numbers for UK and international companies are extracted from company annual reports and key ratios calculated, with some movements over time. Companies are classified by FTSE sectors.
- ◆ 597 UK-based companies (49 from the FTSE 100) are included with R&D investments totalling just under £15bn. The international section comprises the top 500 R&D investing international companies (increased from 300 in previous years) with R&D investments totalling over £193bn.
- ◆ New data for 2001 includes 200 more international companies, market capitalisation and value added calculations. New ratios (R&D as percentage of profit, sales per employee and R&D to Capex) have been introduced for all companies.

What the Scoreboard analysis says:

R&D sector mix

UK sector mix is very different from that found internationally:

- ◆ The R&D investing group of UK companies is dominated by pharmaceuticals (38%) and aerospace (10%), both investing in R&D above international levels.
- ◆ The top two international sectors are IT hardware (27%) and automotive (18%), which account for 45% of total R&D compared to 13% in the UK.
- ◆ Over 17% of international R&D is carried out in electronics, chemicals and engineering compared to under 10% in the UK. The UK, on the other hand, has over 10% in food processors and oil & gas compared to just over 2% internationally.

R&D sector intensity

Overall UK R&D intensity is below the international average:

- ◆ The overall UK company R&D intensity (R&D as percentage of sales) is 2.1% compared to the international average of 4.2%. The UK has an unusually large proportion of its R&D in pharmaceuticals and an unusually large percentage of sales in oil & gas. If these sectors are excluded, the UK average intensity is 1.9% compared to an international average of 4.3% on the same basis.

R&D intensity is an important benchmark measure for sector R&D:

- ◆ UK R&D intensity is above international levels for pharmaceuticals, health and aerospace but below for all other significant sectors.
- ◆ The strong UK sectors of pharmaceuticals, health and aerospace have all maintained or improved their relative positions and IT hardware has increased in both size and intensity over the last two years.
- ◆ International intensity is two or three times that in the UK for chemicals, software & IT services, electronics and engineering. There has been some improvement in software & IT services and engineering over the last two years but a large difference remains.

R&D intensity — effects of company size and ownership

Overseas-owned companies and middle-sized companies in the UK generally have low relative R&D intensity:

¹R&D in UK company annual reports is defined by SSAP 13. Please see notes at the end of the data section (part 2) for further details.

- ◆ Medium R&D intensity sectors in the UK, such as electronics, software & IT services, chemicals and engineering, have lower R&D intensities than their international counterparts. Lower R&D investment by many UK middle-sized companies is mainly responsible for this.
- ◆ 27% of 1000 US Scoreboard Companies have intensities over 10% compared to only 4% of a comparable (but necessarily smaller) set of UK companies.
- ◆ Overseas-owned UK companies have lower R&D intensity than UK-owned companies in all sectors studied except engineering, with overseas-owned low intensity particularly marked in IT hardware and software & IT services. In general, the overseas-owned companies account for 10-35% of each sector's R&D.

R&D and company performance

R&D intensity is positively correlated over the medium term with company performance measures such as sales growth, productivity and market value:

- ◆ Sales growth is greater for high R&D intensity companies and six times greater for companies with a higher proportion of sales from new products.
- ◆ New data on value added² is now available for European companies. Plots of value added per employee vs R&D per employee rise together for the sectors studied, demonstrating a correlation with productivity. The value added per employee in all the R&D intensive sectors is above the UK average for the FTSE 350 companies of around £44K.
- ◆ The number of high R&D companies in the FTSE 100 has increased over the last three years and their average market value has risen more than twice that of the FTSE 100 index.

The challenge for the UK

Given the correlation between R&D intensity and company performance and given that UK R&D is a smaller percentage of surplus (profits plus R&D) than international (both overall and in several sectors) the challenges facing UK industry are:

- ◆ To maintain the UK's leading position in pharmaceuticals, health and aerospace.
- ◆ To increase the intensity of R&D in many medium-intensive R&D sectors where the UK has an average intensity well below international or US levels.
- ◆ For all companies, particularly middle-sized ones, to invest in innovation-led profitable growth and to assess opportunities to make the transition from more mature product areas to higher value added, higher growth areas.

What the Scoreboard doesn't say:

- ◆ That the R&D reported in companies' annual accounts is the only measure of innovation. Investments in capital equipment, people, market development, systems and other intangible assets are all ways of gaining competitive advantage.
- ◆ That it is simply a case of investing more. The Scoreboard is rather an international benchmarking tool to help companies decide if they are investing the right amount compared to competitors as part of their business strategy.
- ◆ That it is the only source of information. Companies and their shareholders are best placed to assess this and other information relevant to their investment plans.
- ◆ That it covers all R&D activity funded by companies in the UK. While the Scoreboard seeks to be as comprehensive as possible it does not, for example, include companies which undertake R&D but do not declare the amount invested in their accounts. It also excludes companies investing less than £20k per annum in R&D.

² Value added is defined as the difference between sales and bought in materials, components and services. It can be calculated from company annual reports by adding the cost of employees and depreciation back to operating profits and making other adjustments. This cannot be done for most US companies since their annual reports do not give employee costs.

Ministerial foreword

Lord Sainsbury of Turville, Parliamentary Under Secretary of State
for Science and Innovation

R&D provides a way for established companies to make the transition to a future of higher value added and growth.

A consistent message from the Scoreboard analysis has been the importance of investment in R&D as a key part of the innovation process and driver for business growth.

Tomorrow's products are needed to succeed in tomorrow's world.

Why investment in R&D is important

In the global business environment of the 21st century, successful companies must compete worldwide. Innovating more successfully than the competition will drive profitable growth. R&D is a crucial component of that innovation, helping companies to make advances that lead to new high value added products, processes and services. With these advances, people and capital can operate much more productively. For established companies, R&D provides a way to make the transition to a future of higher value added and growth.

The 2001 Scoreboard

The DTI R&D Scoreboard is in its eleventh year of publication and is now an increasingly valued international benchmarking tool. Recognising the globalisation of markets and strong overseas competition, we have increased the international section of the Scoreboard to 500 companies from 300. This means that in the R&D intensive sectors, UK companies will be able to benchmark against a greater number of international counterparts. The pharmaceuticals and IT hardware international sectors, for example, both contain over 50 companies.

In recent years, we have concentrated on developing the analysis section in which we examine the data, look for trends and discuss what the findings mean both for individual companies and for the UK economy. A consistent message from the analysis has been to stress the importance of investment in R&D as a key part of the innovation process and driver for business growth.

This year the Scoreboard contains new data on the positive links between R&D intensity and company performance. These were established last year with initial data on sales growth, productivity and market value. This year we show a positive correlation for value added per employee as a new productivity measure.

What do the headline figures show?

This year's Scoreboard data show that UK companies continue to invest substantially and intensively in the aerospace & defence, pharmaceuticals and health sectors. However, there are a number of other sectors where R&D is important but the UK average R&D intensity is well below that found internationally. This is particularly true for many middle-sized companies. In some sectors, such as IT hardware, the picture is improving but there is much still to be done to ensure that UK companies can develop the new products needed to compete in world markets. Tomorrow's products are needed to succeed in tomorrow's world.

The Scoreboard provides an international benchmark which companies and their shareholders can use to compare themselves with a sample of the best in the world and then decide whether they are investing at the right level for their sector, their business strategy and for their future. This year we have invited Sir William Castell, CEO of Amersham Plc and Andy Crossley, Head of Small UK Companies at INVESCO Asset Management Ltd to provide commentaries. These give valuable additional insights into the importance of R&D investment and innovation from a company's and an investor's perspective.



The role of Government

This Government is committed to playing its role in creating a world class business environment that will enable UK companies to compete and invest on a global stage. In the foreword to last year's Scoreboard, I highlighted the introduction of the R&D tax credit for SMEs and the Government's work on reviewing the definition of R&D for tax and company annual reporting purposes (further information on this is available on the DTI website www.dti.gov.uk/support/taxcredit.htm). This year, building on the SME measure, the Chancellor announced that he was minded to introduce a new R&D tax incentive for larger companies. The Government recently completed a wide-ranging consultation on this new incentive with business and other interested parties and is currently considering how best to take the proposed measure forward.

Another key part of the Government's strategy is to invest in the science base and encourage partnership between Government, the science base and business. Working together, the partners will ensure that the UK is better positioned to exploit new opportunities in the rapidly developing knowledge-based economy.

The challenge for business

I have already mentioned that the Scoreboard has established a relationship between R&D investment and the long-term growth of sales and added value. The challenge for UK companies therefore, is to identify international (as well as domestic) opportunities for innovative products and services and exploit these before their international competitors. Success will require vision and consistent commitment to innovation.

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A handwritten signature in blue ink, appearing to read 'David' followed by a stylized flourish.

R&D in the new global economy

Sir William Castell, Chief Executive, Amersham plc

The product is the medium by which knowledge-intensive industries deliver the fruits of their intellectual capital.

Knowledge-based industries

Europe's economies can no longer compete on the basis of their historic and traditional manufacturing industries. The most important economic challenge is to encourage economic activity out of traditional industries — most of which depend on size and economies of scale for their competitiveness — and into those industries that are knowledge-based. The dash to 'knowledge driven' economies is underway and it has deep meaning for business requiring a shift in the business mindset. It is not merely about strengthening the science base — it is fundamental to commerce, affecting all sectors from banking to pharmaceuticals, IT to leisure, insurance to diagnostics.

We have all become familiar with terms such as knowledge-based industries, digital economies, globalisation and intellectual capital, though we may be less familiar with the implications that follow. They are indeed profound, not only for the way we must manage, but also for the very nature of the products we must develop for emerging technology-driven markets where the product is the medium by which knowledge-intensive industries deliver the fruits of their intellectual capital.

R&D in the knowledge economy

Another classic and significant feature of the knowledge economy affects the nature and frequency of decisions on R&D. With increasing market share the more products your company develops and produces, the greater the potential to deliver yet more. The return on capital employed is increased as new products expand market horizons into new areas.

In a rapidly changing world, the lifeblood of research is uncertainty and it is the R&D function that translates that uncertainty into commercial opportunity.

My own company, Amersham, is a classic example of a knowledge-intensive organisation to which all these issues apply. The migration of genetics into commerce is an example of just such an emerging knowledge-based industry. We are dealing with a globally networked ecology, feeding off discoveries and developments in molecular biology, genomics, computational sciences, physics and microrobotics. As this ecology develops and generates new products that meet emerging market needs, it becomes a wealth generating economy, with a thriving network of universities, companies, hospitals, researchers and many others capitalising on new discoveries and technologies to deliver knowledge-based products and services.

As the nature of products has changed so too has the way they are developed. Typically technologies on which they are based are characterised by complementarities, ie, innovations hardly ever function in isolation: they depend on the simultaneous availability of complementary technologies. Today's R&D must seek, find and fuse disparate technologies emanating from the global science base. For these reasons, R&D is complex and uncertain, but in a rapidly changing world the lifeblood of research is uncertainty and it is the R&D function that translates that uncertainty into commercial opportunity.



The R&D global network

Perhaps R&D is not the most meaningful description of the activity which takes place in business. Commercialisation of science and technology might be better. The confusion here is between the description of function and process. R&D's function is to create options for new products and processes, while the process of R&D involves a network that spreads far beyond the confines of the company.

That companies appreciate the scope and real role of their R&D is vital, especially when, as for Amersham, it merits a significant percentage of sales. Our company's R&D is a distributed global function that is part of an ecology feeding off developments in all branches of science and technology. Our success derives not just from our own scientists but also the careful harnessing of others, particularly in academia where we have been able to nurture and develop blue sky science to deliver real products with real uses and real value. Our R&D managers' task of maintaining the delicate balance between opportunity, uncertainty, reward and risk is now more challenging than ever.

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Why London? - Why R&D-heavy European businesses are funded by London Investors

Andy Crossley, Head of UK Small Companies, INVESCO Asset Management Ltd
(A company in the AMVESCAP Group)

London, as a financial centre, has long been supportive of R&D-heavy businesses.

R&D-based businesses

A perception has existed for a number of years that technology companies and R&D-based businesses generally, have been ill-served by the UK's public equity markets. This perception often co-exists with a belief that the British are a nation of great inventors but whose skills are matched only by their ineptitude at commercialising inventions. This view holds that engineers and scientists are esteemed less highly by British society than solicitors and bankers. Generally, inventors are seen as slightly amusing, whilst Sir Richard Branson is seen as the real hero.

However, as in so many aspects of life, perception lags reality. London, as a financial centre, has long been supportive of R&D-heavy businesses. Stocks such as Racal, Vodafone, Glaxo, Wellcome and Psion have been well supported and well funded by London investors for many years and the number has been growing. For example, there has been a big increase in the number of UK listed companies in the R&D-heavy sectors such as pharmaceuticals, software & IT services and IT hardware: the 2001 R&D Scoreboard has 36% more companies than the 1999 Scoreboard in these three sectors.

London's role as funder of R&D-heavy businesses

A number of other factors indicate that London's pre-eminent role as a funder of R&D-heavy businesses is being consolidated.

These include:

- ◆ The success of the techMARK section of the London Stock Exchange and the Alternative Investment Market (AIM). These markets have introduced listing requirements more appropriate for emerging technology businesses, they have focused investor attention on these businesses through the creation of appropriate benchmarks and raised London's profile as *the* place to list R&D-heavy businesses.
- ◆ Specialist venture capitalists have brought many biotechnology companies to market and those now listed in London include Oxford Glycosciences and Cambridge Antibody, both with market capitalisations of around £500m.
- ◆ The difficulties faced by the other European secondary markets (Neuer Markt, Deuxieme Marche, etc) suggest that the intellectual infrastructure that exists in London cannot easily be replicated. Specifically, this infrastructure includes a deeply engrained equity tradition stretching back hundreds of years: an international trading culture — the London Stock Exchange is the most international exchange in the world in the most cosmopolitan city in Europe; protection of minority shareholders combined with successful self-regulation through the Takeover panel; strong corporate governance, accounting disclosure, compliance and regulation.
- ◆ More money is managed out of London than any other European city, the second largest is Edinburgh. More international money is managed out of London than any other city in the world. This liquidity is most easily accessed through a listing on a UK stock market.
- ◆ The UK also has the largest pool of private equity capital available for investment in R&D based businesses. 3i, Europe's largest venture capitalist, announced that nearly half of its new investments made in 2000 were in technology businesses. The UK accounts for 49% of the European venture capital industry; in 2000 £1.5bn was invested by the industry in high technology companies.

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- ◆ These factors all become self-reinforcing. The network benefits include that of liquidity following liquidity; that the pool of existing talent encourages new firms to choose to set up in London and that the creation of new firms and the growth of existing firms encourages the movement of talent to London; that the clustering of brokers, bankers, corporate-financiers, corporate lawyers, financial PR, venture capitalists, financial journalism and fund managers lowers the cost and increases the benefits of doing business in London.

The future

London may not have the vast liquidity nor the sheer scale of the US capital markets, which offer an unrivalled degree of specialisation. However, I would argue that London is now the obvious place to list for those European businesses for which the domestic stock market is unsuitable, either because it does not provide the required profile or liquidity, or there is insufficient local understanding of the sector in which the company operates. For example, Baltimore Technologies and Parthus are listed in London, Nokia is dual listed and a number of Israeli high technology businesses have chosen to list in London. London should also be the first port of call for pan-European businesses which, arguably, have no domestic stock market.

Progress so far has included a very successful start for techMARK which, after one year, had 240 companies with 74 additions during the year — over three quarters of techMARK companies are in software, pharmaceuticals, health and IT hardware. A total of £11bn was raised by techMARK companies in its first year and the techMARK 100 index increased by 47% over the year. Since 1995, 850 companies have used AIM as a vehicle for growth and have raised £6.5bn on the market. The total market capitalisation of AIM companies was £13.3bn by April 2001 and there were almost 50 companies in pharmaceuticals and software.

We believe that London will become the dominant financial centre in Europe which will be to the benefit of its listed R&D-based businesses, not least because of the enhanced analysis and understanding of the full range of R&D-heavy sectors. These R&D-heavy sectors will thus be increasingly well served by London's equity markets. Any business that believes R&D is crucial to a successful future and can demonstrate that credibly will receive a welcome in the London market.

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It is crucial for companies to benchmark their R&D investment against best international practice in their sector and to understand the ways in which their R&D investment will affect future business performance.

R&D and capital investment are two of the most important investments in its future that a company can make.

1. The 2001 R&D Scoreboard

This is the eleventh consecutive annual R&D Scoreboard and the main themes this year build on the insights into sector mix and company performance introduced last year. In particular, the work on differences between UK and international R&D and the links between R&D and company performance are analysed under three main headings:

- ♦ The substantial differences in the proportion of total R&D invested in various sectors between the UK and competitor nations.
- ♦ Differences in R&D intensity (R&D to sales ratio) between industrial sectors in the UK and internationally. This includes, for the first time, the distribution of companies in a number of sectors between high, medium and low R&D intensities.
- ♦ New data on the important positive correlation between R&D intensity and measures of company performance such as sales growth, productivity and market value. This includes, also for the first time, use of value added per employee as a productivity measure.

The world economic situation has changed markedly over the last 18 months and a number of sectors are experiencing difficult business conditions. In these circumstances it is even more crucial for companies to benchmark their R&D investment against best international practice in their sector and to understand the ways in which their R&D investment will affect future business performance. In previous business downturns, companies that have cut R&D investment have often found that their range of products and services compare less well with competitors when the upturn comes and it is then more difficult to protect market share and value added.

The 2001 R&D Scoreboard has many improvements over the 2000 version which make it an even more valuable international benchmarking tool. In particular:

- ♦ The international section has been expanded to include 500 companies (previously 300) and countries have been grouped into the three world economic regions. The European Industrial Research Management Association (EIRMA) is endorsing the R&D Scoreboard — the first international endorser.
- ♦ The R&D-to-Capex ratio has been added for each company together with R&D as a percentage of profit.
- ♦ Market capitalisation is given as of July 2001 for listed companies.
- ♦ Sales per employee and its percentage change have been added and percentage change is also given for R&D per employee.
- ♦ Value added and value added per employee have been introduced for European companies.

The increase in the number of international companies has resulted in the inclusion of companies with R&D down to £43m compared to the 2000 Scoreboard when the lower limit was £94m. This change means that more than twice as many UK companies appear in the 2001 International Scoreboard.

2. R&D investment and innovation

Research and Development and capital investment are two of the most important investments in its future a company can make. They are also both quantified in company annual reports and are listed in the DTI R&D and Capex Scoreboards for both UK and international companies (see references). There are other important investments for the future such as training and the development of new markets, but there is less quantitative information available on them.

R&D is a key investment that leads to new products, processes and services. It is only part of the innovation process since there are other business functions which will contribute to the overall process of identifying customer needs (including latent needs) and satisfying them with profitable new products and services. However, it is the role of R&D to generate technical advances, which drive the flow of innovative new products and services, providing enhanced value for customers and value added growth for the company.

In a fast moving global economy, the best companies understand that continual innovation is the way to avoid products becoming commodities. Innovation may lead to new products, add services to products or enable mass customisation. Innovation may build a brand (see reference 5) or develop and secure a worldwide market niche.

Later in this analysis we will discuss new results on the positive correlation between the intensity of R&D and measures of company performance. To do this we first need to understand how R&D intensity (R&D as percentage of sales) differs between the various industrial sectors in the developed economies. This is summarised in sections three and four.

3. Overall R&D investment and intensity

In comparisons of total R&D investment between countries, the R&D intensity (the ratio of R&D to sales) is much more meaningful than the absolute level of R&D. The R&D intensity is determined both by the mix of industry (the relative proportions of R&D intensive to low R&D sectors) and the intensity of the major sectors compared to those in competitor countries.

The overall total R&D for the 597 UK companies in the 2001 Scoreboard is £15bn, an increase of 14% over the previous year. The total for the 500 international companies (including 32 from the UK) is £193 bn (of which the Americas contribute 46% and Europe 31%) an increase of 10% over the previous year. The UK increase of 14% is partly a genuine increase and partly due to acquisitions; it also mainly arises from increases in R&D at nine large companies whose R&D increased by 28% and which account for 83% of the total increase. The remaining 588 UK companies show an increase of 3.9% over the previous year; the nine international companies with the largest increases have a much smaller overall effect.

Previous Scoreboards have pointed out that the average UK company R&D intensity is about half of the international intensity. However, interpretation of this figure needs to take into account two big differences between the UK and other developed economies. The UK has a substantial high R&D pharmaceuticals sector (which accounts for nearly 40% of all UK R&D) and a large oil & gas sector (accounting for 31% of the total sales of all the R&D Scoreboard companies). No other sector even approaches these two in terms of its percentage of total R&D or sales. Figure 1 shows the UK average R&D intensity compared with international, with Japan and with the US both as an overall figure and for all sectors except pharmaceuticals and oils.

Figure 1 — R&D intensity

Sectors	UK companies	International 500	USA (1000 companies)	Japan (127 companies)
All sectors	2.1%	4.2%	4.3%	4.2%
All sectors except pharmaceuticals and oils	1.9%	4.3%	4.3%	4.2%
Pharmaceuticals	14.8%	12.8%	10.9%*	11.1%
Oil & Gas	0.3%	0.4%	0.4%	0.3%

* Note that the USA sector includes the Scoreboard sectors of health and pharmaceuticals (which has the higher intensity); see reference 6.

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Analysis

The UK pharmaceuticals sector is above best world levels in intensity but the UK average R&D intensity, excluding pharmaceuticals and oils, is significantly less than 50% of the US, Japanese or international averages.

The conclusion from Figure 1 is that the UK pharmaceuticals sector is above best world levels in intensity but that the UK average intensity, even excluding pharmaceuticals and oils (whose effects tend to cancel), is significantly below 50% of the USA, Japanese or international averages. The overall UK average intensity has not varied substantially from just under 50% of the international intensity over the last three years (using the 500 international companies for comparison). The ratio of UK to international (300 companies) intensities in the 1996 and 2000 Scoreboards is also similar.

An explanation of the overall difference between UK and international intensities requires a sector by sector comparison and this is done in section four.

4. Industrial sector mix

Sector mix

While there are 32 sectors represented in the UK Scoreboard and 27 in the international one, only about half of these contribute more than about 1% of total R&D in either Scoreboard. All these sectors are displayed in Figure 2 as three groups; those of high, medium and low R&D-to-Capex ratio (a ratio included in the 2001 Scoreboard for the first time).

The high R&D intensive sectors of pharmaceuticals, health, IT hardware, software & IT services and aerospace fall in the first group whereas the capital-intensive industries such as telecomms and oil & gas make up the third group. The middle group contains the main manufacturing sectors which require R&D at 40-80% of Capex and Figure 2 shows that these are operating at a much lower average R&D intensity in the UK. The high R&D intensity group are dominated by pharmaceuticals in the UK and this raises the average intensity to just above international levels more than compensating for software which has a lower intensity in the UK.

These broad differences in sector intensity are examined in much more detail in Figure 3.

Figure 2 — Sector groups

	High R&D Capex >115%	Medium R&D Capex 45-80%	Low R&D Capex <10%
Sectors*	Software & IT services Pharmaceuticals Aerospace Health IT Hardware	Electronics & electrical Automotive Chemicals Media Engineering Personal Care Food Processors	Telecomms Oil & Gas
Average R&D/Sales			
UK	9.6%	2.0%	0.4%
International	8.7%	3.9%	0.9%

* Sectors grouped on basis of international R&D-to-Capex.

Figure 3 lists the ten largest international sectors together with two others which enter the UK top 10 (but not the international) by proportion of total R&D. All 12 sectors are amongst the 14 displayed in Figure 2. The international and UK R&D intensities for each sector are also shown in Figure 3 together with the ratio of UK to international intensity. The main conclusions to be drawn from Figure 3 are:

The five high R&D intensive sectors are pharmaceuticals, health, IT hardware, software & IT services and aerospace. Internationally, they all have R&D over 115% of capital investment.

Figure 3 — R&D by sector

	Proportion of total R&D		R&D Intensity		
	International	UK	International	UK	Ratio
1. IT hardware	27.3%	7.5%	8.1%	6.2%	0.8
2. Automotive	17.7%	5.5%	4.0%	4.2%	1.0
3. Pharmaceuticals	15.7%	37.7%	12.8%	14.8%	1.2
4. Electronics & electrical	9.6%	4.3%	5.8%	3.0%	0.5
5. Chemicals	5.0%	2.7%	4.1%	1.4%	0.3
6. Software & IT services	4.3%	4.8%	14.3%	4.2%	0.3
7. Aerospace	3.9%	10.0%	4.4%	7.7%	1.7
8. Engineering	2.8%	2.8%	2.8%	1.3%	0.5
9. Telecomms	2.2%	2.9%	1.8%	1.0%	0.6
10. Health	2.0%	1.7%	5.3%	7.2%	1.4
11. Food processors	0.8%	5.8%	1.8%	1.6%	0.9
12. Oil & Gas	1.4%	4.3%	0.4%	0.3%	0.7
Others	7.3%	10%			
Totals	100%	100%			

UK R&D is dominated by pharmaceuticals and aerospace (48% of the total) whereas international is dominated by IT hardware and automotive (45% of the total).

- ♦ UK R&D is dominated by pharmaceuticals and aerospace which together account for 48% of UK R&D (compared to 19% internationally). Both sectors have an R&D intensity above international levels.
- ♦ International R&D is dominated by IT hardware and automotive which together account for 45% of total R&D. Both sectors are more than three times as large as their UK counterparts as a proportion of total R&D. The International R&D intensity for IT hardware is larger than that of the UK; that for automotive is comparable.
- ♦ The UK has larger proportions of R&D in food processors and oil & gas and somewhat larger in software & IT services and telecomms, but UK R&D intensity is lower than international in all four sectors and particularly low in software.
- ♦ The UK has comparable proportions of R&D in engineering and health and much lower proportions in electronics & electrical and chemicals. The UK R&D intensity is substantially higher than international for health but much lower than international in the other three sectors.

Changes in sector mix over time

This picture of the relative proportions and intensities of R&D for the various sectors is qualitatively similar to that presented in the 2000 Scoreboard. How has the situation changed over the last few years? The current FTSE sectors were only introduced in 1999 so a comparison of R&D Scoreboard sectors can only easily be made for this and the two previous Scoreboards. The relative percentage of the total international R&D accounted for by the larger sectors has changed little over this period although there has been some increase in pharmaceuticals (see reference 7 for the 1999 equivalent of Figure 3). However, the changes in the UK have been more significant with increases in pharmaceuticals (33 to 38%), aerospace and defence (7 to 10%) and IT hardware (3 to 7%) and reductions from 7 to 4% in both electronics & electrical and oil & gas.

The changes in IT hardware and electronics are linked with two FTSE 100 companies in IT hardware (Marconi and Spirent) having been, in part, present in electronics under their previous names (GEC and Bowthorpe). These are examples of transition where the product mix and customers of a company change sufficiently (often involving acquisitions) for a new sector to be appropriate.

The UK R&D intensity in pharmaceuticals, health and aerospace is above international levels and this position is being maintained or improved.

Analysis

The comparison of R&D intensities is more difficult between Scoreboards so Figure 4 lists changes in intensity for the sectors in Figure 3 but calculated using companies in the 2001 Scoreboard for which data are available for previous years (almost all). The trends in R&D intensity are shown for both international and UK sectors and an indication is given of the relative trend. This approach necessarily disregards some companies that join or leave a particular sector.

Figure 4 — Changes in R&D intensity by sector

	2001 Ratio of R&D Intensity UK/International	Change* in International Intensity Over 2-3 years	Change* in UK Intensity Over 2-3 years	2-3 yr Change UK Relative to International
IT Hardware	0.8	=	up +	up +
Automotive	1.0	up -	up #	
Pharmaceuticals	1.2	=	=	=
Electronics & electrical	0.5	up -	=	=
Chemicals	0.3	=	down	down
Software & IT services	0.3	up	up	up
Aerospace	1.7	up	up +	up +
Engineering	0.5	=	up	up
Telecomms	0.6	down -	down -	=
Health	1.4	down -	up	up
Food processors	0.9	up +	up +	up -
Oil & Gas	0.7	down +	down +	=

But reduction in 99/2000

* Key to trends

up - = small increase

up + = large increase

down - = small decrease

down + = large decrease

The overall trends can be described as follows, although in all cases care should be taken to look at individual company data in part 2 since a single company can significantly influence trends in certain sectors.

- ♦ The three sectors where UK R&D intensity exceeds international (pharmaceuticals, aerospace and health) all show the UK maintaining or improving its position. There is also some relative improvement in food processors where the UK has a substantial position with intensity comparable to international.
- ♦ Telecomms and oil & gas are sectors where the R&D intensity has trended down both internationally and in the UK, but these are sectors where capital investment is much larger than R&D.
- ♦ In the remaining sectors where the UK intensity is well below international, the UK has improved in IT hardware, engineering and software, steadied in electronics and fallen back in chemicals. All except IT hardware have UK intensities well below international.

A recent comparison of R&D intensity levels for the world's largest companies over the last 20 years (reference 4) points to the increasing intensity in knowledge-intensive sectors. This has been accompanied by an increase in patenting as companies seek to create market exclusivity for the results of their R&D.

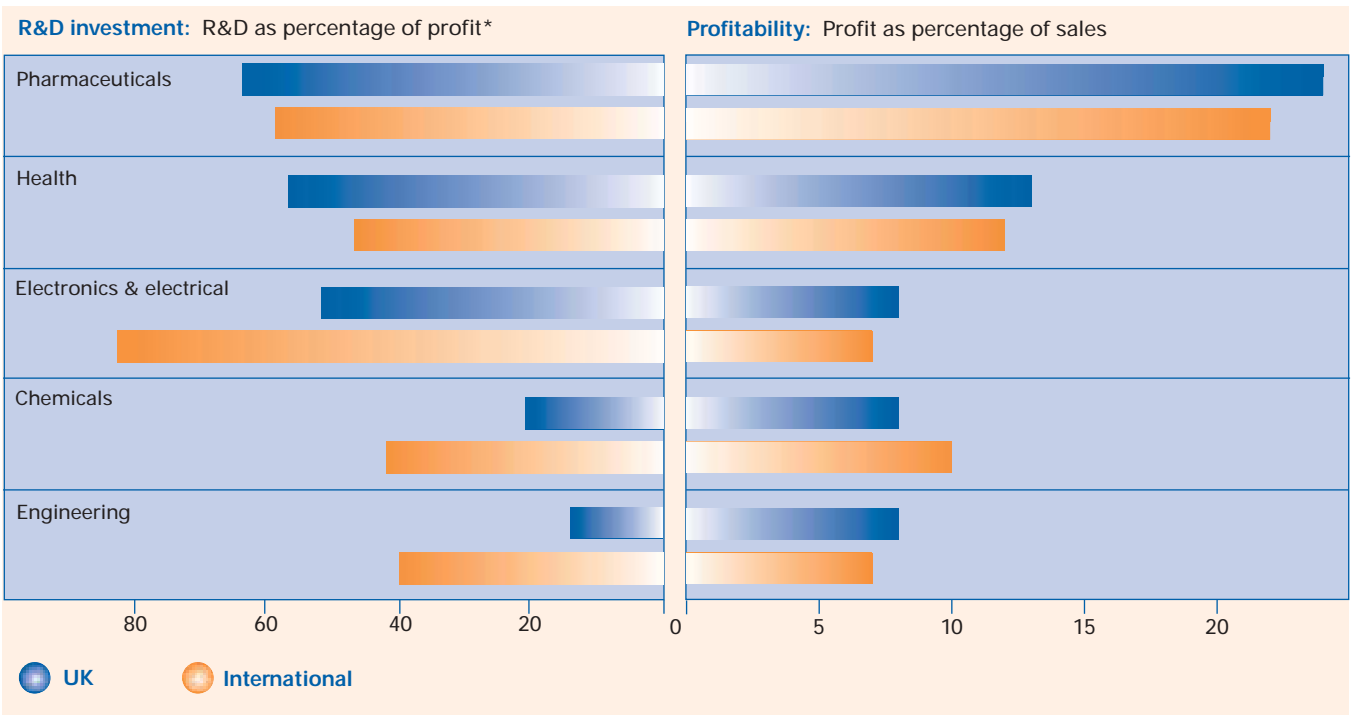
In sectors where the UK R&D intensity is below international, the UK has improved in IT hardware, engineering and software & IT services, remained steady in electronics & electrical and fallen back in chemicals.

R&D intensity levels for the world's largest companies in knowledge-intensive sectors have increased over the last 20 years. This has been accompanied by an increase in patenting.

Affordability of R&D

For the main sectors highlighted in Figures 3 and 4, the differences in R&D intensity between UK and international sectors could, in part, be linked to differences in affordability, represented by R&D expressed as a proportion of profit. To test this, the data on R&D as percentage of profit and profit as a percentage of sales are collected in Figure 5 for several sectors using the 2001 Scoreboard companies, but averaged over four years to provide smoothed data.

Figure 5 — The affordability of R&D



* Averages over four years for all sectors to indicate trends.

Figure 5 indicates that, in sectors such as chemicals, electronics & electrical and engineering UK sectors are on average investing a much smaller proportion of profits in R&D than are their international equivalents, although profits are a comparable fraction of sales (but of course would be a little lower if R&D intensity was similar); indeed, UK profits are a larger fraction of sales for electronics & electrical and engineering. In pharmaceuticals and health, on the other hand, UK sectors have a slightly higher margin and invest a larger proportion of profits in R&D — a virtuous circle of sustained investment and rewards.

In the 2000 Scoreboard, Figure 1 indicated that the substantial increase in US R&D intensity in the 1980s (and the further increase in the late 1990s) was linked to the increasing profitability of the 1990s. The overall UK R&D in the 2001 Scoreboard is 16% of surplus (profit plus R&D) compared to 27% of surplus internationally where the R&D intensity is twice as large. Profit is still larger as a percentage of sales in the international case. Investment at the expense of short term profits is needed to initiate a virtuous circle. The US economy demonstrated the effectiveness of this in the 1980s and 1990s.

In pharmaceuticals and health UK sectors have a slightly higher margin and invest a larger proportion of profits in R&D — a virtuous circle of sustained investment and rewards.

5. The effects of size and ownership on R&D intensity

The importance of R&D intensity has been stressed in the last section, in particular the need for companies to be internationally competitive in this respect in their sector. The analysis of section four dealt with sector averages and a deeper understanding of sectoral R&D in the UK is obtained by examining two further factors for R&D-performing sectors.

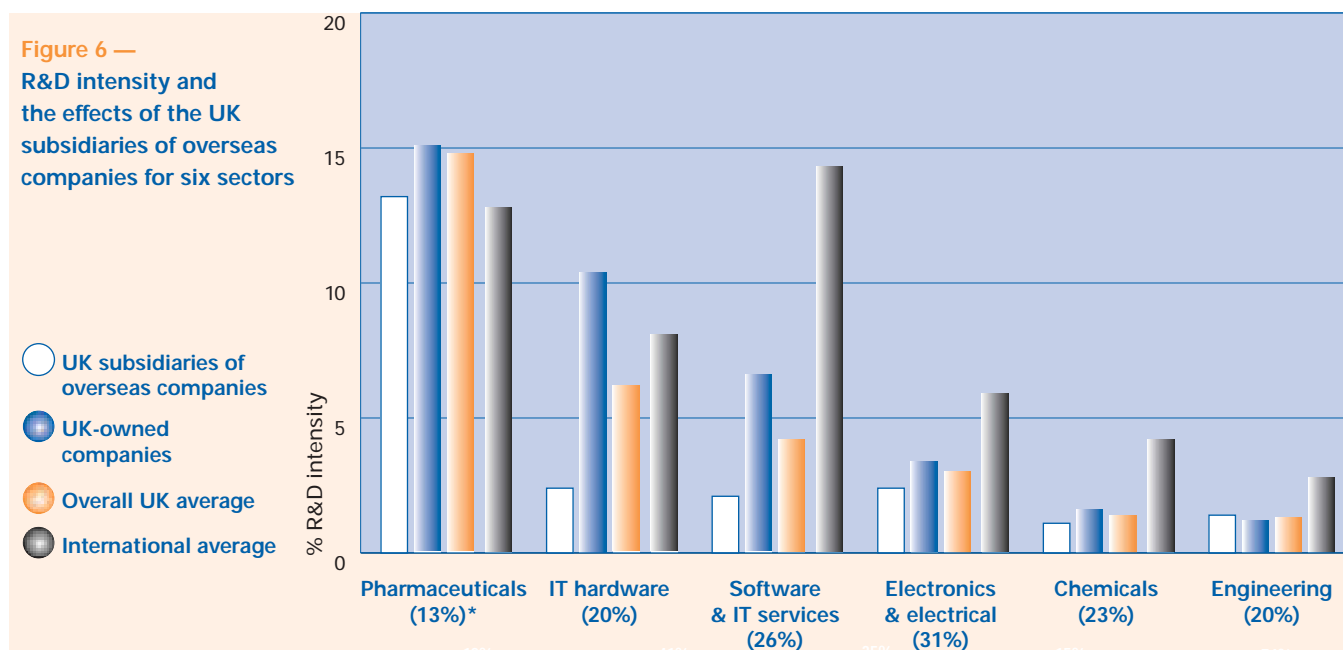
Company size and ownership have a significant effect on R&D intensity in some sectors and shed new light on the reasons for UK/international differences. They do not change the overall conclusions of sections three and four.

- ◆ In some UK sectors a significant proportion of the R&D is carried out by the UK subsidiaries of overseas companies that have their major R&D resource in the 'home' country. This could reduce the UK average and conceal higher R&D by UK-owned companies.
- ◆ In some UK sectors (examples are IT hardware, health, food processors and, to a lesser extent, electronics & electrical) one company accounts for a substantial proportion of the R&D. In such cases the distribution of the number of companies by R&D intensity band gives a more accurate picture of the future potential of the sector.

These two issues are explored in this section. The conclusion is that, while they are certainly significant for some sectors, they do not change the overall qualitative conclusions of sections 3 and 4 but do change ratios and shed new light on the reasons for the differences.

R&D intensity of overseas-owned UK companies

In Figure 6, the effects of UK subsidiaries of overseas companies are shown for six different sectors - pharmaceuticals, software, IT hardware, electronics, chemicals and engineering. In each case, the average R&D intensity of the UK subsidiaries is compared to the average for all other UK companies and to the international average. The subsidiaries account for a significant proportion of the sector's R&D (typically 20-30%).



*The figure in brackets is the % of total R&D in that sector performed by the UK subsidiaries of overseas companies.

Figure 6 shows that UK-owned companies have somewhat higher intensity than the UK subsidiaries of overseas companies for pharmaceuticals. In software & IT services, IT hardware, chemicals and electronics & electrical, the foreign-owned UK subsidiaries have a lower average R&D intensity, but they have a slightly higher intensity for engineering where the UK average is half the international.

The biggest changes are in software & IT services and IT hardware. In software & IT services, although the average intensity for UK-owned companies is well above that for the UK average, both are well below the international average (and the average for the 1000 company US Scoreboard). Only for IT hardware does the order change with the effect of one large UK-owned company bringing the UK-owned average above the international.

Figure 7 — Distribution of companies by R&D intensity for four sectors, UK-owned vs international (excluding UK)

1. Pharmaceuticals R&D intensity					
(R&D >£8m, Sales >£20m)					
	>20%	15-20%	10-15%	5-10%	No of companies
UK	25%	13%	25%	37%	8
International	23%	23%	27%	27%	48
2. Software & IT services R&D intensity					
(R&D >£7m, sales >£30m)					
	>20%	15-20%	10-15%	<10%	No of companies
UK	21%	22%	14%	43%	14
International	33%	34%	15%	18%	33
3. Electronics & electrical R&D intensity					
(R&D >£5m, Sales >£100m)					
	>7%	5-7%	3-5%	<3%	No of companies
UK	8%	34%	25%	33%	12
International	26%	33%	38%	3%	39
4. Engineering R&D intensity					
(R&D >£5m, Sales >£100m)					
	>4%	2-4%	< 2%	No of companies	
UK	6%	25%	69%	16	
International	21%	55%	24%	38	

For software & IT services, engineering and electronics & electrical the UK companies have a much larger representation at the low R&D intensities, whereas the international companies have larger representation at the higher and highest intensities.

The distribution of R&D within sectors

The distribution of UK and international (excluding UK) companies by R&D intensity band is shown in Figure 7 for four of the sectors in Figure 6. UK companies are only included if R&D and sales are above the limits shown. The conclusions here are:

- ♦ For pharmaceuticals, there is little significant difference between the UK and international (given the small UK sample).
- ♦ For software & IT services, electronics & electrical and engineering the UK companies have a much larger representation at the low R&D intensities whereas the international companies have 10-40% of the UK proportion in the lowest intensity band and consequently higher proportions at higher intensities. The difference is most marked in engineering and electronics & electrical. It could be argued that the international companies are mostly much larger than the UK ones; however, using the 1000 company US Scoreboard, the differences for software & IT services, for example, are greater than in Figure 7 even though the US Scoreboard goes down to companies with R&D of only \$1m.

The conclusion is that the R&D intensity deficits seen in Figures 3 and 4 for some sectors are characteristic of middle-sized UK companies and not just determined by a few large companies or by the UK subsidiaries of overseas companies.

Analysis

There are twice as many UK companies with R&D intensity below 2% but only one seventh as many as the US with intensity above 10%.

A cohort of middle-sized companies with high R&D intensity provides a sound basis for increasing innovation-led growth and increased value added.

The positive correlation between sustained high R&D intensity and company performance is a powerful argument for a company to ensure its R&D investments stand comparison with its best international competitors.

The distribution of R&D

These overall conclusions about sectors raise the question of whether the differences in the overall distributions of intensity between UK and US companies are greater than the differences seen in average R&D intensity and highlighted in Figure 1. The distributions are shown in Figure 8 for the UK Scoreboard and the 1000 company USA domestic Scoreboard (see reference 6). UK companies (just over 190) are only included if they are large enough to be included in the USA Scoreboard. The result is that there are twice as many UK companies in the lowest intensity band (0-2%) but only one seventh as many in the band above 10% R&D intensity (where the US has 27% of all companies). The proportion of US companies in the R&D intensity range above 10% has been rising over the last few years. By sector, the difference at the high intensity end is largely due to the physics-based sectors (electronics & electrical, instrumentation, IT hardware and software & IT services). An up-and-coming cohort of middle-sized companies with high R&D intensity provides a sound basis for increasing innovation-led growth and increased value added.

Figure 8 — Comparison of UK and USA Scoreboard distribution of companies by R&D intensity

	R&D intensity band				
	0-2%	2-4%	4-10%	>10%	(>20%)*
US	33%	17%	23%	27%	(7%)
UK	65%	12%	19%	4%	(1%)

Note: The UK companies chosen are all those of sufficient size to justify an entry in the US Scoreboard.

* These figures are also included in the >10% column.

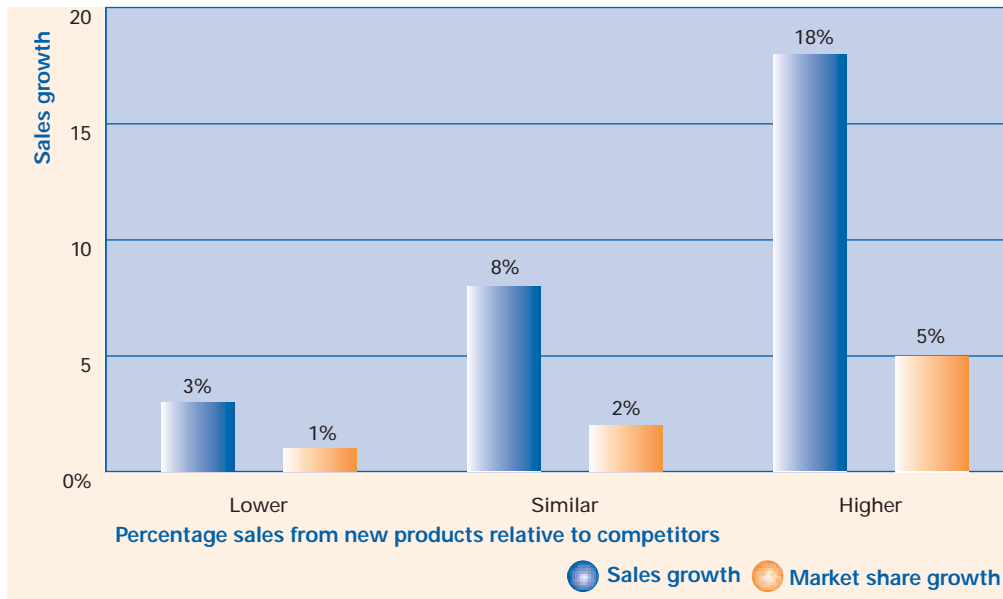
6. The links between R&D intensity and performance

In the 2000 Scoreboard analysis, we described the positive correlation between sustained high R&D intensity and company performance measures (such as sales growth, productivity and market value). These correlations provide a powerful argument for a company to ensure its R&D investment stands comparison with its best international competitors. This is particularly important in more difficult economic conditions when companies' R&D will strongly influence their competitiveness in the upturn.

6.1 Sales growth

The positive correlation between R&D intensity and sales growth has been demonstrated both for US and UK companies (see 2000 R&D Scoreboard and reference 3 for details). The US study excluded acquisitions. A recent study of international consumer goods companies by IMD and PIMS (see reference 5) studied the effects of innovation advantage on company performance. This study demonstrated the positive correlation between significant innovations delivering consumer value and the resulting sales and market share growth. Figure 9 shows the strong correlation found in this study between the percentage of sales deriving from new products and sales growth. For example, companies with a higher than average percentage of sales from new products showed sales growth of six times the level of companies with a lower than average percentage of sales from new products (18% versus 3%).

Figure 9 — Sales growth driven by innovation advantage



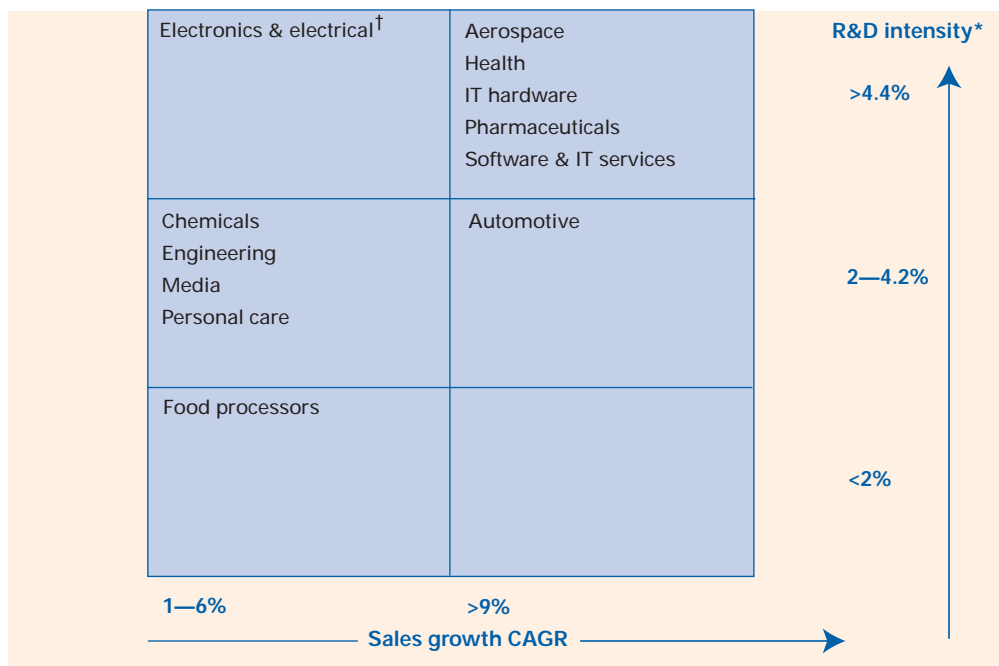
Measured over a period of up to 3 years

Source PIMS/IMD

Companies with a higher than average percentage of sales from new products show sales growth of six times the level of those companies with a lower than average percentage of sales from new products.

The R&D Scoreboard includes data on sales growth over the previous four years (CAGR or compound annual growth rate) and this is related to data on R&D intensity by sector in Figure 10. The matrix displays the sales growth/R&D intensity relationship for most of the high and medium intensity sectors of Figure 2, but cannot totally exclude the effects of acquisitions — although these mainly occur within a sector and, in such cases, would not normally have an effect. Only the international sectors are shown. As expected, the international sectors with high average R&D intensity tend to have the higher sales growth. Were UK sectors to be shown, it would be seen that they had lower average R&D intensities than international in software & IT services, electronics & electrical, chemicals and engineering.

Figure 10 — R&D Intensity and sales growth



The international sectors with high average R&D intensity have the highest rates of sales growth.

† Electronics & electrical has the highest sales CAGR (6%) of sectors in the left hand column.

* Note: The overall international average R&D intensity is 4.2%.

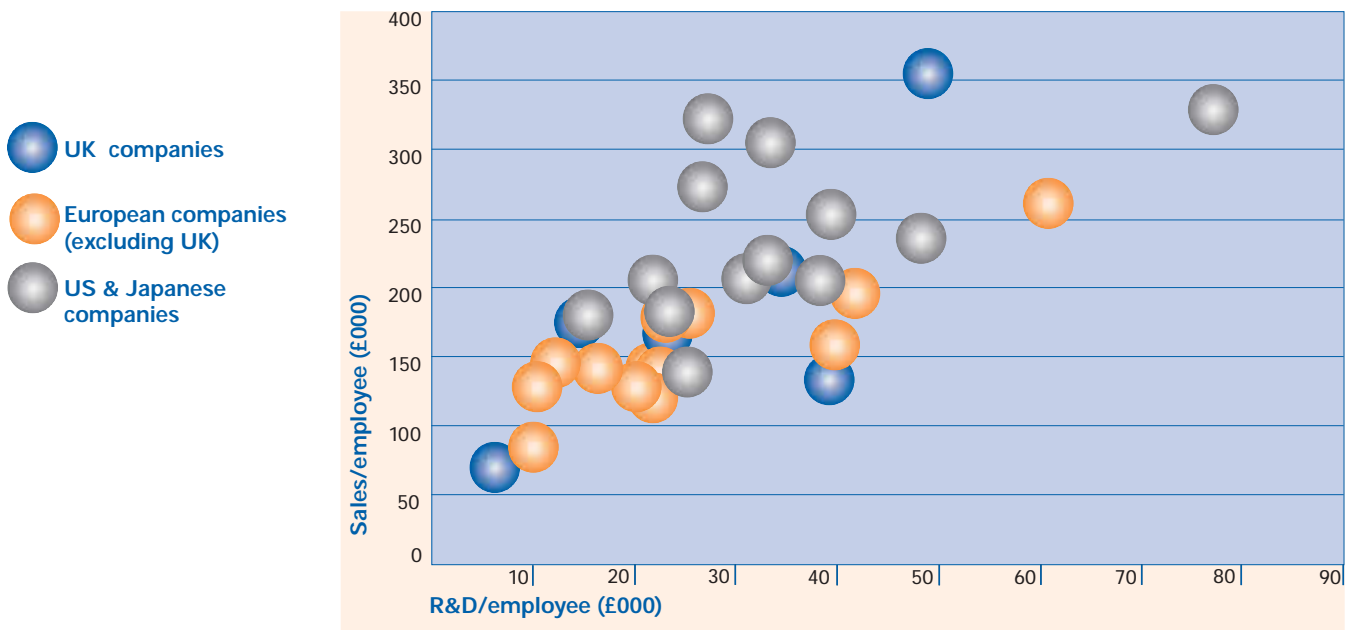
Analysis

6.2 Productivity

In the 2000 Scoreboard, it was shown that sales per employee — the best available surrogate for productivity at that time — rises with R&D per employee for UK and international companies in four sectors dependent on R&D. We now have data on value added and value added per employee for the larger UK and continental European companies and this is preferable to sales per employee as a measure of productivity. For example, the difference is particularly clear in those few cases (eg, Johnson Matthey) where a company purchases large quantities of high value materials or components which increase sales per employee but where the ratio of sales to value added is thus likely to be exceptionally large. In such cases, the value added is more directly linked to R&D intensity than is sales. The US does not disclose sufficient information in their annual reports to enable value added to be calculated so US companies cannot be included, but we do have sales per employee for them.

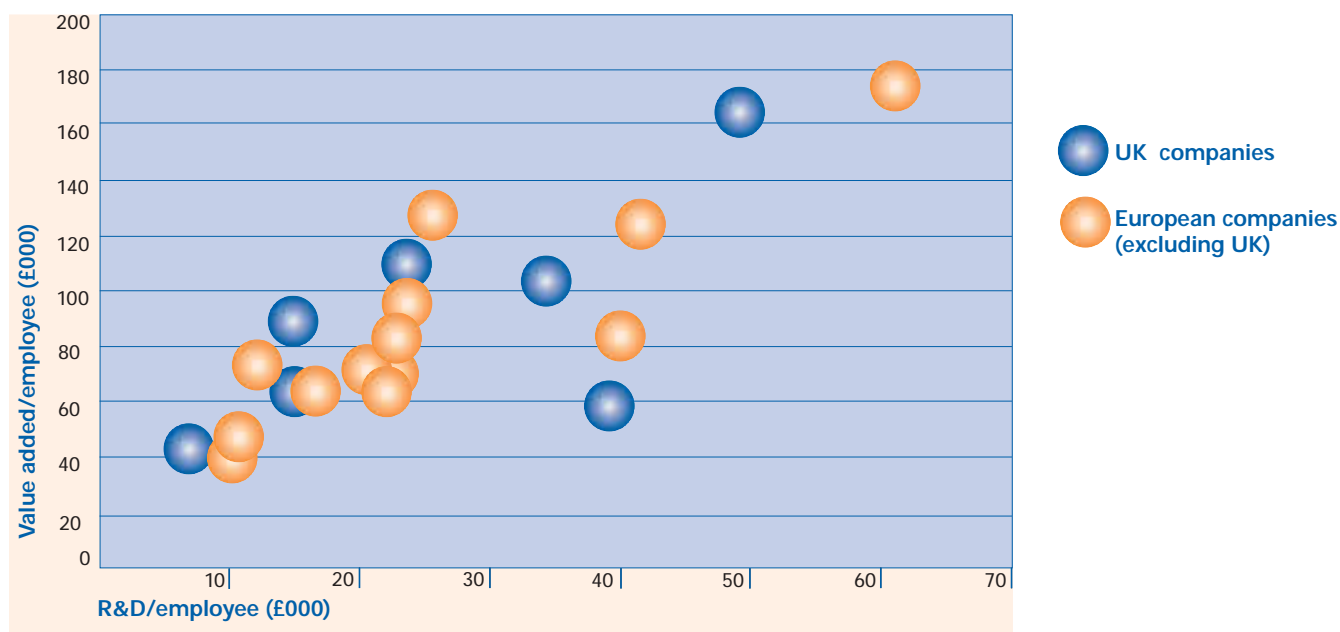
Productivity rises with R&D per employee for sectors dependent on R&D.

Figure 11 — Sales per employee versus R&D per employee — pharmaceuticals



The majority of pharmaceutical companies have sales per employee above £180K and R&D/employee above £25K.

Figure 12 — Value added per employee versus R&D per employee (Europe) - Pharmaceuticals



Figures 11 and 12 show sales per employee and value added/employee plotted against R&D per employee for the pharmaceuticals sector. The value added figure includes all 18 European companies in the international Scoreboard, (including five from the UK) plus two UK companies with R&D over £8m and sales over £60m. Another 13 US and Japanese companies (every other such company in the list excluding two outliers) are also included in the sales per employee graph. The conclusions from these figures are:

- ◆ There is a generally rising trend of both sales/employee and value added/employee as R&D/employee increases. This appears to be more marked in the case of value added. Two companies in both figures have high R&D/employee but are in the earlier stages of growth with sales per employee still therefore relatively low.
- ◆ The UK companies are spread throughout the two figures and appear, as a group, to be comparable with their best European and international competitors on both measures.
- ◆ The levels of sales/employee (the majority of companies in Figure 11 being above £180k per employee) and of value added/employee (the majority of companies in Figure 12 being above £80k per employee) are high compared to most other industries. The levels of R&D per employee (most companies over £25k per employee) are also well above those for most other sectors.

There is a generally rising trend of both sales/employee and value added/employee as R&D/employee increases.

The UK pharmaceutical companies appear, as a group, to be comparable with their best European and international competitors.

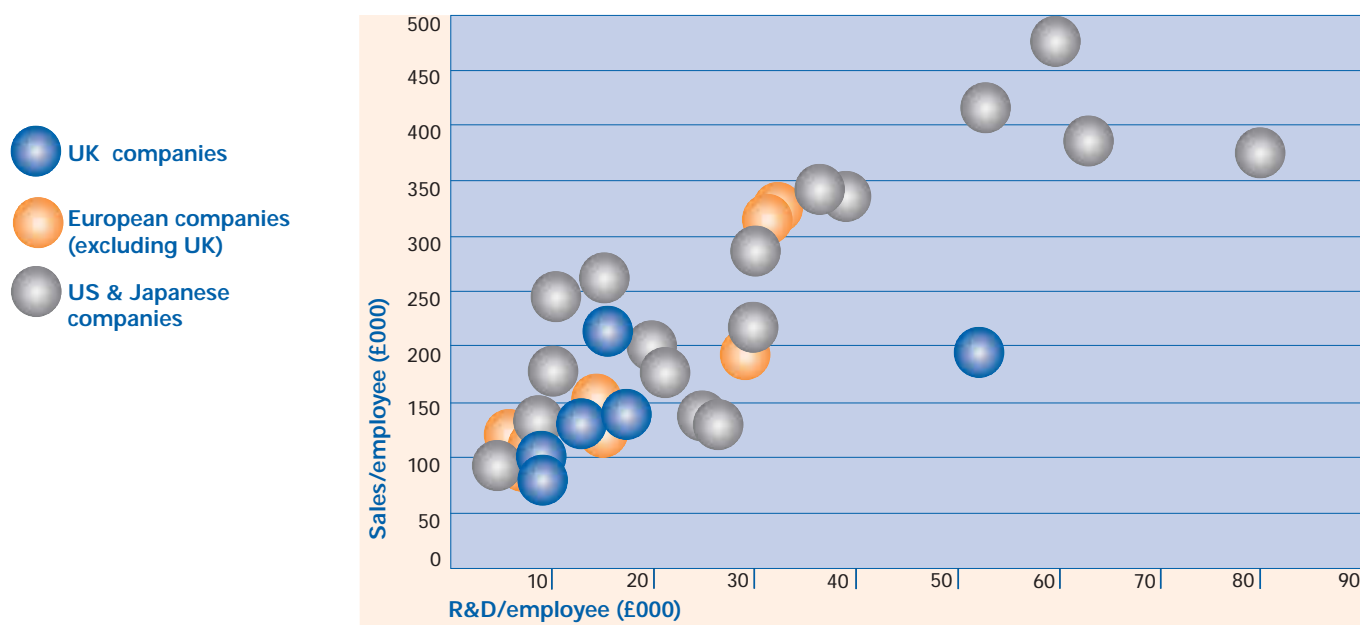
Analysis

For IT hardware most companies have R&D/employee over 17K.

Figures 13 & 14 are similar plots to Figures 11 & 12 but for the IT hardware sector. In Figure 14, value added per employee is shown for the nine European companies in the international Scoreboard plus a further four UK companies whose R&D is over £8m and sales over £60m. In Figure 13, a further 18 international companies are added (about every fourth company from the US and Japan). Again there is a rising trend for both sales/employee and value added/employee with R&D per employee. The other conclusions are:

- ◆ Most international companies lie above £180k sales/employee, as for pharmaceuticals, but the value added/employee levels are lower with most companies above £50k/employee but with some above £120k. R&D per employee levels are somewhat lower than pharmaceuticals with most companies in Figure 13 above £17k rather than £25k.

Figure 13 — Sales per employee versus R&D per employee — IT hardware



UK IT hardware companies tend to have lower sales and R&D per employee than international competitors, except ARM which has very high R&D per employee and the highest value added per employee in Figure 14.

- ◆ The UK companies tend to lie at the lower sales and R&D per employee end of Figure 13 with one exception (ARM) which is high growth and has very high R&D per employee and the highest value added/employee in Figure 14. The small size of the UK hardware sector is reflected in the presence of only two companies out of 89 in the international Scoreboard (compared with five out of 54 for pharmaceuticals).

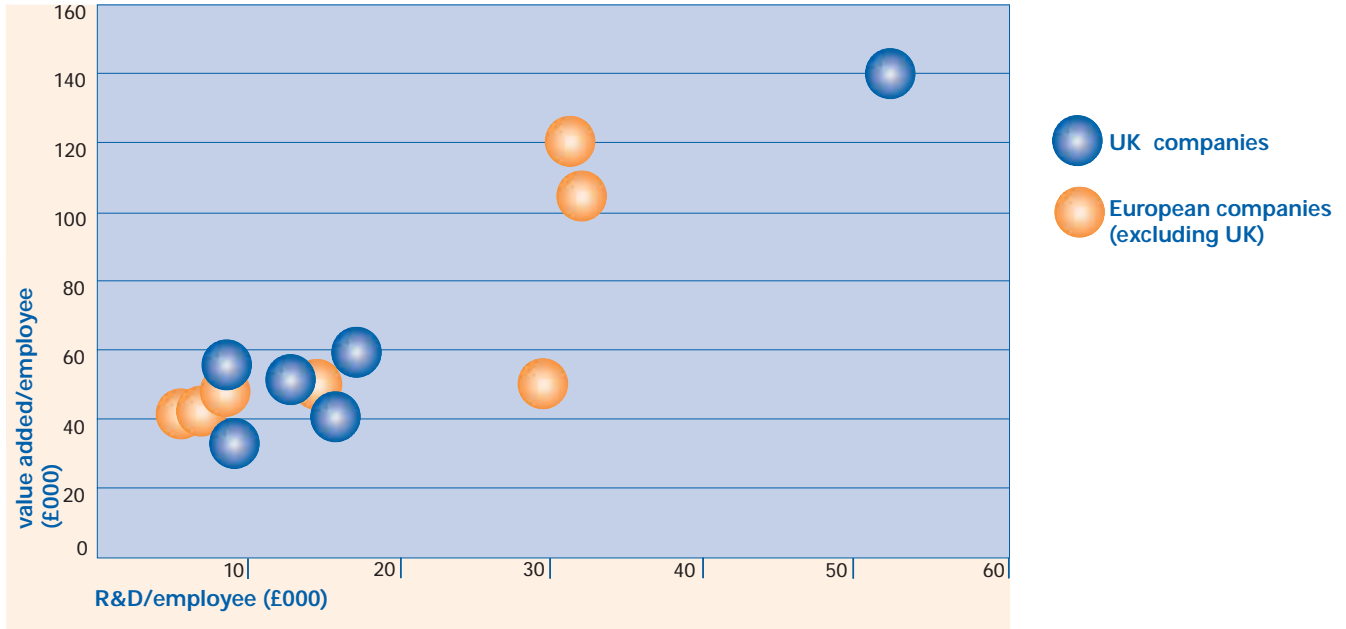
In Figures 11-14, it can be seen that the trend identified in the 2000 Scoreboard for sales per employee to rise with R&D per employee is confirmed and is seen perhaps more clearly when value added is used in place of sales. Productivity is clearly linked to R&D per employee in R&D intensive sectors.

Value added allows cross-sectoral comparisons to be made and this is illustrated in Figure 15. This is a plot, similar to Figures 12 & 14, of value added/employee against R&D/employee but includes all the 14 UK companies in the international Scoreboard drawn from the high R&D sectors of Figure 2.

Figure 15 shows:

- ◆ that the companies all have value added/employee above the average figure for the FTSE 350 companies (about £44k per employee). Some of the companies have more than twice this figure;

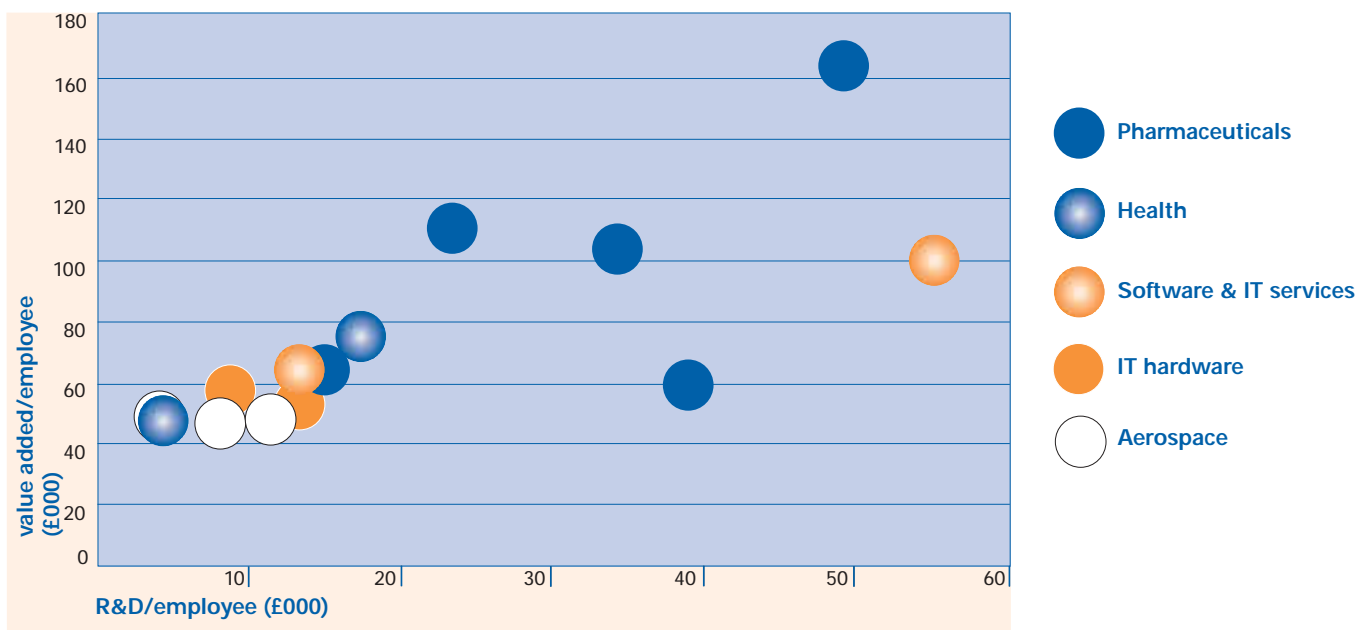
Figure 14 — Value added per employee vs R&D per employee — IT hardware (Europe)



- ♦ that value added/employee rises with R&D/employee for companies over a range of high R&D sectors;
- ♦ that companies from the different sectors are 'layered' in value added with pharmaceuticals* generally at the high value added end followed by software and then by hardware and aerospace & health. A comparison of Figures 12 & 14 shows that there is more overlap of, for example, IT hardware and pharmaceuticals when continental European companies are added, since this brings in a wider range of businesses. There is much more to be gleaned from a detailed study of value added between sectors and companies in the UK and continental Europe.

UK companies in R&D-intensive sectors have value added per employee above the £44k average for FTSE 350 companies.

Figure 15 — Value added for UK large companies in high R&D sectors



*The largest UK health sector company has a substantial pharmaceutical component.

6.3 Market value

The 2001 R&D Scoreboard contains data on the market capitalisation of listed companies for the first time. Some 56% of the market cap of the international Scoreboard is contributed by the US which has 42% of the 500 companies. The UK has over 10% of the total international market cap but under 7% of the companies, so the UK's larger companies are also mostly of above average market cap. The 2000 Scoreboard and References 8 and 9 highlight the relationship in both the US and UK between R&D intensity and market value.

Previous work in both the US and UK has highlighted the positive relationship between R&D intensity and market value.

Turning to the UK's largest listed companies, the FTSE 100 index tracks the share price of the largest group of companies by market cap. The number of 'R&D-heavy' companies (R&D intensity >5%) in the FTSE 100 has increased from eight in the 1998 Scoreboard to 13 in 2001. This is shown in Figure 16 and is a significant increase given the changes that have occurred in the technology sector over the last 18 months.

Figure 16 — R&D-heavy companies in the FTSE 100

	1998	1999	2000	2001
Number of companies with R&D intensity \geq 5% in FTSE 100	8	8	12	13

The share prices of all but one of these knowledge-intensive companies can be followed over several years to see how their market value compares with the FTSE 100 index itself.

This is illustrated by Figure 17a, which shows the share price of the high R&D 1998 Scoreboard companies from 1997 to 2000 (assuming equal investments in each rather than investments weighted by market cap). Figure 17b provides the same data for the 2001 high R&D FTSE 100 Scoreboard companies from 1998 to 2001. In both cases, the performance of the high R&D intensity sub-group of FTSE 100 companies is ahead of the FTSE 100 index. Only in one year — 1999 — does the share price of the 1998 sub-group dip slightly below the index. The 2001 sub-group is ahead in all years. The high R&D sub-group of the FTSE 100 is thus increasing in number and its average share price is ahead of this index.

The high R&D intensity sub-group of FTSE 100 companies is increasing in number and its average share price is well ahead of the FTSE 100 index.

Figure 17a — 1998 Scoreboard (FTSE 100 companies with R&D \geq 5% sales)

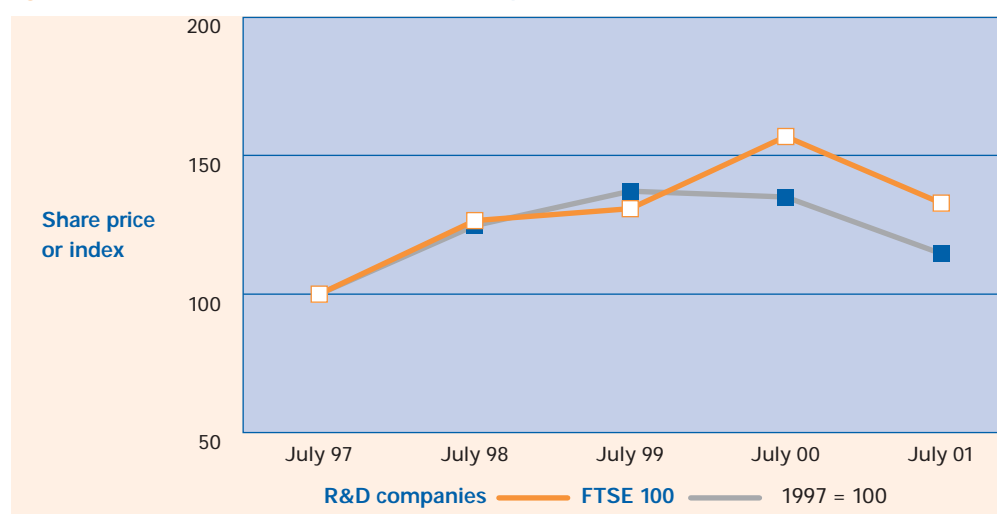
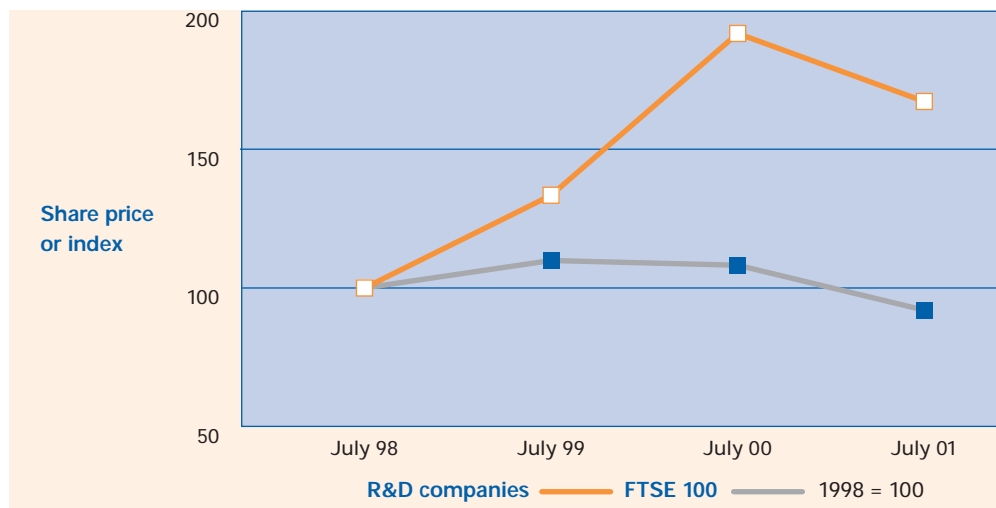


Figure 17b - 2001 Scoreboard (FTSE 100 companies with R&D ≥5% sales)



The market appears to value R&D more consistently in some sectors than others. For example, R&D 'pipelines' in pharmaceutical companies are followed closely by analysts but some other sectors receive less attention, even though they often contain companies with records of consistent and substantial R&D investment that has delivered growth from new products and services. Indeed, the change in the markets' view of internet 'technology' companies over the last 18 months has highlighted the merits of R&D-heavy companies, for achieving innovation-led profitable growth. Conversely, it has been pointed out (Reference 10) that reductions in R&D can often be a leading indicator of potential problems for a company.

The R&D Scoreboard is thus a valuable source of data for the investor on the comparative R&D investment and financial performance of companies in all the major sectors both nationally and internationally. A company's R&D investment is given for the four previous years together with R&D and sales growth CAGR's over four years. This historical information is supplemented by sales per employee and R&D per employee and value added information is now being included. The Scoreboard can be updated between issues for companies of particular interest by following their annual reports.

The change in the markets' view of internet 'technology' companies over the last 18 months highlights the merits of R&D-heavy companies for achieving innovation-led growth.

Fully 50% of UK companies' R&D is in pharmaceuticals, health and aerospace which all have R&D intensity above international levels. 45% of international R&D is in IT hardware and automotive compared to 13% for the UK.

UK R&D intensity is below international levels in electronics & electrical, software & IT services, chemicals and engineering. These sectors also form a smaller proportion of total UK R&D.

7. Conclusions

Analysis of the greatly expanded data-set collected for the 2001 Scoreboard provides insights into R&D-dependent sectors and the potential of R&D investment to improve company performance. The main points made in the preceding sections are:

- ◆ A series of improvements have been introduced for the 2001 Scoreboard. The major ones are the increased size of the international section (from 300 to 500 companies) which makes UK/international comparisons more robust and the introduction of value added per employee as a new productivity measure for European companies.
- ◆ UK companies' total R&D investment is heavily slanted towards pharmaceuticals & health (40%) and aerospace & defence (10%). These sectors total 50% compared to under 22% in the international Scoreboard. These three sectors all have UK R&D intensity (R&D as a percentage of sales) well above the international average intensity for the comparator sector. This position is being maintained or improved in all three cases.
- ◆ International R&D is, on the other hand, slanted towards the physics-based sectors of IT hardware (27%) and automotive (18%). These sectors account for 45% of the total compared to 13% of the UK Scoreboard. The IT hardware sector in the UK has shown a significant increase in both size and intensity over the last few years but is still less than 30% of the relative size of the international sector.
- ◆ UK R&D intensity is well below international levels in sectors such as electronics & electrical, chemicals, software & IT services and engineering. The trend over the last two to three years shows some improvement in engineering and software & IT services although the gap is still large in both cases. A comparison with international sectors suggests that affordability is not the major constraint on UK R&D in electronics & electrical, chemicals and engineering, but pressures on profit may be.
- ◆ Investment at the expense of short-term profit may be needed in some sectors to initiate the virtuous circle of higher profitability sustained by higher R&D. This situation obtains for pharmaceuticals and health in the UK and for other sectors in the USA.
- ◆ These conclusions on the R&D of UK and international sectors are not significantly altered by excluding from the UK sectors the UK subsidiaries of overseas companies which will also have substantial R&D in their home countries.
- ◆ The distribution of companies in a sector by R&D intensity shows that the UK/international intensity differences in sectors such as electronics & electrical, software & IT services, chemicals and engineering result from the presence of a much greater proportion of large and middle-sized UK companies at the lower intensities and, consequently, many fewer at the higher intensities.
- ◆ A comparison of middle-sized and large UK companies with those in the 1000-company USA Scoreboard shows that the US has seven times as many (27% vs 4%) companies with high R&D intensity of over 10%. The difference lies mainly in the physics-based industries of IT hardware and software & IT services, electronics & electrical, and instrumentation. The US proportion of high R&D intensity companies has also been increasing over the last few years.

- ◆ R&D intensity is positively correlated with company performance measures such as sales growth, productivity and market value. Sales growth is shown to be much larger for companies having a large percentage of sales from new products. The 2000 Scoreboard analysis of the correlation of R&D with productivity used sales per employee as a surrogate measure of productivity and linked this with R&D per employee. New data on value added per employee (for European companies) has been used in the 2001 Scoreboard to show a similar but more pronounced rising trend with R&D per employee. The proportion of high R&D companies in the FTSE 100 has been increasing over the last three years and their market value has been rising faster than the index.
- ◆ Overall, the messages for the UK are that strong relative positions in pharmaceuticals, health and aerospace & defence based on substantial R&D investment are being maintained. However, the proportion of R&D is low by international standards in physics-based industries such as IT hardware, automotive and electronics & electrical. The UK also has low relative R&D intensity in software & IT services and in medium R&D sectors such as electronics & electrical, engineering and chemicals. This is not just determined by the largest companies or by UK subsidiaries of overseas companies but is reflected in the overall group of UK-owned middle-sized and larger companies. There are promising companies of smaller size, some of which have the potential to grow and succeed in their sectors, for example by becoming leaders in worldwide market niches.
- ◆ The challenge for the UK is to maintain its areas of strength while enhancing the chances for companies of all sizes to grow and succeed in the high and medium R&D intensive sectors where there is room for improvement. Both innovation-led growth and transition to higher value added, higher growth areas provide ways of achieving this.

R&D intensity is positively connected with company performance, but the UK has a smaller proportion of companies than the US with intensity over 10%.

The challenge for the UK is to maintain its areas of strength whilst enhancing other sectors through innovation-led growth and transition to higher growth, higher value-added.

8. References

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Listings by sector of top 500 UK companies by R&D investment

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per % employee £000
	£000	% CAGR		£m	CAGR	
All companies composite	14,991,733	14	2.1	731,399	6	3.5
1 Aerospace & defence	1,503,296	30	7.7	19,452	9	8.5
BAE Systems	987,000	44	10.2	9,646	11	11.6
Rolls-Royce	371,000	17	6.3	5,864	8	8
Smiths Industries (now Smiths)	63,300	6	4.3	1,464	10	4.1
Meggitt	22,950	19	5.9	386	11	5.4
Cobham	21,600	18	3.8	568	20	3.1
Britax International	17,700	6	2.8	638	-10	2.6
Ultra Electronics	9,555	0	4.2	227	16	4.1
Alvis	5,936	39	2.9	203	23	3.9
Chemring	3,207	19	4.8	67	-4	2.7
Vosper Thornycroft	830	-15	0.3	323	8	0.2
2 Automobiles & parts	822,515	29	4.2	19,636	8	5.1
<i>Ford</i>	<i>633,000</i>	<i>44</i>	<i>7.3</i>	<i>8,706</i>	<i>8</i>	<i>16.2</i>
GKN	88,000	-2	2.1	4,124	9	2
<i>TRW</i>	<i>35,000</i>	<i>n/a</i>	<i>2</i>	<i>1,743</i>	<i>n/a</i>	<i>1</i>
<i>Federal-Mogul</i>	<i>19,000</i>	<i>n/a</i>	<i>3.5</i>	<i>548</i>	<i>n/a</i>	<i>2.3</i>
<i>Nissan Motor</i>	<i>11,215</i>	<i>5</i>	<i>0.6</i>	<i>1,814</i>	<i>7</i>	<i>2.4</i>
<i>Goodyear</i>	<i>10,763</i>	<i>26</i>	<i>2.8</i>	<i>383</i>	<i>-8</i>	<i>2.7</i>
Torotrak	6,938	84	n/a	0	n/a	48.5
Wagon	5,900	29	1.4	409	0	1.1
Avon Rubber	5,184	-11	1.9	278	-5	0.9
<i>Pirelli</i>	<i>4,803</i>	<i>-11</i>	<i>0.7</i>	<i>690</i>	<i>5</i>	<i>1.1</i>
Antonov	1,070	1	n/a	0	n/a	62.9
Mayflower	800	n/a	0.1	593	21	0.2
Wilshaw	490	24	2.1	23	-19	1.7
3 Beverages	72,267	-23	0.5	15,288	9	0.8
Diageo	69,000	2	0.6	11,870	26	1
<i>PepsiCo</i>	<i>1,769</i>	<i>-21</i>	<i>0.4</i>	<i>463</i>	<i>-6</i>	<i>0.4</i>
Allied Domecq	1,000	-29	<0.1	2,620	-16	0.1
HP Bulmer	498	-3	0.1	335	7	0.4
4 Chemicals	404,524	-3	1.4	28,311	-1	2.6
ICI	176,000	-2	2.3	7,748	-7	3.8
BOC	59,200	-12	1.7	3,580	-1	1.4
Johnson Matthey	39,900	12	0.7	5,904	25	6.2
<i>Lubrizol</i>	<i>18,184</i>	<i>24</i>	<i>13.4</i>	<i>136</i>	<i>6</i>	<i>43.7</i>
<i>Millennium</i>	<i>17,405</i>	<i>38</i>	<i>1.6</i>	<i>1,064</i>	<i>28</i>	<i>3.9</i>
Yule Catto	10,863	19	2.3	470	14	2.8
<i>Laporte (now part of Degussa)</i>	<i>10,300</i>	<i>-2</i>	<i>1.1</i>	<i>930</i>	<i>-3</i>	<i>1.9</i>
<i>Ciba Specialty Chemicals</i>	<i>10,154</i>	<i>n/a</i>	<i>1.7</i>	<i>582</i>	<i>12</i>	<i>3.3</i>
Croda International	7,200	-2	2	366	-5	3
<i>DUKL</i>	<i>5,498</i>	<i>n/a</i>	<i>0.4</i>	<i>1,231</i>	<i>n/a</i>	<i>1.1</i>
<i>Exxon Chemical (now ExxonMobil Chemical)</i>	<i>5,048</i>	<i>-13</i>	<i>1.1</i>	<i>444</i>	<i>-4</i>	<i>5.8</i>
<i>Albright & Wilson (now Rhodia) (now part of Rhodia, France)</i>	<i>4,600</i>	<i>-13</i>	<i>0.6</i>	<i>742</i>	<i>1</i>	<i>1</i>
<i>Ascot (now part of Dow)</i>	<i>3,800</i>	<i>n/a</i>	<i>1.1</i>	<i>337</i>	<i>36</i>	<i>1.8</i>
<i>Monsanto</i>	<i>3,729</i>	<i>2</i>	<i>1.4</i>	<i>273</i>	<i>-7</i>	<i>2.7</i>
<i>Hickson International (now part of Arch Chemicals)</i>	<i>3,700</i>	<i>-14</i>	<i>1.8</i>	<i>208</i>	<i>-14</i>	<i>2.7</i>
British Vita	3,500	34	0.4	944	1	0.4
<i>BASF</i>	<i>3,301</i>	<i>5</i>	<i>0.7</i>	<i>502</i>	<i>-8</i>	<i>3</i>
Scapa	3,200	-19	1.6	203	-21	1.7
Yorkshire	2,690	-3	1.9	143	2	2.2
<i>Bayer</i>	<i>2,158</i>	<i>66</i>	<i>0.6</i>	<i>344</i>	<i>-7</i>	<i>1.7</i>
Porvair	2,155	0	3.3	65	4	3.3
Victrex	1,562	14	2.6	59	12	9.6
<i>Clariant</i>	<i>1,232</i>	<i>28</i>	<i>0.6</i>	<i>215</i>	<i>45</i>	<i>1.4</i>
<i>Chemetall</i>	<i>998</i>	<i>-24</i>	<i>5</i>	<i>20</i>	<i>-39</i>	<i>4.8</i>
<i>MacDermid</i>	<i>980</i>	<i>n/a</i>	<i>1.8</i>	<i>54</i>	<i>n/a</i>	<i>2</i>
<i>Robinson Brothers</i>	<i>963</i>	<i>0</i>	<i>4.2</i>	<i>23</i>	<i>-9</i>	<i>2.6</i>
<i>Great Lakes Europe</i>	<i>829</i>	<i>-49</i>	<i>0.5</i>	<i>174</i>	<i>-28</i>	<i>1</i>

Company
4 Chemicals continued
<i>Starnhurst</i>
<i>Dow Chemical</i>
<i>Exxon Chemical Olefins</i>
<i>Exchem</i>
Environmental Polymers
Zotefoams
European Colour
Reflec
5 Construction & building
Pilkington
Caradon (now Novar)
<i>Hepworth (now part of Vaillant, Germany)</i>
Balfour Beatty
BPB
Low & Bonar
Hanson
Wolseley
Cape
<i>Norcros</i>
<i>SGB (now part of Harsco, USA)</i>
Johnston
James Halstead
Titon
<i>Anglian (now part of Naiglan Investments)</i>
Blue Circle Industries
6 Distributors
Premier Farnell
Headlam
7 Diversified industrials
<i>Wassall (now part of Wengen)</i>
<i>Barlow International (now Barloworld)</i>
8 Electricity
<i>British Nuclear Fuels</i>
Innogy
British Energy
International Power
<i>ABB</i>
National Grid
Viridian
Scottish Power
PowerGen
Scottish and Southern Energy
<i>WPD</i>
9 Electronic & electrical
Invensys
<i>Philips Electronics</i>
<i>Siemens</i>
<i>Racal Electronics (now part of Thales, France)</i>
Fairey (now Spectris)
<i>ASTEC</i>
Pace Micro Technology
Laird
Oxford Instruments
<i>Sony</i>
Renishaw
Domino Printing Sciences
Roxboro
Pressac
Delta
Chloride

The data below are an extract from the full 2001 Scoreboard. The extract includes the top 500 R&D investing companies among the 597 companies in the UK list and the top 500 R&D investing companies in the international list. The sector-level figures shown are those calculated for all 597 companies. To access the full set of data for all 597 companies and 500 international companies see the back cover.

	2000 R&D investment		R&D as % of sales	Sales		R&D per employee
	£000	% CAGR	£m	% CAGR	£000	
	800	n/a	0.5	148	n/a	0.6
	629	159	0.2	291	-7	1.9
	620	-16	0.3	246	-3	2.7
	557	-9	1.5	38	-2	1.4
	549	n/a	n/a	0	n/a	42.2
	529	14	2.5	21	0	2.4
	523	7	1.2	43	17	1.7
	465	108	15.5	3	44	9.9
	89,292	-17	0.4	23,396	-8	0.5
	29,000	-12	1.2	2,507	-4	1.1
	27,200	3	1.6	1,745	-5	1.6
	9,100	-1	1.5	600	-6	1.5
	8,000	-28	0.3	2,342	-14	0.3
	3,500	-14	0.2	1,587	3	0.3
	2,591	3	0.9	305	-8	0.7
	2,200	-52	0.1	3,136	-29	0.1
	1,500	-24	<0.1	6,403	10	0
	1,300	-5	0.6	236	-1	0.2
	1,000	n/a	1.3	76	n/a	0.4
	900	n/a	0.3	273	n/a	0.2
	576	-12	0.4	141	-2	0.4
	502	8	0.5	93	4	0.7
	499	3	3.3	15	6	2
	442	-20	0.2	260	5	0.1
	400	-56	<0.1	2,127	4	0
	2,404	n/a	0.2	1,482	6	0.2
	1,000	0	0.1	876	8	0.2
	527	n/a	0.1	449	25	0.2
	7,652	10	0.5	1,477	-4	0.6
	6,600	32	1.2	565	-13	1.1
	1,052	-23	0.1	912	4	0.1
	132,581	-3	0.4	31,299	11	1.4
	45,000	1	2.2	2,064	7	2.3
	20,000	n/a	0.5	3,884	n/a	5.9
	17,000	-4	0.8	2,124	3	3.2
	14,000	-18	0.7	1,885	-15	2.8
	12,181	22	1.2	989	-2	1.4
	8,100	1	0.2	3,800	27	1.1
	6,200	n/a	1	641	3	2.1
	4,200	-7	0.1	6,349	21	0.2
	4,000	-10	0.1	4,191	10	0.6
	1,300	13	<0.1	3,586	39	0.1
	400	-5	0.1	470	-2	0.2
	640,176	4	3	21,048	11	2.9
	283,000	11	3.6	7,863	27	3
	54,400	13	4.4	1,229	-3	9.6
	54,400	-20	2.2	2,471	13	3.5
	43,300	-12	4.9	891	-4	4.4
	25,733	20	5.5	464	17	5.8
	24,181	47	5.7	427	4	1.5
	22,320	55	5.9	378	18	20.2
	12,600	1	1.1	1,097	3	0.9
	10,843	1	5.9	185	6	7
	9,571	-5	0.4	2,452	5	1.9
	9,277	15	8.8	106	8	7.2
	8,261	6	5.5	150	8	5.5
	8,226	8	4.8	172	12	3.9
	6,459	53	2.4	268	40	1.6
	5,700	30	0.8	687	-8	0.5
	5,385	26	2.8	192	11	3

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per employee
	£000	% CAGR	£m	% CAGR	£000	
9 Electronic & electrical continued						
First Technology	5,360	26	4.6	117	32	3.6
<i>Sharp Electronics</i>	4,877	-4	1.6	301	0	3.6
MTL Instruments	4,663	0	9.7	48	3	5.2
Xaar	3,921	15	17	23	84	19.1
Druck	3,870	11	5.5	70	10	4.4
NXT	3,819	32	29.4	13	-27	21.3
Volex	3,460	20	0.8	418	24	0.3
<i>Industrial Control Services (now part of Tritrax)</i>	3,303	-5	6.4	52	-9	5.7
Linx Printing Technologies	2,559	13	7.3	35	20	5.5
<i>Zellweger Analytics</i>	2,134	6	5.5	39	18	4.3
Amstrad	2,119	106	1.7	127	68	29.8
Osmetech	1,952	84	n/a	0	n/a	51.4
<i>SDL (UK)</i>	1,732	69	21.7	8	41	22.5
Densitron	1,679	18	5.6	30	0	7.6
TGI	1,375	1	2.9	47	2	3
Blick	1,355	6	1.7	80	6	1.2
Advanced Power Components	814	92	9	9	11	15.7
Dewhurst	748	9	3.4	22	10	2
Magnum Power	608	-6	30.4	2	19	17.9
<i>Emerson</i>	603	-20	0.2	258	8	0.2
Bulgin	586	10	3.3	18	-1	1.4
Radamec	580	0	4.8	12	-8	3.1
FW Thorpe	542	17	2	27	6	1.2
<i>Utilitec</i>	542	62	1.3	43	36	0.6
Feedback	519	-10	5.8	9	3	3.9
<i>Biddle</i>	480	9	4	12	0	3.2
Roxspur	403	32	0.9	46	10	0.6
10 Engineering & machinery						
<i>TI (now part of Smiths)</i>	42,400	4	1.6	2,729	17	1.1
Cookson	41,100	12	1.7	2,482	11	1.9
<i>Cummins</i>	28,509	-4	4.4	655	-4	6.6
Kidde	27,600	n/a	2.5	1,113	n/a	2.9
Tomkins	25,400	25	0.5	5,618	12	0.4
<i>JCB Service</i>	23,674	49	2.9	806	3	6.2
IMI	19,500	11	1.2	1,616	5	1
<i>AGCO International</i>	18,690	32	1.6	1,178	8	2.5
Morgan Crucible	16,900	5	1.6	1,051	4	1
<i>LDV</i>	16,741	33	7.9	213	0	11.6
Enodis	13,600	14	1.2	1,180	23	1.2
<i>Caterpillar</i>	11,630	n/a	2.4	480	n/a	1.1
Glynwed International (now AGA Foodservice)	8,700	21	0.9	969	-8	0.8
Henlys	8,255	32	1.2	680	7	1.6
FKI	8,000	2	0.5	1,742	15	0.5
Halma	7,994	9	3	268	8	2.6
Charter	7,600	-9	0.8	934	-2	0.7
Vitec	7,500	22	3.8	200	8	4.8
<i>Peek</i>	6,069	-8	4.9	123	-4	6.1
Weir	5,453	15	0.7	746	5	0.6
<i>Kvaerner</i>	5,300	-19	0.2	2,600	-14	0.3
<i>Luxfer</i>	5,100	12	1	502	1	1.4
<i>NSK-RHP Europe (now NSK Europe)</i>	4,614	-2	1.9	248	4	0.7
Spirax-Sarco Engineering	4,571	-1	1.6	278	1	1.2
<i>B Elliott</i>	3,930	11	4.1	97	-5	2.7
Senior	3,200	4	0.6	505	-3	0.5
<i>McKechnie</i>	3,100	0	0.6	526	-3	0.6
<i>Endress + Hauser</i>	3,065	n/a	3.8	80	n/a	3.7
LTG Technologies	2,941	n/a	4.3	69	n/a	3.5
<i>Baxi Partnership</i>	2,672	18	1.6	167	15	1.2
Fenner	2,562	3	1.4	180	-9	1.2
Renold	2,500	16	1.2	217	5	0.8
<i>ITT Industries</i>	2,460	-7	2.3	107	-8	3.2

Listings by sector of top 500 UK companies by R&D investment

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per % employee £000
	£000	% CAGR		£m	CAGR	
10 Engineering & machinery cont						
APW	2,441	n/a	1.1	224	n/a	0.7
Molins	2,400	-32	2.4	101	-24	2.3
Syltone	2,281	5	2.7	83	2	2.2
Babcock International	2,235	0	0.5	471	-10	0.3
L Gardner	2,189	n/a	1.8	123	54	0.9
Domnick Hunter	2,096	21	2	103	19	1.7
Rotork	2,040	12	1.9	108	4	2
<i>New Terex</i>	2,003	n/a	0.8	248	n/a	1.4
<i>Raychem</i>	1,672	-29	4.2	40	-28	1.5
<i>Eaton</i>	1,587	-10	1	167	8	1
Manganese Bronze	1,482	-1	1.1	130	8	1.6
600 Group	1,248	1	1.3	99	-9	1.2
McLeod Russel	1,216	11	1.4	89	-6	0.9
Bullough	962	-25	0.8	118	-24	0.6
<i>BWI</i>	931	-25	1.6	59	-10	2
Robotic Technology Systems	914	46	0.8	108	278	1.3
Brunel	839	74	1.2	72	-21	1.1
Lincat	761	-3	2.9	26	1	2.6
Gooch & Housego	723	3	5.6	13	23	3.8
Alumasc	707	10	0.5	136	-3	0.4
<i>Redwood</i>	562	n/a	0.8	71	n/a	0.7
Eleco	449	-14	1.6	28	2	1.7
11 Financials	4,484	n/a	2.1	218	19	4.4
Towry Law	2,026	n/a	6	34	16	4.3
DBS Management	2,010	62	1.1	179	23	4.9
Cresco International	403	n/a	7.5	5	n/a	3.4
12 Food processors	863,254	4	1.6	55,425	-5	2.1
Unilever	746,025	6	2.5	29,905	-3	2.9
Cadbury Schweppes	25,000	4	0.5	4,575	-3	0.7
<i>Hoops</i>	23,976	1	1.3	1,808	2	4.3
Tate & Lyle	13,000	-14	0.3	3,827	-6	0.7
<i>United Biscuits (now part of Finalrealm)</i>	11,800	-14	0.7	1,611	-17	n/a
Devro	8,255	0	3.6	230	-7	2.4
<i>Wittington Investments</i>	8,000	3	0.2	4,445	-6	0.2
PIC International	5,400	-26	3.9	140	-58	3.7
<i>Booker (now part of Iceland)</i>	4,200	-23	0.1	3,715	-3	0.4
<i>Kraft Jacobs Suchard (now Kraft Foods)</i>	3,615	-5	0.5	680	-4	1.4
<i>Hazlewood Foods (now part of Greencore, Ireland)</i>	2,400	3	0.3	775	0	0.2
<i>Bernard Matthews</i>	2,173	1	0.6	344	3	0.3
<i>Milk Products Holdings</i>	1,530	-6	0.4	348	-6	2.7
Dairy Crest	1,500	14	0.1	1,228	21	0.2
<i>Weetabix</i>	1,401	15	0.4	341	6	0.5
<i>Kellogg</i>	1,399	3	0.2	697	2	0.6
<i>Golden Wonder</i>	1,337	31	0.8	162	10	0.9
<i>Tetley</i>	860	-17	0.3	290	10	0.6
Pura	645	4	0.3	201	-8	1.5
13 Forestry & paper	23,097	10	0.5	4,636	-1	0.8
<i>Arjo Wiggins Appleton</i>	21,800	12	0.6	3,364	-1	1.2
James Cropper	697	3	1.3	54	-3	1.4
David S Smith	600	-18	<0.1	1,218	0	0.1
14 Gas distribution	19,100	n/a	0.1	13,020	n/a	0.4
Lattice	19,000	n/a	0.6	3,087	n/a	1.2
15 General retailers	123,266	n/a	1.1	11,725	n/a	0.8
Great Universal Stores	86,300	43	1.4	6,041	21	1.2
Boots	25,500	6	0.5	5,221	3	0.3
Body Shop International	6,700	9	1.8	374	8	1.2

Company

15 General retailers continued

QXL.com (now QXL ricardo)
ebookers.com

16 Health

Nycomed Amersham (now Amersham)
Smith & Nephew
SSL International
Biocompatibles International
Gyrus
Whatman
Medisys
Axis-Shield
Huntleigh Technology
AorTech International
Bespak
Bioquell
Tepnel Life Sciences
Maelor
Biotrace International
CytoCell
Celsis International
Drew Scientific
Genetix
Advanced Medical Solutions
Ferraris
NMT
Medical Solutions

17 Household goods

Courtaulds Textiles (now part of Sara Lee, USA)
Kenwood Appliances (now part of De'Longhi Pinguino, Italy)
Coats Vijella (now Coats)
Stoves (now part of Precip (521)
Texon International
Gaskell
Pittards
Lamont
Chapelthorpe
Royal Doulton
Hornby

18 IT hardware

Marconi
NCR
Nortel Networks
Spirent
Motorola
ARM
Filtronic
Bookham Technology
STMicroelectronics
Psion
Xerox
TTP Communications
ARC International
Plasmon
Imagination Technologies
Telemetrix
Telspec
Zen Research
Hitachi Europe
Scipher
Toshiba
NEC Europe

	2000 R&D investment		R&D as % of sales	Sales		R&D per employee
	£000	% CAGR	£m	% CAGR	£000	
	2,840	n/a	40.6	7	n/a	26.3
	1,926	n/a	2.3	82	n/a	3.3
	261,523	33	7.2	3,632	17	7.5
	149,000	59	11.6	1,283	36	17
	46,400	9	4.1	1,135	2	4.4
	9,300	49	1.4	649	58	1.2
	8,999	2	16.4	55	50	7.4
	7,141	101	26.4	27	138	22.8
	6,786	15	6.9	99	4	6.4
	6,187	63	68.7	9	22	24.5
	5,403	49	15.4	35	55	12.9
	5,062	11	3.8	132	9	3.3
	4,626	188	115.7	4	19	39.9
	2,473	32	3	83	2	2.6
	1,671	58	11.1	15	2	6.5
	1,103	15	110.3	1	n/a	19
	1,040	94	n/a	0	n/a	57.8
	887	8	11.1	8	12	8.4
	842	56	84.2	1	n/a	n/a
	787	-27	4.4	18	22	3.3
	756	30	25.2	3	11	13
	754	78	6.9	11	54	12.8
	706	23	8.8	8	68	4.4
	566	50	1.5	38	17	1
	489	16	n/a	0	n/a	3.8
	444	n/a	4.4	10	19	3.1
	18,175	0	0.5	3,695	-8	0.2
	3,300	9	0.4	900	-5	0.1
	2,963	-3	2	145	-7	1.6
	2,600	-12	0.2	1,596	-10	0.1
	2,064	18	2	102	13	1.5
	1,590	6	1	152	8	1.1
	1,499	16	2	76	15	1.4
	651	43	0.8	81	-7	0.8
	574	-2	1.2	48	-21	0.8
	519	-12	0.4	139	-17	0.5
	500	-2	0.3	183	-8	0.1
	401	23	1.6	25	-4	2.2
	1,129,702	11	6.2	18,289	-1	11.2
	669,000	10	10.1	6,653	1	12.9
	64,682	28	12.3	528	5	21.4
	64,500	-7	3.5	1,851	23	6.4
	60,300	27	8.7	697	7	8.7
	46,872	6	1.3	3,718	6	5.1
	27,518	72	27.2	101	55	52.4
	26,352	67	11.9	222	61	9.1
	17,355	253	66.8	26	196	28.2
	16,735	2	52.3	32	-4	60
	16,276	20	7.4	220	15	15.8
	14,000	-10	2	697	-36	5
	13,581	n/a	50.3	27	n/a	71.5
	9,298	113	84.5	11	77	51.9
	8,579	49	12.4	69	20	17.1
	7,990	16	44.4	18	5	47.8
	7,671	1	7.5	102	-6	6.8
	5,835	13	13	45	-8	12.8
	5,553	9	n/a	0	n/a	85.4
	5,093	6	0.4	1,143	2	3.1
	4,766	55	29.8	16	34	15
	4,644	n/a	2	229	-7	3.4
	4,484	62	0.4	1,054	-6	3.4

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per employee
	£000	% CAGR	£m	% CAGR	£000	
18 IT hardware continued						
<i>Lucent Technologies (now Avaya (UK)) (now part of Avaya, USA)</i>						
	3,689	17	1.1	344	35	4.3
Surface Technology Systems	3,182	58	8.8	36	24	12.5
Tadpole Technology	2,754	11	16.2	17	-8	21.5
Radstone Technology	2,752	5	6.7	41	20	7.3
DICOM	2,413	169	2.4	99	73	5.4
CML Microsystems	2,034	8	9.2	22	5	9.6
IQE	1,870	n/a	6.2	30	n/a	5.8
Memory (now Torridon)	1,709	21	1.7	98	361	9.7
<i>Remec Europe</i>	1,503	36	12.5	12	41	9.6
Motion Media	1,381	173	46	3	44	22.6
Yeoman	1,376	412	12.5	11	n/a	6.6
<i>Cadence Design Systems</i>	1,189	-2	3.4	35	18	3.8
Inteltek	973	71	2.9	34	6	2
Concurrent Technologies	929	23	11.6	8	3	18.2
Network Technology	468	33	5.2	9	-15	2.9
19 Leisure & hotels						
Eidos	47,173	102	24.2	195	164	80.9
Games Workshop	2,362	12	3	78	15	1.1
On-Line	1,934	205	193.4	1	0	52.3
Arthur Shaw	1,421	n/a	12.9	11	n/a	6
Digital Animations	639	95	32	2	26	18.3
Whitbread	500	-44	<0.1	2,595	-4	0
Kunick	416	n/a	0.3	149	6	0.1
20 Media & photography						
Reuters	323,000	12	9	3,592	5	19.1
<i>Kodak</i>	26,200	6	2.1	1,259	3	4.5
Aegis	22,400	11	0.4	5,713	13	4.1
<i>British Broadcasting</i>	17,600	16	0.6	3,165	8	0.7
Carlton Communications	14,900	8	0.7	2,080	6	1.1
<i>Channel Four Television</i>	7,000	5	1	716	8	7.8
Photo-Me	3,531	7	1.8	200	0	1.8
<i>Independent Television Commission</i>	2,865	10	15.9	18	3	15.3
<i>Clear Channel</i>	2,192	n/a	0.9	240	n/a	1.4
365	1,050	n/a	2.1	50	n/a	1.9
MotionPoster	854	n/a	n/a	0	n/a	106.8
Sportsworld Media	845	n/a	4	21	n/a	3
21 Mining						
Rio Tinto	26,108	-17	0.5	5,272	3	0.9
Anglo American	22,761	n/a	0.2	9,924	34	0.1
Lonmin	1,339	-18	0.2	637	-25	0
<i>Watts Blake Bearne</i>	1,275	6	0.8	155	11	0.7
22 Oil & gas						
BP Amoco (now BP)	290,534	23	0.3	99,118	22	3
Shell	260,410	-13	0.3	99,843	5	2.7
BG	34,000	-11	0.7	4,769	-16	2
<i>Esso</i>	33,600	0	0.8	4,353	-3	10.1
<i>Total Oil (now TotalFinaElf)</i>	11,389	-15	0.3	4,047	15	0.9
<i>Schlumberger</i>	9,089	-19	3.4	265	-3	2.9
<i>Elf</i>	4,500	-4	0.1	3,442	18	2.1
Hunting	2,600	10	0.2	1,190	-2	0.3
<i>Texaco North Sea</i>	1,955	-25	<0.1	6,347	13	0.5
Enterprise Oil	1,500	-2	0.1	1,841	16	2.5
Expro International	898	-19	0.5	172	13	0.6
<i>Chevron</i>	707	-32	0.2	302	-27	2.5
23 Packaging						
Rexam	25,000	2	0.9	2,730	4	1.1
<i>Chesapeake</i>	2,534	n/a	1.3	199	n/a	0.9
API	2,333	44	1.2	189	10	1.3

Listings by sector of top 500 UK companies by R&D investment

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per % employee £000
	£000	% CAGR		£m	CAGR	
23 Packaging continued						
<i>Dolphin Packaging</i>	1,059	10	2.1	51	11	1.4
24 Personal care	61,221	8	1.1	5,550	10	1.7
Reckitt Benckiser	46,000	11	1.4	3,202	8	2.4
<i>Kimberly-Clark</i>	5,017	-2	0.7	694	-3	2
<i>Gillette Industries</i>	3,214	18	0.3	1,126	22	1.5
Paterson Zochonis	3,192	-3	0.8	409	3	0.3
<i>International Flavours & Fragrances</i>	2,984	5	3.8	79	2	11.9
Swallowfield	703	2	1.8	40	-2	1
25 Pharmaceuticals	5,651,172	25	14.8	38,086	20	27.2
GlaxoSmithKline	2,526,000	21	14	18,079	21	23.3
AstraZeneca	1,936,672	34	16	12,119	23	34
<i>Pfizer</i>	373,241	16	39.2	952	36	84.3
<i>Merial</i>	94,792	n/a	8.4	1,125	n/a	14.8
<i>Roche</i>	92,000	21	17.3	531	11	33.1
<i>Eli Lilly</i>	77,933	n/a	7.8	1,000	n/a	22.9
Celltech	70,200	56	29.7	236	106	38.9
<i>RPR (Aventis)</i>	57,788	-4	7.3	787	-16	13
Shire Pharmaceuticals	47,471	82	13.8	344	97	49
<i>Novartis</i>	40,400	60	7.2	560	19	14.7
<i>Bristol-Myers Squibb</i>	34,788	64	6.6	530	2	12
British Biotech	24,076	-5	802.5	3	-22	79.5
Oxford Glycosciences	22,233	52	247	9	46	136.4
Powderject Pharmaceuticals	21,624	193	720.8	3	n/a	108.7
Vernalis	18,617	11	620.6	3	32	138.9
Cambridge Antibody	15,728	40	157.3	10	50	97.7
<i>Cantab Pharmaceuticals (now part of Xenova)</i>	14,782	25	246.4	6	57	105.6
Amarin	13,963	21	107.4	13	-9	126.9
SkyePharma	13,104	54	54.6	24	22	35.1
Acambis	12,712	27	211.9	6	26	119.9
<i>Johnson & Johnson</i>	9,783	-27	1.2	789	16	2
PPL Therapeutics	9,388	3	n/a	0	n/a	60.2
ML Laboratories	9,269	23	77.2	12	5	48.8
Protherics	9,029	8	451.5	2	19	48.3
Bioglan Pharma	8,341	40	8.3	101	61	14.7
Galen	8,029	56	9.3	86	3	6.7
<i>Quadrant Healthcare (now part of Elan, Ireland)</i>	7,912	102	395.6	2	n/a	87.9
CeNeS Pharmaceuticals	7,785	46	111.2	7	n/a	70.8
Xenova	7,422	-3	n/a	0	n/a	130.2
Gemini Genomics	7,046	n/a	n/a	0	n/a	111.8
Antisoma	6,472	91	323.6	2	n/a	231.1
<i>Merck</i>	5,746	21	3.4	168	8	6.2
Alizyme	5,200	60	n/a	0	n/a	433.3
Weston Medical	5,122	n/a	256.1	2	n/a	61.7
Oxford Biomedica	5,033	37	503.3	1	n/a	102.7
<i>Servier</i>	4,741	14	67.7	7	15	57.1
Provalis	3,900	-10	55.7	7	-11	31.5
Phytopharm	3,394	30	169.7	2	n/a	117
SR Pharma	3,001	32	300.1	1	n/a	125
Pharmagene	2,710	54	271	1	n/a	45.9
<i>PolyMASC</i>	2,264	167	n/a	0	n/a	94.3
ReNeuron Holdings	1,981	n/a	4	49	n/a	66
Senetek	1,809	9	33.8	5	41	95.2
<i>Meconic (now part of Johnson Matthey)</i>	1,291	3	2.1	61	16	5.2
ReGen Therapeutics	1,281	n/a	n/a	0	n/a	106.8
Goldshield	1,004	29	1.4	71	41	3.3
KS Biomedix	978	53	n/a	0	n/a	20.4
<i>Oxford Asymmetry International (now Evotec OAI)</i>	792	41	3.3	24	34	3.2
Proteome Sciences	695	4	n/a	0	n/a	69.5

Company

25 Pharmaceuticals continued
Profile Therapeutics
William Ransom
26 Software & IT services
<i>IBM</i>
Misys
<i>ICL</i>
Amdocs
NDS
CMG
Sage
Merant
Logica
Northgate Information Solutions
Baltimore Technologies
London Bridge Software
NSB
<i>TTP</i>
Infobank International (now Izodia)
Kewill Systems
RM
Cadcentre
DCS
Staffware
Exchange FS
Royalblue
RiverSoft
AIT
Financial Objects
Kalamazoo Computer
Autonomy
<i>Bull</i>
OSP
interactive investor international
Insignia Solutions
Macro 4
<i>Willett International</i>
Sopheon
Sherwood International
Cedar
iSoft
<i>Chyron</i>
Vocalis
Alphameric
Eyretel
Patsystems
Orchestream
Recognition Systems
Flometrics
Anite
Electronic Data Processing
Knowledge Support Systems
EasyScreen
SDL
PhoneLink (now TelMe.com)
Intelligent Environments
JSB Software Technologies (now SurfControl)
Gresham Computing
Microgen
Lynx
IndigoVision
VI
Clinical Computing
XKO
Ultras

	2000 R&D investment		R&D as % of sales	Sales		R&D per employee
	£000	% CAGR	£m	% CAGR	£000	
	533	n/a	10	n/a	4.7	
	436	30	9	-5	2.9	
	724,285	18	17,175	9	6	
	107,400	2	5,901	6	5.5	
	77,600	39	709	26	13.5	
	76,300	-15	2,775	-3	3.4	
	50,108	n/a	748	n/a	6	
	46,184	82	160	84	54.9	
	39,900	101	810	35	3.6	
	38,867	38	412	32	8.4	
	34,485	10	227	31	17.4	
	30,500	46	847	31	3.7	
	15,467	0	165	3	9.7	
	14,720	123	74	65	18.8	
	10,126	199	57	76	19.4	
	8,542	92	41	113	19.8	
	8,011	34	35	4	21.8	
	7,937	n/a	3	-54	42.2	
	7,400	n/a	69	14	10.3	
	7,365	16	208	20	4.7	
	6,485	24	28	13	24.4	
	6,455	42	140	65	3.9	
	6,297	47	38	40	19.4	
	6,137	n/a	21	n/a	20.1	
	6,086	51	57	48	11.9	
	5,759	171	5	n/a	32.4	
	5,744	93	34	33	19	
	4,674	16	18	4	25.1	
	4,666	18	63	-2	5.3	
	4,176	129	44	180	25	
	4,115	39	398	18	1.7	
	4,115	-6	41	13	6.6	
	3,993	173	6	82	31.7	
	3,990	-18	7	-29	37.6	
	3,839	17	39	12	13.4	
	3,482	13	77	2	3.5	
	3,321	28	8	68	22.1	
	3,311	18	54	21	7	
	3,053	33	36	32	9.5	
	2,833	n/a	31	n/a	11.2	
	2,781	74	21	4	14.3	
	2,724	49	3	11	25.2	
	2,715	36	54	40	5.1	
	2,659	37	28	24	9.5	
	2,300	139	2	n/a	26.7	
	2,287	n/a	3	n/a	25.7	
	2,249	81	9	108	24.4	
	2,233	25	12	24	18.2	
	2,104	-41	159	-12	1.5	
	1,828	1	8	-13	9.6	
	1,803	n/a	3	n/a	21.5	
	1,788	n/a	1	n/a	68.8	
	1,610	115	30	65	3.4	
	1,586	-5	52	90	5.9	
	1,326	20	9	32	11.8	
	1,253	22	9	46	8.8	
	1,241	19	23	26	4.8	
	1,136	311	25	-24	3.4	
	1,130	n/a	250	30	0.5	
	1,115	43	1	n/a	28.6	
	1,077	28	6	14	14	
	1,014	0	2	0	26	
	1,004	n/a	38	89	2.2	
	801	n/a	1	n/a	13.8	

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per employee
	£000	% CAGR	£m	% CAGR	£000	
26 Software & IT services continued						
MSW Technology (now Manpower Software)	762	25	2	0	14.1	
Ultima Networks	752	-23	13	-30	4.9	
Pennant International	740	205	14	63	2.4	
Total Systems	619	n/a	4	7	11.9	
Planit	609	n/a	13	7	2.9	
Superscape	608	-14	1	-24	6.4	
TransEDA	597	n/a	4	n/a	16.1	
InterX	440	n/a	403	31	1	
Axon	427	n/a	43	n/a	1.6	
Intercede	391	n/a	2	n/a	16.3	
27 Steel & metals						
Corus	110,320	23	12,451	12	1.6	
British Alcan Aluminium	106,000	24	11,698	13	1.6	
Kelsey Industries (now part of Henkel, Germany)	2,900	2	541	0	1	
1,397	7	1.8	77	5	1.8	
28 Support services						
Chubb	122,811	4	13,710	4	0.4	
Securicor	27,800	7	2,453	8	0.5	
De La Rue	20,700	70	721	-13	0.4	
AEA Technology	15,900	-13	525	-9	2.6	
PA	14,700	28	374	9	3.2	
Post Office (now Consignia)	14,623	n/a	322	14	5.1	
11,000	16	0.1	7,522	5	0.1	
Ricardo	5,158	12	121	4	4	
Genus	3,814	293	134	29	2.4	
Upperpoint (now Eskdale Sidings)	1,075	n/a	45	n/a	2.6	
Applied Optical	1,057	17	29	30	3.1	
Universe	1,044	59	48	68	4.9	
Dawson	900	3	627	10	0.3	
BTG	800	-20	36	14	4.7	
Screen	787	62	5	26	10.1	
WRc	482	n/a	16	-5	1.5	
Latchways	422	31	9	22	9.8	
USF	400	n/a	122	n/a	0.4	
29 Telecommunications						
BT	439,614	0	45,396	18	1.8	
Vodafone	364,000	6	20,427	8	2.7	
Cable and Wireless	72,000	21	15,004	71	1.4	
3,000	-60	<0.1	8,099	8	0.1	
30 Tobacco						
BAT	59,000	12	10,915	3	0.7	
31 Transport						
BBA	41,151	-14	4,547	-3	1.1	
Civil Aviation Authority	19,000	1	1,564	9	1.4	
Powell Duffryn (now part of Prestige Acquisitions)	15,155	-1	651	3	2.4	
2,900	-8	0.7	411	-18	0.7	
Trafficmaster	1,767	40	14	47	8.3	
Minorplanet Systems	1,329	49	17	n/a	5.4	
Railtrack	1,000	-53	1,890	-6	0.1	
32 Water						
Thames Water (now part of RWE, Germany)	26,312	-4	8,394	3	0.4	
9,000	2	0.7	1,368	3	0.7	
AWG	5,300	-5	882	1	0.5	
Severn Trent	3,400	-14	1,682	8	0.2	
Pennon	3,300	13	435	6	1	
United Utilities	2,600	-14	1,698	-8	0.2	
Kelda	1,000	-2	681	2	0.3	
General Utilities (now Vivendi Water)	805	n/a	205	3	0.6	
Hyder (now part of WPD)	700	4	1,286	19	0.1	

Listings by sector of top 500 International companies by R&D investment

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per % employee £000
	£000	% CAGR		£m	CAGR	
All companies composite	193,351,493	10	4.2	4,588,399	9	8.2
1 Aerospace & defence	7,540,329	12	4.4	172,648	11	5.6
BAE Systems, UK	987,000	44	10.2	9,646	11	11.6
Boeing, USA	964,654	5	2.8	34,356	23	4.9
United Technologies, USA	871,603	4	5	17,543	3	5.7
Aerospatiale (now EADS), The Netherlands	676,890	19	5.5	12,210	26	7.6
TRW, USA	593,788	12	5.1	11,535	15	5.8
Honeywell International, USA	547,597	24	3.3	16,751	16	4.4
Snecma, France	510,339	31	14.4	3,548	19	13.9
Finmeccanica, Italy	470,334	n/a	8	5,868	n/a	10.8
Lockheed Martin, USA	433,124	-5	2.6	16,956	-1	3.3
Rolls-Royce, UK	371,000	17	6.3	5,864	8	8
Raytheon, USA	352,122	13	3.1	11,310	8	3.8
Thales, France	249,576	n/a	4.6	5,392	n/a	4.4
Northrop Grumman, USA	144,598	-4	2.8	5,100	-1	3.7
Goodrich, USA	126,255	17	4.3	2,921	18	4.8
Smiths Industries (now Smiths), UK	63,300	6	4.3	1,464	10	4.1
Litton Industries, USA (now part of Northrop Grumman)	62,137	9	1.7	3,741	12	1.5
SAAB, Sweden	61,015	-17	4.8	1,266	21	4
Bombardier, Canada	54,998	-2	0.8	7,176	19	1
2 Automobiles & parts	33,978,625	6	4	854,603	9	7.7
Ford Motor, USA	4,552,149	0	4	113,847	10	13.2
General Motors, USA	4,418,262	-7	3.6	123,599	4	11.4
DaimlerChrysler, Germany	3,982,779	22	3.9	102,058	31	8.9
Toyota Motor, Japan	2,644,907	4	3.6	74,458	4	12.3
Volkswagen, Germany	2,599,293	19	4.8	53,770	14	8.5
Honda Motor, Japan	1,958,099	11	5.5	35,752	9	17.4
Nissan Motor, Japan	1,398,788	n/a	4	35,037	0	9.9
Renault, France	1,287,160	10	5.1	25,250	9	7.7
Robert Bosch, Germany	1,276,028	8	6.4	19,832	11	6.5
Delphi Automotive Systems, USA	1,138,037	n/a	5.8	19,507	n/a	5.4
Fiat, Italy	1,061,530	11	2.9	36,203	10	4.8
Peugeot (PSA), France	1,021,306	15	3.7	27,768	14	5.9
Denso, Japan	938,233	5	8.5	11,038	7	11.6
Istituto Finanziario Industriale, Italy	889,322	7	2.6	34,245	7	3.7
Mitsubishi Motors, Japan	655,951	12	3.4	19,550	-1	10
Mazda Motor, Japan	446,246	n/a	3.5	12,674	4	10.2
Michelin, France	405,573	n/a	4.2	9,676	9	3.2
Valeo, France	360,128	21	6.3	5,732	20	4.8
Aisin Seiki, Japan	311,187	n/a	5.3	5,868	3	9.5
Goodyear, USA	283,237	3	2.9	9,651	2	2.7
Johnson Controls, USA	270,451	25	2.4	11,484	14	2.6
Yamaha Motor, Japan	265,053	5	5.2	5,141	5	10.3
Continental, Germany	262,900	n/a	4.1	6,357	17	4.1
Fuji Heavy Industries, Japan	235,199	15	3	7,796	5	8.7
Dana, USA	192,127	15	2.3	8,341	17	2.4
Faurecia, France	145,685	31	4	3,670	42	4
Toyoda Automatic Loom Works Ltd (now Toyota Industries), Japan	141,050	0	3.8	3,670	9	10.7
Lear, USA	139,711	31	1.5	9,421	23	1.1
Pirelli, Italy	133,870	7	2.8	4,699	9	3.3
Autoliv, Sweden	131,008	18	4.8	2,755	15	4.7
GKN, UK	88,000	-2	2.1	4,124	9	2
Federal-Mogul, USA	85,554	73	2.1	4,025	31	1.7
ArvinMeritor, USA	76,985	n/a	2.2	3,450	n/a	2.1
Yokohama Rubber, Japan	68,151	-1	3	2,298	0	5
NGK Spark Plug, Japan	63,016	10	5.5	1,149	6	7.1
Akebono Brake Industry, Japan	51,650	9	7.3	709	1	11
3 Beverages	194,709	2	1.1	18,160	17	2.1
Kirin Brewery, Japan	125,709	3	2	6,290	5	5.7
Diageo, UK	69,000	2	0.6	11,870	26	1

Company

4 Chemicals

Bayer, Germany
El du Pont de Nemours, USA
BASF, Germany
Dow Chemical, USA
AKZO Nobel, The Netherlands
Mitsubishi Chemical, Japan
Sumitomo Chemical, Japan
Toray Industries, Japan
Solvay, Belgium
Mitsui Chemicals, Japan
Asahi Chemical Industry, Japan
PPG Industries, USA
ICI, UK
Rohm and Haas, USA
Clariant, Switzerland
Teijin, Japan
DSM, The Netherlands
Shin-Etsu Chemical, Japan
Kyowa Hakko Kogyo, Japan
Dow Corning, USA
Rhodia, France
Ciba Specialty Chemicals, Switzerland
FMC, USA
Union Carbide, USA (now part of Dow Chemical)
Eastman Chemical, USA
Showa Denko, Japan
Air Products and Chemicals, USA
Hitachi Cable, Japan
UBE Industries, Japan
Mitsubishi Gas Chemical, Japan
Kaneka, Japan
Mitsubishi Rayon, Japan
DIC, Japan
Daicel Chemical Industries, Japan
LAir Liquide, France
BOC, UK
Lubrizol, USA
Crompton, USA
Nippon Shokubai, Japan
Engelhard, USA
Tosoh, Japan
Hercules, USA
Avery Dennison, USA
Solutia, USA
Lonza, Switzerland
Praxair, USA

5 Construction & building

Saint-Gobain, France
Sekisui Chemical, Japan
Asahi Glass, Japan
Kajima, Japan
Bouygues, France
Toto, Japan
Lafarge, France
Taisei, Japan
Shimizu, Japan
Sekisui House, Japan
<i>Pilkington, UK</i>

6 Diversified industrials

General Electric, USA
E.ON, Germany
Tyco International, Bermuda

	2000 R&D investment		R&D as % of sales		Sales		R&D per employee	
	£000	% CAGR	£m	% CAGR	£m	% CAGR	£000	% CAGR
	9,710,046	5	237,374	3	8.4			
	1,497,077	7	19,465	6	12.6			
	1,188,914	15	18,924	-10	12.8			
	958,959	7	22,592	10	9.2			
	597,135	4	15,402	3	14.3			
	496,512	11	8,801	8	7.3			
	390,288	4	9,789	0	11.7			
	347,871	2	5,569	0	19.9			
	227,385	3	5,803	1	6.4			
	226,259	4	5,570	6	8.4			
	223,580	19	5,182	23	19.1			
	223,000	-9	6,999	0	8.4			
	201,500	6	5,777	5	5.7			
	176,000	-2	7,748	-7	3.8			
	173,383	8	4,605	15	9.4			
	171,025	60	4,372	46	5.4			
	166,784	3	3,541	-1	7.6			
	165,923	11	5,085	15	7.7			
	158,079	11	3,980	4	8.4			
	151,754	6	2,198	0	19.3			
	122,975	-3	1,842	2	13.2			
	121,928	-1	4,663	8	4.1			
	121,039	-1	3,264	0	6			
	103,428	-5	2,628	-6	7			
	101,754	-1	4,369	2	9			
	99,746	-5	3,543	3	6.8			
	97,238	5	4,379	16	7.4			
	83,278	2	3,660	8	4.8			
	79,892	1	2,104	-2	5.5			
	76,059	n/a	3,019	-7	6.3			
	72,114	n/a	1,700	-2	n/a			
	71,738	5	2,075	6	10.9			
	62,946	2	1,841	-1	n/a			
	62,600	-25	1,504	2	2			
	60,923	-2	1,395	-1	25.8			
	59,896	4	5,091	11	2			
	59,200	-12	3,580	-1	1.4			
	57,839	-14	1,189	3	13.2			
	56,615	16	2,034	18	6.8			
	55,958	3	950	1	18.3			
	55,429	10	3,711	15	8.6			
	54,516	-4	2,192	2	6.9			
	53,555	9	2,110	11	5.5			
	45,388	6	2,607	5	2.5			
	44,852	-5	2,132	2	4.4			
	44,202	n/a	1,016	n/a	7.8			
	43,513	-3	3,376	3	1.9			
	953,716	0	89,985	6	1.9			
	188,549	7	18,110	20	1.1			
	168,666	-1	5,393	-4	34.8			
	158,272	8	7,368	9	3.7			
	76,621	-10	10,129	-1	6.6			
	73,777	n/a	11,979	14	0.6			
	72,213	-3	2,298	-6	4.3			
	62,850	n/a	7,678	23	1			
	54,393	-6	9,854	0	n/a			
	52,986	-8	9,174	-4	n/a			
	45,389	0	8,002	-1	2.5			
	29,000	-12	2,507	-4	1.7			
	2,972,961	16	225,147	15	2.5			
	1,249,833	7	86,636	13	4			
	359,500	39	46,539	21	2			
	353,126	91	19,368	37	1.6			

Company	2000 R&D investment		R&D as % of sales		Sales		R&D per employee	
	£000	% CAGR	£m	% CAGR	£m	% CAGR	£000	% CAGR
6 Diversified industrials continued								
RWE, Germany	317,390	14	26,665	6	2			
Textron, USA	205,516	13	8,763	16	2.9			
Suez Lyonnaise des Eaux, France	125,699	35	21,757	25	0.7			
Dover, USA	117,151	15	3,616	7	4			
NGK Insulators, Japan	101,482	44	1,852	8	8.5			
Unaxis, Switzerland	90,470	8	1,357	-2	9.9			
Montedison, Italy	52,794	-9	8,595	2	1.7			
Wassall, UK	6,600	32	565	-13	1.7			
7 Electricity	1,159,095	n/a	1.3	91,273	3	4.3		
Tokyo Electric Power, Japan	419,211	n/a	1.4	29,849	0	8.7		
Kansai Electric Power, Japan	200,033	n/a	1.3	15,171	0	6.1		
Korea Electric Power, South Korea	185,748	12	2.3	8,040	11	6.1		
Enel, Italy	99,325	n/a	0.8	12,396	n/a	1.2		
Taiwan Power, Taiwan	81,367	43	0.9	9,227	18	3.5		
Kyushu Electric Power, Japan	74,142	n/a	0.9	8,377	0	4		
Chugoku Electric Power, Japan	54,270	n/a	0.9	6,149	1	3.7		
British Nuclear Fuels, UK	45,000	1	2.2	2,064	7	2.3		
8 Electronic & electrical	18,815,643	6	5.8	321,672	6	7.3		
Siemens, Germany	3,515,178	11	7.1	49,272	13	8.2		
Matsushita Electric, Japan	3,080,783	7	7.2	42,786	2	10.6		
Sony, Japan	2,312,412	11	6.3	36,567	10	12.2		
Philips Electronics, The Netherlands	1,738,420	11	7.3	23,796	5	7.5		
Canon, Japan	1,140,452	7	7	16,302	2	13.2		
Sharp, Japan	722,853	1	6.6	10,874	3	14.5		
Sanyo Electric, Japan	583,843	35	5.1	11,372	39	7		
Asea Brown Boveri, Switzerland	470,612	-28	3.1	15,375	-10	2.9		
Emerson Electric, USA	397,577	10	3.8	10,406	9	3.2		
Ricoh, Japan	389,960	3	4.6	8,482	7	5.8		
Matsushita Electric Works, Japan	321,797	2	4.6	6,923	0	7.5		
Alstom, France	318,019	7	3.1	10,200	15	2.6		
Rockwell International, USA	317,312	-2	6.6	4,787	0	7.7		
Schneider, France	298,159	4	4.9	6,094	1	4.1		
Invensys, UK	283,000	11	3.6	7,863	27	3		
JVC, Japan	254,121	3	5	5,100	2	7.1		
Sumitomo Electric, Japan	245,985	1	3.2	7,673	3	3.7		
Pioneer, Japan	194,997	3	5.6	3,494	4	7.1		
Olympus Optical, Japan	187,318	4	7.4	2,515	14	9.9		
Minolta, Japan	181,239	16	6.4	2,831	7	8.3		
Eaton, USA	180,078	0	3.2	5,562	5	3		
Fuji Electric, Japan	165,612	-8	3.3	4,994	-1	6		
Japan Radio, Japan	142,662	27	8.8	1,618	2	15.7		
Alps Electric, Japan	137,539	11	4.3	3,206	9	4.8		
Daikin Industries, Japan	124,824	10	4.6	2,714	2	8.7		
Novellus Systems, USA	119,333	35	15.2	786	26	39.1		
Yokogawa Electric, Japan	113,135	4	6.2	1,835	5	n/a		
Brother Industries, Japan	95,667	44	5.3	1,817	9	5.8		
Molex, USA	81,805	9	5.5	1,484	13	4.6		
Pitney Bowes, USA	80,657	10	3.1	2,598	0	2.8		
Legrand, France	77,305	11	4.4	1,759	12	n/a		
Fanuc, Japan	68,467	-1	5.6	1,225	10	n/a		
Fujikura, Japan	64,833	7	3.4	1,905	-1	3.1		
Harman International Industries, USA	61,927	12	5.5	1,123	5	6.3		
Symbol Technologies, USA	56,072	25	5.8	970	22	9.3		
Dainippon Screen Mfg, Japan	53,056	-3	5.2	1,026	-4	11.3		
EPCOS, Germany	51,389	28	9.3	553	45	3.9		
SPX, USA (now part of United Dominion Industries)	49,873	32	2.8	1,793	25	3.6		
Cae, Canada	49,650	2	9.4	531	8	7.1		
Scitex, Israel	43,863	n/a	9.5	462	n/a	48.2		
Yamatake, Japan	43,859	-7	4.4	997	-4	6.6		

Listings by sector of top 500 International companies by R&D investment

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per % employee £000
	£000	% CAGR		£m	CAGR	
9 Engineering & machinery	5,445,430	3	2.8	193,485	5	3.9
Mitsubishi Heavy, Japan	760,692	5	4.5	16,853	-1	11.7
Caterpillar, USA	434,462	12	3.2	13,506	6	6.5
Deere, USA	362,900	10	4.9	7,477	4	8.3
Volvo, Sweden	345,943	-12	3.7	9,228	-4	6.4
Komatsu, Japan	248,898	4	4	6,190	1	8.7
H'berger Druckmaschinen, Germany	226,091	n/a	7.8	2,892	n/a	9.5
Kubota, Japan	194,312	-3	3.4	5,786	-2	8
Cummins, USA	163,342	1	3.7	4,416	6	5.8
Navistar International, USA	151,292	22	2.7	5,628	11	8.9
Hino Motors, Japan	134,801	n/a	3.5	3,828	2	5.6
Rheinmetall, Germany	133,053	27	4.7	2,822	25	4.3
MAN, Germany	130,099	-9	2.8	4,729	-9	1.7
Ingersoll-Rand, USA	126,121	-3	2.1	5,890	7	2.5
Oce, The Netherlands	119,451	13	5.9	2,026	14	5.4
Thermo Electron, USA	118,326	3	7.7	1,527	-6	9.1
Kawasaki Heavy Industries, Japan	116,653	4	1.7	6,741	1	3.9
Scania, Sweden	115,007	11	3	3,819	12	4.5
Linde, Germany	114,386	10	2.2	5,311	17	2.5
Framatome, France	103,676	7	3.9	2,646	11	4
Ebara, Japan	97,168	4	2.9	3,318	4	7.2
Danaher, USA	92,382	31	3.7	2,529	20	3.8
MG Technologies, Germany	84,372	10	1.5	5,529	-2	2.2
American Standard Companies, USA	84,349	-6	1.7	5,086	7	1.4
Sandvik, Sweden	82,158	8	2.6	3,104	12	2.4
Sulzer, Switzerland	81,795	-2	3.5	2,370	0	3.7
Metso, Finland	77,305	21	3.2	2,445	18	3.5
Illinois Tool Works, USA	76,639	20	1.1	6,684	19	1.4
Thyssen Krupp, Germany	72,906	-10	0.3	23,386	17	0.4
Atlas Copco, Sweden	68,749	6	2.1	3,301	17	2.6
Paccar, USA	68,617	22	1.4	4,979	15	n/a
Hitachi Metals, Japan	68,567	3	2.5	2,714	-1	2.6
ITT Industries, USA	66,518	-22	2.1	3,233	-14	1.6
Sumitomo Heavy Industries, Japan	59,792	n/a	1.8	3,324	-2	4.3
Parker Hannifin, USA	59,619	11	1.7	3,585	11	1.4
SMC, Japan	59,540	8	5.2	1,137	7	6
SKF, Sweden	50,373	-1	1.8	2,827	4	1.3
Wartsila, Finland	50,028	14	2.9	1,701	8	3.9
Saurer, Switzerland	45,049	7	4.9	919	7	4
Ti, UK	42,400	4	1.6	2,729	17	1.1
10 Financials	216,205	n/a	1.2	18,338	n/a	2.1
Deutsche Bank, Germany	113,129	n/a	0.6	17,737	n/a	1.2
CMGI, USA	103,075	117	17.1	601	138	18
Towry Law, UK	2,026	n/a	6	34	16	4.3
11 Food processors	1,568,404	9	1.8	88,864	3	2.5
Unilever, UK	746,025	6	2.5	29,905	-3	2.9
Nestle, Switzerland	428,802	10	1.3	33,636	8	1.9
Ajinomoto, Japan	141,197	40	2.9	4,860	3	6.3
Kellogg, USA	79,261	9	1.7	4,656	1	5.3
Danone, France	78,562	5	0.9	8,979	3	0.9
General Mills, USA	51,613	6	1.2	4,485	5	4.7
Danisco, Denmark	42,945	15	1.8	2,343	15	2.4
12 Forestry & paper	173,199	5	0.5	31,810	12	0.9
International Paper, USA	61,588	-5	0.3	18,865	9	0.5
Stora Enso, Finland	59,393	38	0.7	8,181	32	1.4
Svenska Cellulosa, Sweden	52,218	0	1.1	4,765	5	1.4
Arjo Wiggins Appleton, UK	21,800	12	0.6	3,364	-1	1.2
13 Gas distribution	108,100	0	2.2	4,977	2	11.3
Osaka Gas, Japan	108,100	0	2.2	4,977	2	11.3
Lattice, UK	19,000	n/a	0.6	3,087	n/a	1.2

Company

14 General retailers
Amazon.com, USA
Great Universal Stores, UK
15 Health
Abbott Laboratories, USA
Warner-Lambert, USA (now part of Pfizer)
Medtronic, USA
Baxter International, USA
Guidant, USA
PE (now Applera), USA
Becton Dickinson, USA
Nycomed Amersham (now Amersham), UK
Boston Scientific, USA
Allergan, USA
Beckman Coulter, USA
McKesson HBOC, USA
Stryker, USA
Bausch & Lomb, USA
Fresenius, Germany
Smith & Nephew, UK
Dragerwerk, Germany
16 Household goods
Whirlpool, USA
TDK, Japan
Hasbro, USA
Mattel, USA
Electrolux, Sweden
Kuraray, Japan
Brunswick, USA
Citizen Watch, Japan
Black & Decker, USA
Toyobo, Japan
Adidas-Salomon, Germany
Swatch, Switzerland
Steelcase, USA
Courtaulds Textiles, UK
17 IT hardware
IBM, USA
Ericsson, Sweden
Motorola, USA
Cisco Systems, USA
Lucent Technologies, USA
Nortel Networks, Canada
Intel, USA
Hitachi, Japan
Fujitsu, Japan
Toshiba, Japan
Alcatel, France
Nokia, Finland
NEC, Japan
Hewlett-Packard, USA
Sun Microsystems, USA
Mitsubishi Electric, Japan
Compaq Computer, USA
Texas Instruments, USA
Agilent Technologies, USA
Applied Materials, USA
3M, USA
Xerox, USA
Marconi, UK
STMicroelectronics, France
EMC, USA

2000 R&D investment		R&D as % of sales	Sales %	R&D per employee	
£000	% CAGR		£m	CAGR	£000
277,307	91	3.5	7,890	29	3.5
191,007	184	10.3	1,849	262	21.2
86,300	43	1.4	6,041	21	1.2
3,852,123	14	5.3	72,704	18	10.7
904,421	3	9.8	9,202	6	14.9
842,817	26	9.7	8,655	16	19.2
321,127	19	9.6	3,357	23	14.9
253,715	3	5.5	4,616	6	5.9
236,444	23	13.9	1,706	25	25.6
183,958	28	20	918	4	37.8
149,807	10	6.2	2,422	7	6
149,000	59	11.6	1,283	36	17
133,217	14	7.5	1,783	16	9.7
130,941	13	12.5	1,046	8	21.2
123,845	14	9.8	1,263	16	12.8
98,741	9	0.4	28,123	34	4.3
81,805	21	5.3	1,532	26	6.8
81,336	13	6.9	1,186	-2	6.6
71,649	22	1.9	3,833	17	1.5
46,400	9	4.1	1,135	2	4.4
42,898	6	6.7	642	9	4.6
1,175,343	4	2.6	45,299	5	3.3
170,036	7	2.5	6,912	4	2.8
157,968	0	4	3,951	6	4.6
139,567	8	5.5	2,535	6	14.4
120,180	9	3.8	3,126	5	4
93,013	-5	1.1	8,833	3	1.1
70,912	-1	3.8	1,852	-1	9.5
68,416	4	2.7	2,552	5	2.9
67,412	-1	3.3	2,022	-3	3.8
63,797	-2	2.1	3,053	-2	2.7
62,881	n/a	2.6	2,433	-4	4.9
57,193	48	1.6	3,667	25	4.3
55,769	70	3.2	1,761	11	2.9
48,199	1	1.9	2,601	12	2.2
3,300	9	0.4	900	-5	0.1
52,952,296	12	8.1	651,659	9	15.6
3,280,894	4	5.5	59,175	4	9.7
2,974,217	24	15.3	19,409	22	29.3
2,970,277	17	11.8	25,157	8	20.2
2,729,281	79	21.5	12,671	47	80.3
2,689,784	22	11.9	22,636	21	21.3
2,681,082	22	13.2	20,267	24	28.4
2,608,783	21	11.6	22,577	13	30.3
2,553,338	-4	5.2	49,340	0	7.5
2,350,972	4	7.6	30,804	9	12.5
1,960,221	2	5.8	33,700	3	10.3
1,911,256	16	9.7	19,740	6	14.5
1,871,661	50	9.8	19,091	46	31.9
1,847,466	1	6.3	29,257	3	11.9
1,771,321	-1	5.4	32,656	6	20
1,091,177	25	10.4	10,524	22	29.7
1,019,977	0	4.6	22,123	2	8.7
983,398	38	3.5	28,373	24	14
892,355	10	14.1	6,338	-8	23.4
842,148	13	11.7	7,212	11	17.9
741,680	23	11.6	6,402	23	38.6
737,046	4	6.6	11,196	4	9.8
698,889	0	5.6	12,519	2	7.6
669,000	10	10.1	6,653	1	12.9
658,912	17	12.7	5,197	17	15.3
593,077	48	10	5,940	41	24.6

Company	2000 R&D investment		R&D as % of sales	Sales %		R&D per employee
	£000	% CAGR		£m	CAGR	£000
17 IT hardware continued						
Advanced Micro Devices, USA	429,642	12	13.8	3,109	24	29.8
3Com, USA	408,978	27	14.1	2,901	17	38.6
Corning, USA	361,427	30	7.6	4,771	18	9
Avaya, USA	313,295	n/a	6.1	5,141	n/a	10.1
Micron Technology, USA	286,183	22	5.8	4,911	19	15.2
Tellabs, USA	277,974	40	12.3	2,267	41	32.2
Conexant Systems, USA	277,461	14	19.7	1,408	14	31.5
Analog Devices, USA	268,152	23	15.5	1,726	21	29.5
National Semiconductor, USA	258,468	2	18	1,433	-5	24.6
Apple Computer, USA	254,385	-11	4.8	5,344	-5	29.7
LSI Logic, USA	253,673	20	13.8	1,833	22	35.1
Dell Computer, USA	243,004	43	1.1	21,347	42	6.1
Qualcomm, USA	227,880	20	10.6	2,140	41	36.2
ADC Telecommunications, USA	226,269	39	10.3	2,201	41	10.1
NCR, USA	222,921	-3	5.6	3,989	-4	6.8
Tokyo Electron, Japan	217,683	21	8.4	2,585	2	24.3
Omron, Japan	214,576	2	6.6	3,253	1	8.6
Silicon Graphics, USA	201,666	-4	12.9	1,560	-5	30
Teradyne, USA	201,446	20	9.9	2,038	27	19.8
OKI Electric, Japan	172,980	-5	4.4	3,927	-3	6.8
Storage Technology, USA	172,579	10	12.5	1,379	0	22.7
Murata Manufacturing, Japan	170,231	9	6.3	2,691	9	6.7
Atmel, USA	168,669	23	12.5	1,348	17	18.6
Broadcom, USA	167,811	n/a	22.1	760	n/a	67.1
Kyocera, Japan	166,256	10	3.5	4,766	6	4
Comverse Technology, USA	165,810	67	20.2	820	58	26
Maxtor, USA	157,321	28	8.7	1,811	37	18.4
Kla-Tencor, USA	154,122	19	15.4	1,003	8	26.6
Lexmark, USA	144,932	15	5.7	2,549	12	11.1
Xilinx, USA	142,720	32	12.9	1,111	31	53.3
ASM Lithography, The Netherlands	136,491	42	9.9	1,374	38	31.2
Advantest, Japan	135,727	51	13.9	979	3	n/a
Rohm, Japan	133,271	19	6.3	2,110	5	9.8
Cypress Semiconductor, USA	123,491	22	14.3	862	25	27.8
PMC Sierra, USA	119,699	57	25.7	465	39	69.4
Lam Research, USA	118,419	1	14.4	824	0	31.9
Altera, USA	115,392	37	12.5	922	29	59.3
Western Digital, USA	109,250	2	8.3	1,311	-9	14.9
Nikon, Japan	104,331	1	4.8	2,181	3	8.7
Bull, France	100,559	-7	4.9	2,039	-3	5.8
Cabletron Systems, USA	97,827	-2	13.6	717	-7	25.4
Maxim Integrated Products, USA	95,246	32	16.4	579	20	23.2
ECI Telecom, Israel	94,116	27	12.6	746	25	15.3
Tektronix, USA	91,374	-5	12.2	750	-11	21.4
Silicon Valley, USA (now part of ASM Lithography, The Netherlands)	90,658	19	16.1	564	7	24.2
ATI Technologies, Canada	89,942	63	9.8	918	45	45.5
Quantum, USA	87,097	-18	9.3	941	-28	35.6
Ciena, USA	86,403	95	15	575	99	31.1
Integrated Device Technology, USA	86,189	-4	13	664	17	17.2
Cirrus Logic, USA	85,419	-14	16.4	521	-4	63
JDS Uniphase, USA	75,914	126	7.9	957	133	4
Casio Computer, Japan	72,325	-9	3	2,403	0	3.7
Harris, USA	66,876	-11	5.5	1,210	-16	6.7
Spirent, UK	60,300	27	8.7	697	7	8.7
Koor Industries, Israel	59,569	-3	4.3	1,371	-10	6.9
Vitesse Semiconductor, USA	57,719	67	19.5	296	61	52.2
PerkinElmer, USA	57,650	19	5.1	1,135	4	4.6
Mitel (now Zarlink Semiconductor), Canada	55,801	22	18.6	300	-1	n/a
Hitachi Maxell, Japan	54,493	7	4.3	1,260	9	10.5
Acer, Taiwan	51,516	7	1.4	3,669	16	n/a
Unova, USA	46,660	24	3.8	1,230	12	5.5

Listings by sector of top 500 International companies by R&D investment

Company	2000 R&D investment		R&D as % of sales	Sales		R&D per % employee
	£000	% CAGR		£m	CAGR	
17 IT hardware continued						
ASM International, The Netherlands	46,383	24	7.9	588	43	7.1
Imation, USA	45,254	-23	5.5	827	-14	10.5
GN Great Nordic, Denmark	44,208	40	7.5	590	27	8.6
18 Leisure & hotels						
Thomson Multimedia, France	182,046	3	4.3	4,205	5	3.4
America Online (now AOL Time Warner), USA	151,961	47	3.3	4,610	60	10.1
Nintendo, Japan	93,791	n/a	3	3,107	11	n/a
Eidos, UK	47,173	102	24.2	195	164	80.9
19 Media & photography						
Eastman Kodak, USA	524,836	-7	5.6	9,368	-3	6.7
Fuji Photo Film, Japan	479,067	3	5.8	8,218	7	12.9
Reuters, UK	323,000	12	9	3,592	5	19.1
Konica, Japan	148,753	4	4.5	3,289	3	n/a
Groupe Lagardere, France	145,811	-42	1.9	7,663	9	3.3
Dai Nippon Printing, Japan	115,375	0	1.5	7,544	1	3.3
Toppan Printing, Japan	107,678	4	1.5	7,251	1	3.2
Thomson, Canada	72,299	n/a	1.7	4,361	-4	2
Polaroid, USA	55,831	-8	4.5	1,242	-5	6.3
20 Oil & gas						
TotalFinaElf, France	431,148	40	0.6	71,999	44	3.5
Exxon Mobil, USA	377,561	2	0.3	137,959	12	3.8
Schlumberger, USA	361,961	5	5.6	6,434	2	6
BP Amoco (now BP), UK	290,534	23	0.3	99,118	22	3
Shell, UK	260,410	-13	0.3	99,843	5	2.7
Halliburton, USA	154,639	15	1.9	7,937	13	1.7
ENI, Italy	147,068	1	0.5	30,129	13	2.1
Chevron, USA	114,473	-2	0.3	33,868	4	3.3
Petroleo Brasileiro, Brazil	90,391	4	0.5	17,090	29	2.3
Baker Hughes, USA	78,993	28	2.3	3,504	15	3.2
Texaco, USA	72,299	-6	0.3	28,310	-2	3.8
Norsk Hydro, Norway	68,169	4	0.6	11,908	17	1.8
Nippon Mitsubishi Oil, Japan	66,650	-5	0.3	21,074	9	4.2
Repsol YPF, Spain	60,776	34	0.2	27,681	28	1.7
Chinese Petroleum, Taiwan	56,660	6	0.6	9,465	9	3.3
21 Personal care						
Procter & Gamble, USA	1,271,255	12	4.8	26,745	3	11.6
L'Oreal, France	240,714	-5	3	7,964	8	5
Kao, Japan	223,117	0	4.5	4,965	0	14
Henkel, Germany	201,119	12	2.5	8,032	11	3.3
Kimberly-Clark, USA	185,701	7	2	9,360	2	2.8
Gillette, USA	119,829	-3	1.9	6,222	-1	3.4
Colgate-Palmolive, USA	117,887	2	1.9	6,265	2	3.1
Shiseido, Japan	90,860	2	2.6	3,500	2	3.7
International Flavors & Fragrances, USA	75,426	5	7.7	979	0	11.4
Beiersdorf, Germany	55,308	-3	2.1	2,587	9	3.3
Reckitt Benckiser, UK	46,000	11	1.4	3,202	8	2.4
22 Pharmaceuticals						
Pfizer, USA	2,968,938	27	15	19,798	27	33
GlaxoSmithKline, UK	2,526,000	21	14	18,079	21	23.3
Johnson & Johnson, USA	1,958,763	11	10	19,507	8	19.9
AstraZeneca, UK	1,936,672	34	16	12,119	23	34
Novartis, Switzerland	1,923,824	6	13	14,791	0	23.2
Pharmacia, USA	1,842,951	21	15.2	12,146	26	31.2
Roche, Switzerland	1,631,759	13	13.8	11,845	16	25.2
Merck, USA	1,569,019	12	5.8	27,020	19	22.6
Eli Lilly, USA	1,351,252	14	18.6	7,271	10	37.9
Bristol-Myers Squibb, USA	1,298,032	11	10.6	12,194	5	29.5

Company

22 Pharmaceuticals continued						
American Home Products, USA						
Aventis, France						
Schering-Plough, USA						
Boehringer Ingelheim, Germany						
Sanofi-Synthelabo, France						
Amgen, USA						
Schering, Germany						
Takeda Chemical, Japan						
Sankyo, Japan						
E Merck, Germany						
Yamanouchi Pharmaceutical, Japan						
Novo Nordisk, Denmark						
Eisai, Japan						
Fujisawa Pharmaceutical, Japan						
Chugai Pharmaceutical, Japan						
Daiichi Pharmaceutical, Japan						
Elan, Ireland						
Biogen, USA						
Chiron, USA						
Millennium Pharmaceuticals, USA						
Ares-Serono (now Serono), Switzerland						
Shionogi, Japan						
Altana, Germany						
Taisho Pharmaceutical, Japan						
Incyte Genomics, USA						
Lundbeck, Denmark						
Ono Pharmaceutical, Japan						
UCB, Belgium						
Tanabe Seiyaku, Japan						
Yoshitomi Pharma (now Welfide), Japan						
Sepracor, USA						
Genzyme, USA						
Merial, UK						
Gilead Sciences, USA						
Dainippon Pharmaceutical, Japan						
Celltech, UK						
Teva Pharmaceutical Industries, Israel						
Kissei Pharmaceutical, Japan						
Santen Pharmaceutical, Japan						
Shire Pharmaceuticals, UK						
Watson Pharmaceuticals, USA						
Alza, USA (now part of Johnson & Johnson)						
Mylan Laboratories, USA						
23 Software & IT services						
Microsoft, USA						
Oracle, USA						
SAP, Germany						
Computer Associates, USA						
ADP, USA						
Electronic Arts, USA						
Unisys, USA						
Peoplesoft, USA						
Cadence Design Systems, USA						
Sybase, USA						
Adobe Systems, USA						
BMC Software, USA						
Novell, USA						
I2 Technologies, USA						
Synopsys, USA						
Informix (now Ascential Software), USA						
Rational Software, USA						
Veritas Software, USA						
Network Associates, USA						

	2000 R&D investment £000	% CAGR	R&D as % of sales	Sales % £m	CAGR	R&D per employee £000
	1,129,930	4	12.7	8,879	-1	23.5
	927,032	8	11.7	7,918	-1	9.8
	892,355	17	13.6	6,570	15	31.8
	608,384	11	15.6	3,889	14	22.3
	593,929	n/a	15.8	3,748	n/a	20.3
	565,671	12	23.3	2,429	13	77.2
	517,881	14	18.3	2,824	14	21.8
	452,893	3	8.4	5,411	4	27.9
	377,696	4	10.9	3,459	1	33.3
	343,159	13	8.1	4,236	17	10.2
	321,357	8	12.6	2,544	1	35.9
	285,459	11	16.3	1,752	9	22.5
	273,776	6	15.5	1,770	3	39.1
	267,099	6	15.8	1,694	2	33.4
	234,437	10	20.4	1,149	2	48.1
	212,372	1	12	1,764	4	30.6
	204,378	41	23.4	872	53	61
	202,731	23	32.7	620	37	137.4
	196,077	-6	46.7	420	-11	57.3
	179,904	67	137.1	131	57	135.3
	176,163	13	21.2	830	11	41.3
	158,431	2	6.8	2,345	3	n/a
	137,795	15	11.3	1,216	14	16.1
	136,220	5	8.5	1,612	6	27.2
	128,903	47	99.3	130	47	97.5
	119,194	42	25.2	473	25	39.7
	117,995	5	15.9	744	-1	n/a
	114,386	20	8.3	1,385	15	12
	114,161	-1	10.5	1,084	-3	21.7
	113,399	16	9.7	1,167	18	26.5
	111,920	47	201.4	56	53	197.7
	108,808	31	18	604	15	24.7
	94,792	n/a	8.4	1,125	n/a	14.8
	88,076	33	67.1	131	56	103.6
	70,806	-1	7.8	909	2	n/a
	70,200	56	29.7	236	106	38.9
	70,006	14	6	1,172	16	8.1
	54,112	6	16.2	334	1	33.2
	54,053	14	11	492	4	n/a
	47,471	82	13.8	344	97	49
	45,049	42	8.3	544	43	15
	44,919	59	6.8	662	25	18.4
	43,101	11	7.6	567	18	n/a
	8,307,304	24	14.3	58,107	18	23.8
	2,527,112	27	16.4	15,368	28	64.6
	676,049	23	10	6,781	24	16.4
	609,250	34	15.5	3,938	35	26.1
	465,256	22	16.6	2,810	1	25.6
	308,124	17	8	3,835	13	7.7
	260,361	35	29.4	885	21	74.4
	223,323	-1	4.8	4,609	2	6.1
	217,377	45	18.7	1,162	40	27.1
	214,754	26	25.1	857	15	38
	163,468	8	25.4	643	-1	33.6
	160,806	8	19	848	13	53.5
	157,116	32	15.6	1,007	27	21.4
	157,030	-4	20.2	778	-4	32.1
	145,895	96	19.4	754	96	24.3
	138,865	25	25.7	540	23	47.5
	133,134	13	21.4	622	0	36.2
	122,847	66	22.5	546	54	31.5
	117,754	102	14.6	808	141	24.6
	116,125	35	23.3	499	15	33.6

Company	2000 R&D investment £000	% CAGR	R&D as % of sales	Sales £m	CAGR	R&D per employee £000
23 Software & IT services continued						
Baan, The Netherlands	114,485	66	27.6	414	30	23.7
Autodesk, USA	114,130	16	18.2	627	17	32.8
Intuit, USA	113,190	22	15.5	732	19	23.3
Dassault Systemes, France	106,744	n/a	26.9	397	n/a	33.3
SunGard Data Systems, USA	98,592	24	8.9	1,112	25	12.6
Parametric Technology, USA	96,240	38	15.5	621	12	20.4
JD Edwards, USA	86,267	28	12.9	670	20	17
Symantec, USA	84,799	9	14.8	572	16	22.3
Mentor Graphics, USA	84,317	6	21.3	395	7	30.7
Yahoo!, USA	80,846	128	10.9	743	176	24.8
Compuware, USA	77,753	21	5.8	1,346	25	5.9
Misys, UK	77,600	39	10.9	709	26	13.5
Gemplus SCA, France	61,368	n/a	8.1	757	n/a	7.8
Unigraphics solutions, USA	54,376	15	15.4	352	6	16
Amdocs, UK	50,108	n/a	6.7	748	n/a	6
NDS, UK	46,184	82	28.9	160	84	54.9
Intergraph, USA	45,659	-10	9.9	462	-11	9.9
24 Steel & metals						
POSCO, South Korea	1,128,969	2	1.2	94,464	4	2.1
Sumitomo Metal, Japan	160,968	17	2.2	7,290	9	8.5
AlCoA, USA	140,628	-2	1.7	8,347	0	3.6
NKK, Japan	129,870	4	0.8	15,354	15	0.9
Kawasaki Steel, Japan	117,239	-4	1.2	9,877	-2	3
Corus, UK	115,111	n/a	1.6	7,368	2	n/a
Usinor, France	106,000	24	0.9	11,698	13	1.6
Mitsubishi Materials, Japan	101,816	2	1.2	8,562	3	1.6
Kobe Steel, Japan	86,534	-1	1.5	5,786	-3	3.5
Pechiney, France	60,015	-11	0.8	7,345	-4	2.1
Alcan Aluminium (now Alcan), Canada	56,565	-3	0.8	6,712	2	1.9
25 Support services						
Ascom, Switzerland	152,807	0	5.6	2,746	11	n/a
Convergys, USA	89,478	-6	6.9	1,298	2	8.3
Chubb, UK	63,328	13	4.4	1,448	27	n/a
	27,800	7	1.1	2,453	8	0.5
26 Telecommunications						
NTT, Japan	4,250,571	2	1.8	242,506	10	3.2
Deutsche Telekom, Germany	2,096,382	3	3.4	60,865	7	9.4
BT, UK	439,947	3	1.7	25,730	6	2.1
France Telecom, France	364,000	6	1.8	20,427	8	2.7
AT&T, USA	282,195	-14	1.3	21,164	10	1.5
Telstra, Australia	269,112	-11	0.6	44,170	6	1.6
Alltel, USA	225,413	63	3.3	6,922	5	4.4
Telia, Sweden	144,062	29	3	4,731	22	5.3
GTE, USA (now part of Verizon Communications)	110,963	3	2.9	3,836	5	3.7
Vodafone, UK	87,696	-1	0.5	16,961	6	0.9
Telefonica, Spain	72,000	21	0.5	15,004	71	1.4
Kokusai Denshin Denwa, Japan (now part of DDI)	66,557	-4	0.4	17,905	24	0.5
Sonera, Finland	48,250	18	1.4	3,500	20	9.1
	43,995	16	3.4	1,293	15	4.3
27 Tobacco						
Philip Morris, USA	698,055	5	0.9	78,897	4	2.3
Japan Tobacco, Japan	360,155	1	0.9	42,359	4	2
BAT, UK	278,899	9	1.1	25,623	5	6.8
	59,000	12	0.5	10,915	3	0.7

Accessing the full data using the website

This section describes how you can access the full 2001 Scoreboard data set including UK and international companies, as well as the text parts of the Scoreboard.

The Scoreboard web site.

The Scoreboard website is on www.innovation.gov.uk/finance. Select the hypertext button 'R&D Scoreboard' from the contents bar down the left-hand side of the screen. From this page, the main text parts of the Scoreboard can be viewed on screen or printed off.

Searching for data...

In addition, all data from 1992 to the present is on the site, and there is a software engine which allows you to search this data in the following ways:

...for a sector in a given year

- ♦ for a given year you can choose a sector and then list all the companies in the sector ordered by decreasing R&D spend, showing a full range of data, including R&D spend, sales, profits, changes in these quantities and ratios between them. Above each column of data is a virtual button which, when clicked, organises all the data on screen in descending order of the data in that column. In that way, you can, for example, order the companies by decreasing R&D intensity.

...for a company in any year

- ♦ for a given company, you can search for data entries in all years at once. The results will show all the appearances of that company in the Scoreboard, with a full range of data for each year.

Downloading the data for remote analysis

The data can also be accessed from the above page by choosing the option to download the data as a CSV file. These files can usually be opened in a spreadsheet program (eg, Lotus 123 or Microsoft Excel) and converted into a spreadsheet from where the data can be studied.

Hard copies of the data sets

A limited number of hard copies of the data sets are available from the DTI publications order line on 0870 1502 500 or fax: 0870 1502 333.

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Ranking of UK companies by R&D investment

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Data sources and definitions

COMPANY REPORTING

Department of Trade and Industry

Future & Innovation Unit

B 7/17, 1 Victoria Street
London SW1H 0ET

For additional copies:

Website: www.innovation.gov.uk/finance

Telephone: 0870 1502 500

Fax: 0870 1502 333

Company Reporting Limited

11 John's Place

Edinburgh EH6 7EL

Telephone 0131 561 8000

Fax: 0131 561 8001

Email: research@comrep.co.uk



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