Department for **Innovation, Universities** & **Skills**

The 2007 R&D Scoreboard

The top 850 UK and 1250 global companies by R&D investment

BERR | Department for Business Enterprise & Regulatory Reform

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Ministerial Foreword

Ian Pearson,
Minister of State for
Science and Innovation

By Ian Pearson,
Minister of State for Science and Innovation

A great deal has happened since the publication of the R&D scoreboard 12 months ago. We have seen the establishment of the new Department for Innovation, Universities and Skills (DIUS) and the full set up of the Technology Strategy Board. I am delighted to be the new Science and Innovation Minister in a department that is committed to improving innovation performance across the economy.

I am clear that innovation will be a key driver of UK prosperity in the decades ahead. Without it, our industries won't be able to compete with the growing economic powers of East Asia.

The Scoreboard is invaluable in helping us to track progress of one of the key measures of innovation - R&D investment. R&D is an important element in many companies' financial success, driving not just high-value products and services but also playing a role in improving firms' own operations.

I am very pleased to report a 9% increase in R&D investment by UK firms – an investment totalling £21 billion. The largest 75 R&D investors based in the UK increased their R&D by an impressive 12%.

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British firms also compared favourably with their global competitors, with the UK's top 75 increasing profits by 32% – twice as fast as the world's top 1250 R&D firms – and growing their R&D faster than the global average (10%). This partly reflects the UK's strengths in the R&D-intensive pharmaceuticals sector.

The government has an important role to play in stimulating R&D investment. Over £1.8 billion of support has been made available through the R&D tax credits scheme. We have recently announced that we will be providing a new package of support for technology and innovation in business, with £1billion to support the Technology Strategy Board over the next three years.

I am looking forward to working with business to build on this success and ensure we achieve even greater investment in the future.

Mike Carr
Chief Science Officer, BT Group

Increasing R&D spend is not only a good "lead" indicator of successes yet to come, it is also a signal of business confidence.

Commentary

By Mike Carr,
Chief Science Officer, BT Group

Each year the Government publishes the "R&D Scoreboard" which provides a snapshot of R&D activity by both the UK's most active 850 companies, and the 1250 most active globally. Over recent years the Scoreboard has become the core reference for benchmarking R&D investment data.

For BT specifically, it has become an invaluable tool. The key strength is that it provides a comprehensive review of auditable data across diverse industry sectors. As Chief Science Officer for BT I routinely use this data as a benchmark input for our internal annual Research investment case.

Of course it would be possible for BT to independently assemble a small subset of data found in the Scoreboard by analysing a handful of reports and accounts directly. However, I have found from experience that this is ineffective as it generates more questions on why a particular set of companies was chosen than it answers by giving a true benchmark on a wide range of companies.

In addition, as an open public document, the Scoreboard data reference gives confidence to our shareholders that we are taking appropriate action in the sector we operate in. BT has moved very rapidly from being a telephone company and has become a significant broadband and global ICT player. Without wide shareholder awareness of the metrics involved, our significant year-on-year R&D increase might have been difficult to understand.

In 2003 BT spent about 2% of its sales revenue on R&D. This year's Scoreboard lists us at over 5%. This substantial increase is consistent with the fast changing market in which BT competes. The increase can be categorised into three areas:

1. BT's success in winning significant networked ICT business globally. These wins, worth several billions of pounds, require substantial development and integration of new technology.

2. Products and services which take advantage of the new "broadband" world. Innovative products such as BT Fusion and BT Vision were not possible on narrowband. Our success with driving broadband in the UK has created some fantastic opportunities requiring R&D investment.

3. The creation of our 21st Century Network platform (21CN). This massive undertaking is all about building a global, flexible, cost effective network and service infrastructure which can support the dynamic needs of our future customers.

Increasing R&D spend is not only a good "lead" indicator of successes yet to come, it is also a signal of business confidence. However, for many companies, the challenge is to prioritise sufficient funds from today's business to be able to invest for the future. Looking at the Scoreboard it is clear that there is massive R&D investment around the globe. Driving innovation in the UK through continued investment in R&D is absolutely key to the UK's future success. The UK Government is keen to drive the average UK R&D investment level from its current level of about 1.8% to 2.5% of GDP. This needs to happen company-by-company, sector-by-sector. Keeping a close eye on where any company sits in R&D investment, compared to the Global benchmark, may well spark a re-examination of investment priorities.

I believe the UK is actually very well placed to take advantage of increased R&D investment from industry. We have a world class UK science base (and we need to ensure it remains so) which results from a long history of leading UK Research Universities and Science institutions. These have led to an extraordinary record of scientific discovery in this country. The real challenge is turning these innovations and opportunities into real products and real services. Only industry can do this. We must therefore continue to build our collective investment in applied R&D activities.

Summary

Highlights

- The top 850 UK companies in Research & Development (R&D) grew their R&D by 9% to £20.9 billion in the last year.
- The 75 UK companies with the most R&D increased their investment by 11.9% – more rapidly than their global peers.
- In contrast, R&D spending by other smaller UK investors amongst the 850 most active UK companies grew by less than 3.4%.
- The fastest growing sector in the UK in the last year was fixed line telecommunications, which increased its spending by 54%. The pharmaceuticals sector remained the largest in the UK and was the biggest contributor to total R&D growth.
- Pharmaceuticals & biotechnology companies are now the biggest investors in R&D worldwide, having surpassed firms in the technology sector.

What the Scoreboard means for companies and investors

The top 850 UK companies in Research & Development (R&D) grew their R&D by 9% to £20.9 billion in the last year.

Mike Carr, Chief Science Officer for BT Group, writes: "Over recent years the Scoreboard has become the core reference for benchmarking R&D investment data... The key strength is that it provides a comprehensive review of auditable data across diverse industry sectors."

This analysis aims to offer insights to both companies examining their R&D investment needs and to analysts and investors concerned with identifying good performance in companies.

The UK's top R&D companies

In 2006, the 850 UK companies undertaking the most Research & Development (the 'UK850') increased their investment by 9% on the previous year to £20.9 billion – more than double the rate of increase in the previous year. This is largely due to increased spending by large firms in the pharmaceuticals, fixed line telecommunications and banking sectors. Operating profit rose 26% over the previous year on the back of strong performances from electricity (55%) and mining companies (54%). Pharmaceuticals profits rose by 20% but there were falls in software & computer services (21%) and aerospace & defence (18%).

The UK's fixed line telecommunications sector showed the fastest growth in R&D spending over the last year – it was up by 54% in the last year (and by 94% the average R&D in the four previous years). Firms in both mobile telecommunications and banking reported average R&D growth of around 40% in the year.

R&D is a key expenditure in many sectors. UK aerospace, software and technology firms invested substantially more in R&D than they earned as profits. But capital and other expenditure is also important to the UK's top R&D firms. In the last year, investment in R&D by the UK850 amounted to nearly 22% of overall capital expenditure: in some sectors, notably technology, software and pharmaceuticals this proportion has exceeded 70%.

The UK's 75 biggest R&D investors – which also form part of the 'G1250' largest R&D spenders worldwide – conduct two thirds of the UK850's R&D. This 'UK75' grew their R&D by 11.9% over the previous year; their global peers averaged a 9.9% increase. Smaller UK firms increased their R&D expenditure more slowly than the global leaders in their sectors. For example, the other 775 UK companies which form part of the UK850 increased their investment in R&D by only 3.4%. However, the smallest companies in the UK850 are doing more R&D: 95 more firms invested over £0.5 million in R&D compared to last year's Scoreboard.

The UK850's R&D has grown significantly faster (9%) than total employment, which increased by 2% over the same period.

In the last year, for the UK850 firms as a whole, R&D growth has outstripped sales growth with the result that R&D has increased as a proportion of their sales.

Global R&D spending by the G1250 rose by 10% to £244 billion.

The global picture

Global R&D spending by the G1250 rose by 10% to £244 billion. It continues to be dominated by companies registered in just five countries – the USA, Japan, Germany, France and the UK – which contributed 81% of R&D by the G1250. Firms from India and China have yet to establish themselves as significant players in the G1250, although other evidence suggests that both countries are increasingly important locations for R&D. Globally, average R&D intensity remains unchanged at 3.5% of sales.

Summary

R&D investment in the global pharmaceuticals sector grew by 16% in the last year; it has replaced technology hardware (which grew by 13%) as the largest global R&D sector. Other rapidly growing sectors amongst the ten largest investors were the software and aerospace & defence sectors which both grew at more than 12%.

Analysis in this Scoreboard suggests that, overall, the 75 UK companies in the G1250 have increased their R&D expenditure more quickly than their global peers in the same sectors, largely due to the concentration of UK firms in fast growing sectors such as pharmaceuticals. In many sectors, however, UK firms increased their R&D more slowly than their global peers.

There are well-established links between R&D growth and intensity and sales growth, wealth creation efficiency and market value. Alongside excellent operations and strategic decision-making, companies continue to regard investment in R&D as a key factor determining future success: the Scoreboard shows this especially strongly in the UK's aerospace, software and technology firms.

Key Facts

- The 850 UK companies that invest the most in R&D spent £20.9 billion in 2006, compared with the £19.1 billion they put into R&D in 2005.
- 83% of UK R&D is conducted by the hundred most active companies.
- More than half of R&D activity by the 75 UK companies represented in the G1250 takes place in the pharmaceuticals and aerospace sectors.
- Globally, the 1250 companies most active in R&D invested £244 billion in 2006-7, an increase of 10% on the previous year: the 75 UK companies in this group increased their R&D spend at a faster rate (12%).
- More than 81% of global R&D occurs in five countries: USA, Japan, Germany, France and the UK.
- Global R&D intensity (R&D expenditure as a proportion of sales) has remained broadly constant at 3.5%.

Introduction

This short report summarises the findings of the 2007 R&D Scoreboard, an investigation of the financial performance of the top UK and global corporate investors in R&D.

About the 2007 R&D Scoreboard

This is the 17th annual edition of the R&D Scoreboard, which is published by the Department for Innovation, Universities & Skills (DIUS) in collaboration with the Department for Business, Enterprise & Regulatory Reform (BERR).

The Scoreboard is an international league table of the companies investing most in R&D. It is designed as a benchmarking tool for companies, investors and policy-makers. Sixteen leading business and professional organisations 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; a list of the endorsers is printed inside the back cover.

This report summarises the 2006 data on investment in R&D and financial performance of the 850 most active UK companies (including foreign-owned companies whose R&D is conducted and reported in the UK) and the 1250 most R&D active companies globally. It also highlights the principal trends discernible in the data.

How is the Scoreboard compiled?

The Scoreboard data are taken from the published accounts of UK-based and global companies by Company Reporting Limited, using the most recent accounts as of 30 July 2007. For most companies the data represents their accounts for 2006 or for financial year 2006/07. There are some important aspects of the data which affect their interpretation:

- not all companies disclose their R&D investment in published annual reports and accounts;
- for many diversified groups, the R&D investment disclosed in their accounts arises from only part of their activities, whereas sales, operating profit and other data such as market capitalisation reflect all their activities: as a result, some statistics for these companies will be understated for the divisions that are active in R&D;
- the R&D investment reported in company accounts is independent of the location of the R&D activity which means that the UK850 data indicate the overall level of R&D funded by UK companies, not all of which is carried out in the UK: in contrast, other

information such as the Business Enterprise R&D (BERD) data generated by the Office for National Statistics (ONS) focuses R&D activity within the UK, independent of the source of funding, and exclude R&D carried out by UK companies in other countries. The Scoreboard complements country-level R&D data; it is not a sound basis for comparisons between countries; and

- the composition of the UK850 and G1250 lists fluctuates from year to year with changes in individual companies' spending patterns. Unless otherwise stated, growth rates quoted in this document are based on the prior performance of the current list of UK850 and G1250 firms.

Further details of the scope of the Scoreboard, the key definitions used and the resulting limitations of the data are set out in Appendix A.

The analysis is principally the work of PricewaterhouseCoopers LLP. Dr Mike Tubbs, the author of several previous R&D Scoreboards, has also provided advice on the 2007 Scoreboard.

Where to go for further information

The accompanying CD contains full data on all the companies included, additional detailed analysis and overviews of six key sectors. This information is also available online at www.innovation.gov.uk/rd_scoreboard

The Pattern of R&D – An Overview

Introduction

This section provides an overview of the pattern of investment in R&D in 2006 in the UK and globally across sectors and between the different categories of firms highlighted by this year's Scoreboard. It also summarises the key trends in R&D over both the last year and over a longer period.

The scale of R&D

The 850 largest corporate spenders on R&D in the UK (the UK850) invested £20.9 billion in 2006, 9% more than they spent the previous year. Although this growth was achieved in a positive economic climate, even allowing for inflation, investment in R&D by these firms increased significantly. The figures cannot be compared directly with UK economic data, but they are consistent with the UK's continued transformation into a more knowledge-based economy.

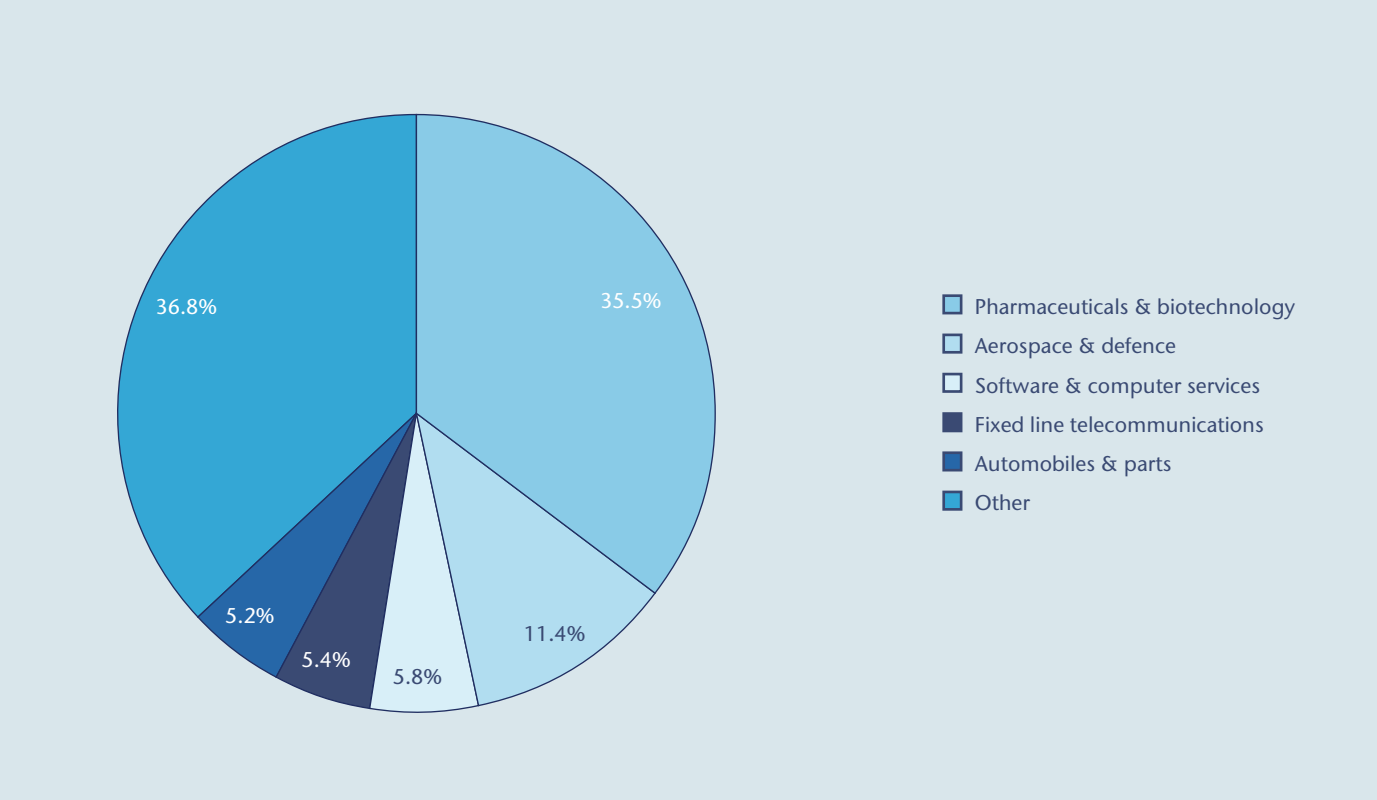
The 1,250 companies in the world most active in R&D in 2006 (the G1250) invested £244 billion, up 10% on the previous year. This R&D was highly concentrated in firms based in five countries: more than 81% of the investment was undertaken by companies from the USA, Japan, Germany, France and UK and 945 of the companies come from these countries (see Figure 1). The proportion of total R&D spending by the G1250 attributed to companies in both the USA and Japan fell slightly in the last year.

Figure 1: Distribution of R&D expenditure among G1250 by country (2006)

The sectoral distribution of R&D

R&D spending by companies in the UK850 was dominated by five sectors: pharmaceuticals & biotechnology, aerospace & defence, software & computer services, fixed line telecommunications and automobiles & parts, which together accounted for almost two thirds of R&D (see Figure 2). The pharmaceuticals & biotechnology sector was by far the largest investor (35.5% of the UK850 total). It invested over three times as much as the aerospace & defence sector (11.4%) which in turn invested almost twice as much as the software & computer services sector (5.8%).

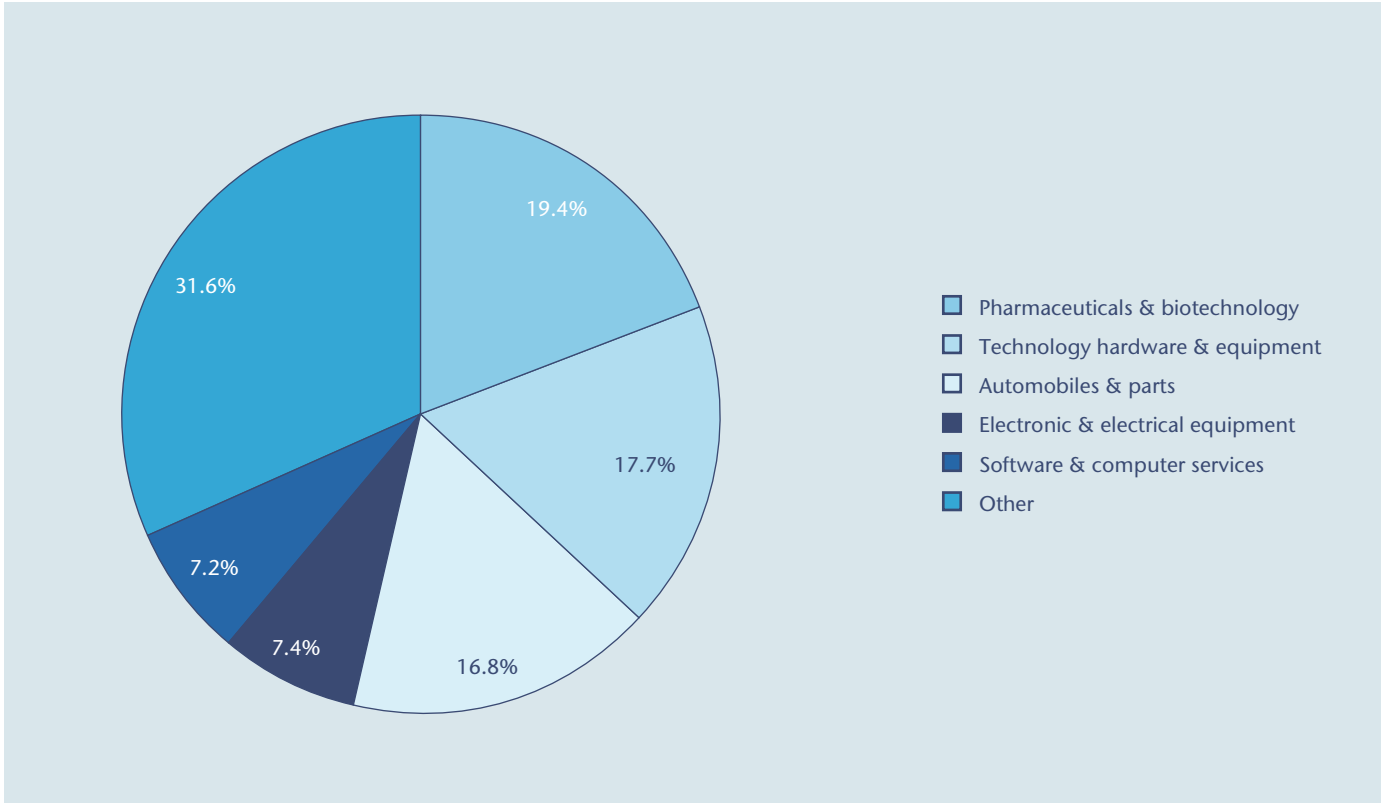
Figure 2: Distribution of UK850 R&D expenditure by sector (2006)



Comparing the UK850 in this year's R&D Scoreboard with last year's UK800, the relative importance of firms in the five biggest sectors fell slightly to 63% of total R&D from 65% in the previous year. This was despite the fixed line telecommunications sector being the fastest growing sector in the last year (R&D up 54%). The increase from 800 to 850 firms was not a major factor in this change; the last 50 firms in the UK850 contribute only £27 million of R&D, 0.1% of the total.

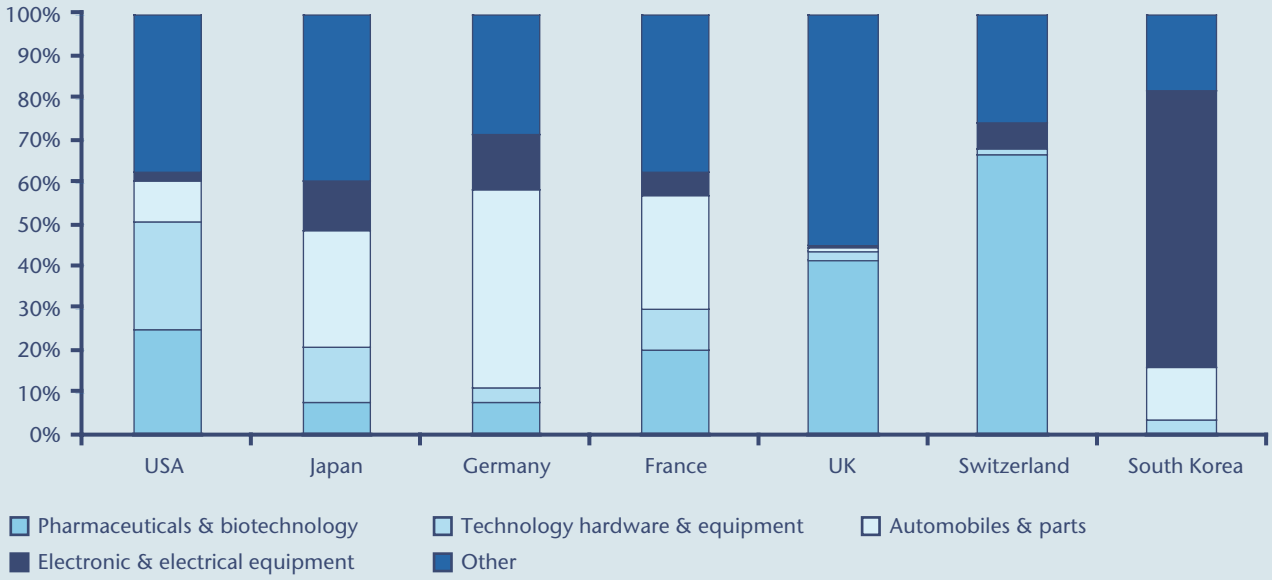
Globally, five sectors also dominated expenditure by the world's leading R&D investors. They accounted for more than 68% of investment by the G1250 (see Figure 3). Three of the sectors were also amongst the five largest spending sectors in the UK – pharmaceuticals & biotechnology, automobiles & parts and software & computer services – but two were different; technology & hardware equipment and electronic & electrical equipment. The pharmaceuticals & biotechnology sector is now the largest sector globally, having displaced technology & hardware equipment. In contrast to the UK, the three biggest spending sectors globally have broadly similar shares of total R&D investment among the G1250.

Figure 3: Distribution of G1250 R&D expenditure by sector (2006)



While R&D was relatively concentrated in the leading countries' firms, the sectors in which those firms operate varied significantly between the leading countries (see Figure 4). Both the USA and France had relatively diversified portfolios of R&D whereas Germany and, to a lesser extent, Japan were more concentrated. R&D in South Korea and Switzerland remained highly specialised in pharmaceuticals & biotechnology and automobiles & parts and electronic & electrical equipment respectively. The UK was also quite specialised, with pharmaceuticals & biotechnology and aerospace & defence its two largest groups of firms, but – like the US and France – had a significant amount of R&D outside the major sectors.

Figure 4: Distribution of G1250 R&D expenditure by country and by sector (2006)



The concentration of R&D

In 2006, the 75 UK firms in the G1250 accounted for 67% of R&D by the UK850. More than half of their spending (54%) was conducted by firms in the pharmaceuticals & biotechnology and aerospace & defence sectors.

The share of total R&D expenditure by the UK850 attributed to its 100 biggest investors (including those in the G1250) declined to 83% compared with 85% the year before. Coupled with the fact that the UK's largest firms also had the most substantial R&D increases, it suggests that the UK's complement of R&D companies is developing some strength in depth. There is other evidence that this may be the case. For example, in the UK list there were 843 firms in this Scoreboard with an R&D of £0.5m or more, compared to 752 in the 2006 Scoreboard and 669 in 2005.

The UK's biggest investors in R&D

Table 1 lists the 25 UK companies which invested the most in R&D in 2006. Two companies from the pharmaceuticals & biotechnology sector continued to dominate the list: GlaxoSmithKline and AstraZeneca between them invested £5.5 billion, some 26% of the UK850 total. The biggest climbers in the Top 25 were BT, Royal Dutch Shell and Tesco. Among the foreign-owned UK companies in the list, Ford remained the largest investor in R&D (£584 million) despite a fall in its R&D. Note that the comparison here is between the global operations of UK-owned firms and subsidiaries of major multinationals; some multinationals do not prepare consolidated accounts containing an R&D figure for their UK operations and are therefore not included in the Scoreboard despite carrying out substantial R&D[1]. They may also be more subject to year-on-year variability of results based on changes in financial practice within their group (e.g. choosing to fund R&D locally or from head office).

Table 1: Top 25 UK companies by R&D expenditure (2006)

Rank 2007	Company	Sector	R&D (£ million)	Growth in R&D over last year (%)	Rank 2006
1	GlaxoSmithKline	Pharmaceuticals & biotechnology	3,457	10	1
2	AstraZeneca	Pharmaceuticals & biotechnology	1,994	15	2
3	BAE Systems	Aerospace & defence	1,248	-14	3
4	BT	Fixed line telecommunications	1,119	54	4
5	Unilever	Food producers	610	-5	6
6	Ford*	Automobiles & parts	584	-15	5
7	Royal Dutch Shell	Oil & gas producers	452	51	10
8	Airbus*	Aerospace & defence	445	30	9
9	Rolls-Royce	Aerospace & defence	411	17	7
10	Royal Bank of Scotland	Banks	382	16	11
11	Pfizer*	Pharmaceuticals & biotechnology	370	6	8
12	HSBC	Banks	301	40	13
13	Land Rover*	Automobiles & parts	253	10	14
14	Vodafone	Mobile telecommunications	222	8	15
15	BP	Oil & gas producers	202	-21	12
16	Smiths	General industrials	179	37	19
17	Reuters	Media	176	45	22
18	Shire	Pharmaceuticals & biotechnology	154	5	17
19	ICI	Chemicals	153	4	18
20	Telent	Software & computer services	139	-22	16
21	Tesco	Food & drug retailers	129	12	23
22	Nokia*	Technology hardware & equipment	111	9	n/a
23	Eli Lilly and Company*	Pharmaceuticals & biotechnology	110	47	20
24	Reed Elsevier	Media	108	6	25
25	Syngenta*	Chemicals	103	43	n/a

* signifies foreign owned company

1 For example, UCB has indicated to DIUS that its UK branch would show R&D investment of around £171m for 2006 if it prepared UK accounts. That would have placed it within the top 25 firms shown here.

The global leaders in R&D

Only one UK firm – GlaxoSmithKline – was among the 25 largest investors in R&D globally in 2006 (see Table 2). The list is dominated by firms from the automobiles & parts and pharmaceuticals & biotechnology sectors. The biggest climber in the list was Johnson & Johnson, whilst several leading investors from the automobiles & parts sector, notably Ford and DaimlerChrysler, reduced their spending on R&D.

Table 2: Top 25 global companies by R&D expenditure (2006)

Rank 2007	Company	Sector	Country	R&D (£ billion)	Growth in R&D over last year (%)	Rank 2006
1	Pfizer	Pharmaceuticals & biotechnology	USA	3,883	2%	3
2	Ford Motor	Automobiles & parts	USA	3,679	-10%	1
3	Johnson & Johnson	Pharmaceuticals & biotechnology	USA	3,640	13%	8
4	Microsoft	Software & computer services	USA	3,638	8%	6
5	DaimlerChrysler	Automobiles & parts	Germany	3,526	-7%	2
6	Toyota Motor	Automobiles & parts	Japan	3,485	8%	7
7	GlaxoSmithKline	Pharmaceuticals & biotechnology	UK	3,457	10%	9
8	Siemens	Electronic & electrical equipment	Germany	3,385	-3%	4
9	General Motors	Automobiles & parts	USA	3,372	-1%	5
10	Samsung Electronics	Electronic & electrical equipment	South Korea	3,140	4%	10
11	Intel	Technology hardware & equipment	USA	3,001	14%	15
12	Sanofi-Aventis	Pharmaceuticals & biotechnology	France	2,967	9%	13
13	IBM	Software & computer services	USA	2,900	6%	11
14	Volkswagen	Automobiles & parts	Germany	2,857	4%	12
15	Roche	Pharmaceuticals & biotechnology	Switzerland	2,758	15%	18
16	Novartis	Pharmaceuticals & biotechnology	Switzerland	2,741	11%	16
17	Nokia	Technology hardware & equipment	Finland	2,501	2%	17
18	Merck	Pharmaceuticals & biotechnology	USA	2,444	24%	23
19	Matsushita Electric	Leisure goods	Japan	2,422	-8%	14
20	Robert Bosch	Automobiles & parts	Germany	2,289	16%	22
21	Sony	Leisure goods	Japan	2,280	6%	19
22	Honda Motor	Automobiles & parts	Japan	2,189	9%	21
23	BMW	Automobiles & parts	Germany	2,161	3%	20
24	Motorola	Technology hardware & equipment	USA	2,098	12%	25
25	Cisco Systems	Technology hardware & equipment	USA	2,078	22%	n/a

Key sectoral trends in R&D – a comparison of UK and global performance

Introduction

This section analyses the key trends in R&D expenditure among the different sectors, both globally and in the UK. First, it considers the changing volumes of R&D and compares them with other business inputs, notably capital expenditure and employment. Second, it examines the ratio of companies' investment in R&D to their sales and profits. The final part of the section compares recent trends in UK firms' investment in R&D with those of their peers globally.

Summary

Table 3 summarises the key changes in R&D and other measures of business performance over the last year. The key points to note are that:

- R&D investment by the UK850 increased 9% over the last year;
- The fastest growing sector in the UK850 in the last year was fixed line telecommunications, which increased its spending by 54%;
- The pharmaceuticals & biotechnology sector was the biggest contributor to growth amongst the UK850;
- Firms in both mobile telecommunications and banking reported average R&D growth of around 40% in the year;
- Analysis suggests that, overall, UK companies in the G1250 have increased their R&D expenditure more quickly than their global peers in the same sectors largely due to the concentration of firms in fast-growing sectors such as pharmaceuticals;
- In many sectors, however, UK firms increased their R&D more slowly than their global peers.

Table 3: Key sectoral trends across UK850 (2006)

	R&D in 2006 (£ million)	Change in R&D over last year (%)	R&D as % of capital expenditure (%)	Change in employees over last year (%)	Change in sales over last year (%)	Change in profits over last year (%)
Pharmaceuticals & biotechnology	7,420	10.5%	304%	2.5%	8.3%	20.9%
Aerospace & defence	2,392	0.0%	197.6%	3.8%	6.7%	-18.1%
Software & computer services	1,208	3.9%	347.6%	18.8%	16.6%	-21.1%
Fixed line telecommunications	1,127	53.6%	41.5%	2.7%	4.1%	4.4%
Automobiles & parts	1,087	-8.8%	87.8%	-1%	4.9%	n/a
Banks	869	31.3%	15.4%	10.2%	13.7%	12.6%
Technology hardware & equipment	862	1.3%	80.4%	-10.8%	4.5%	-0.1%
Food producers	847	0.4%	35.9%	-3%	4.1%	2.8%
Oil & gas producers	701	18.1%	3%	-3%	6.5%	4.7%
Electronic & electrical equipment	602	-3.5%	173.7%	-13.4%	-12.7%	40.8%
Other sectors	3,813	13.4%	9.5%	2.0%	7.6%	14.5%
Total	**20,928**					

The scale of R&D expenditure by sector

Although overall R&D amongst the UK850 increased by 9.0% in the last year, the longer term rate of growth has been slower: investment in R&D has grown by 5.5% over the average of the previous four years' R&D level. Figure 5 shows the pattern of change in the level of R&D investment among the UK850 in the largest sectors defined by their investment in R&D. It highlights the strong rises in pharmaceuticals & biotechnology, aerospace & defence and fixed line telecommunications. These are the only sectors which have grown consistently over the five year period. Other sectors have either reduced their levels of reported R&D over the period or did not disclose significant R&D investment throughout the period (e.g. banks).

Figure 5: Growth in R&D expenditure by sector across UK850 (2002-2006)

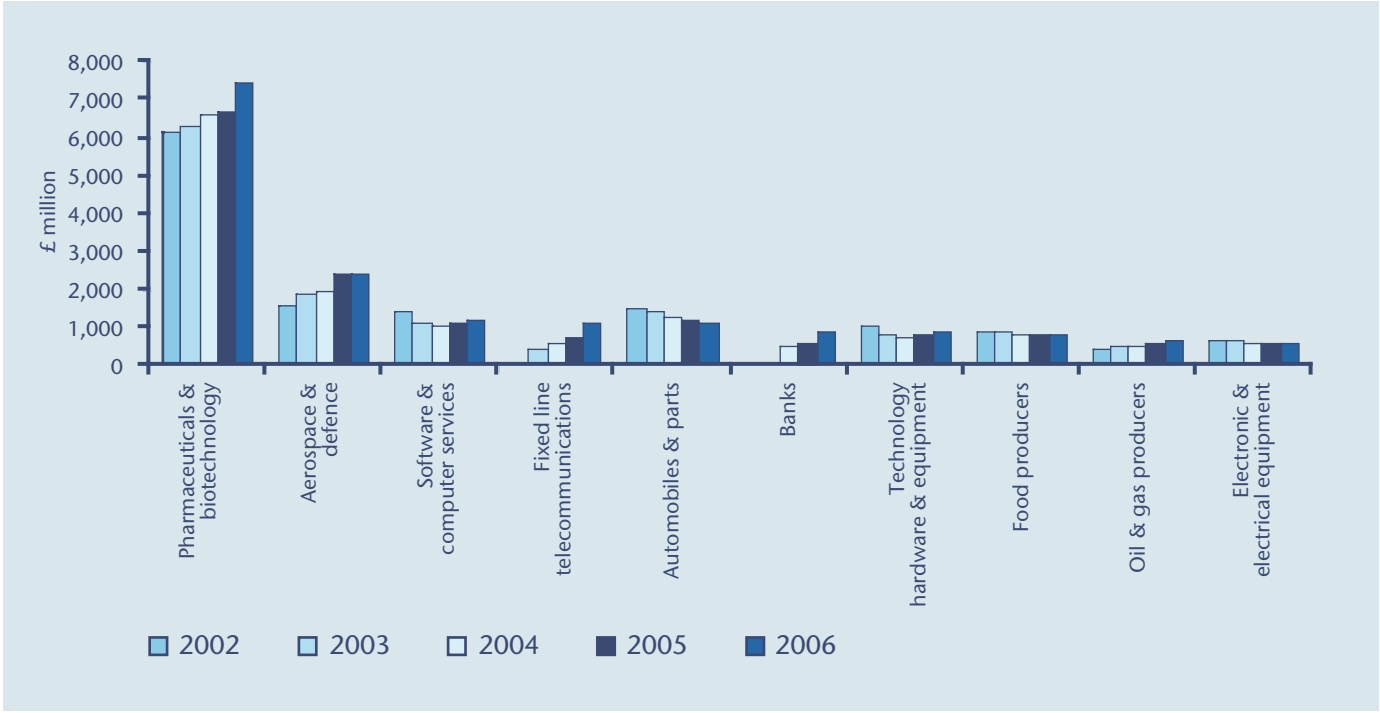


Figure 6: Growth in R&D expenditure by sector across G1250 (2002-2006)

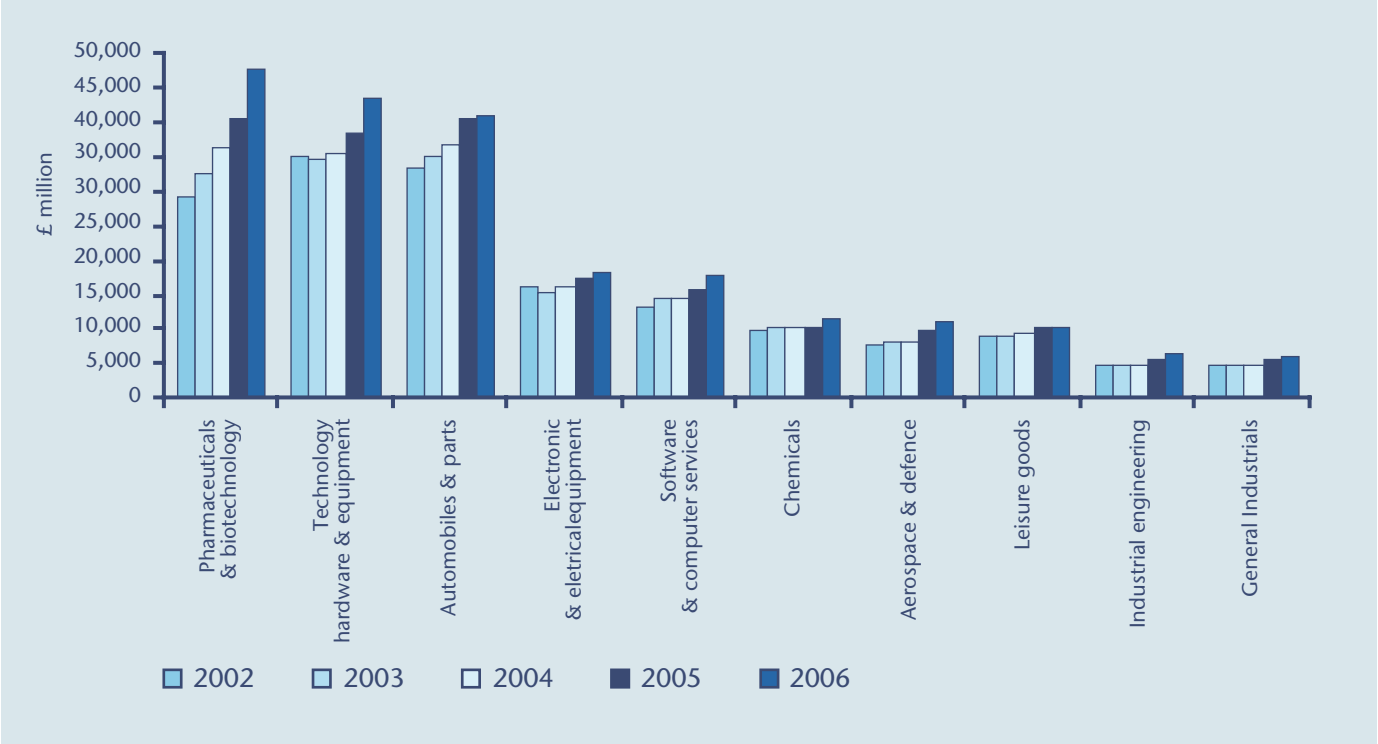


Figure 6 shows the growth in investment in R&D across the G1250 over the last five years.

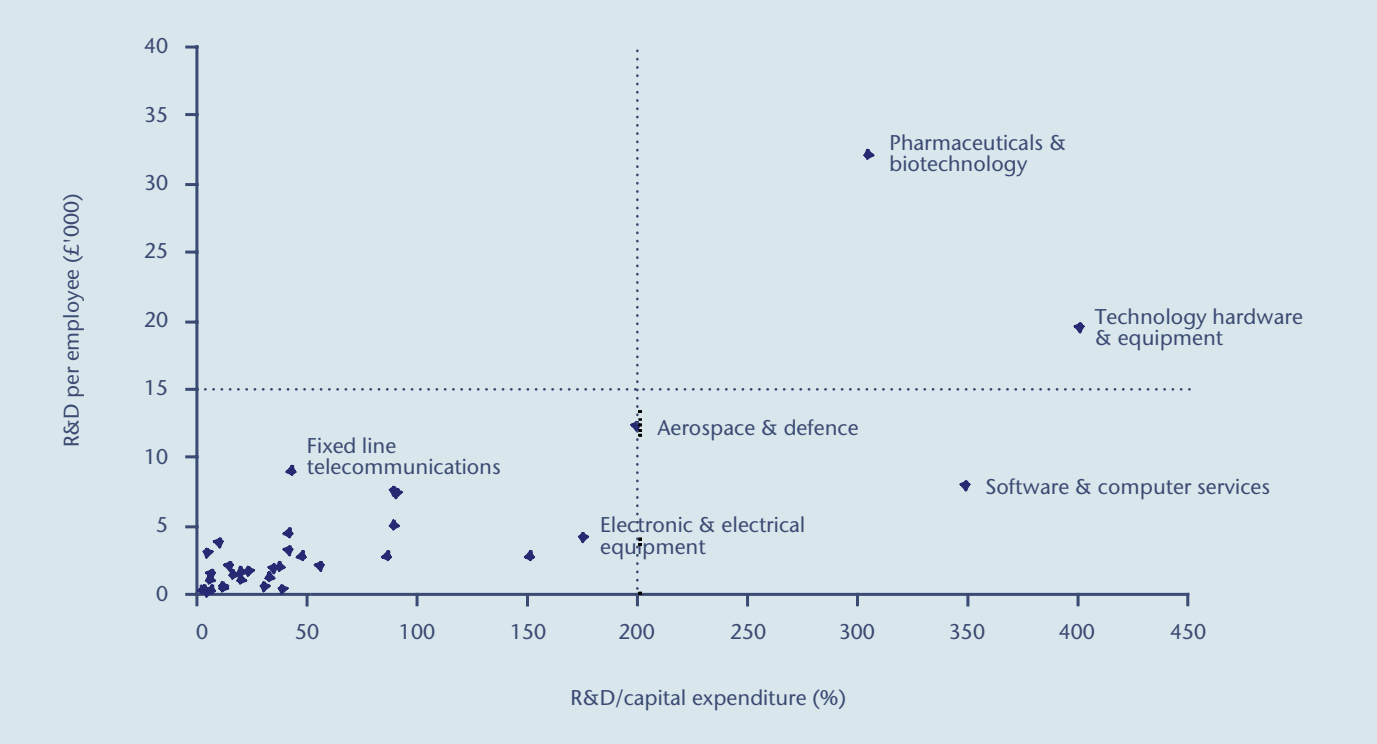
Compared with the G1250, the rate of increase in investment in R&D among the UK850 over the previous four years was 12.2% less. This is not a like-for-like comparison; the UK850 includes many smaller firms and foreign subsidiaries, which are not present in the G1250. That said, investment in R&D grew more quickly in the G1250 than in the UK firms across almost all sectors: only electronic & electrical equipment and fixed line telecommunications increased their R&D more quickly than the rest of the world.

Growth in the UK electronic & electrical equipment sector was driven by two companies, Laird and Renishaw, which increased their R&D investment by 138% and 82% respectively over the four years. The UK fixed line telecommunications sector was largely driven by the strong performance of BT, which increased its R&D spending by 128% over the four years.

The intensity of R&D – capex and employment

Figure 7 highlights the differences between sectors in the relative importance of investment in R&D compared to capital expenditure for firms in the UK850. Each point on the chart represents an individual sector. The pharmaceuticals & biotechnology sector stands apart from the rest: R&D per employee was almost double that of any other sector in 2006. Similarly, both the technology hardware & equipment and software & computer services sectors spent substantially more on R&D

Figure 7: R&D per employee and R&D/capital expenditure in UK850 (2006)



than on capital expenditure. Whilst the importance of R&D is evident for some sectors, it is also clear that for sectors such as banking and oil & gas, R&D is not the most important business input.

Performance: R&D, sales and operating profits

R&D and sales

Across the UK850, the ratio of investment in R&D to sales averaged 1.8% in 2006. This average figure, however, masked considerable variations across the sectors: in two sectors – pharmaceuticals & technology and aerospace & defence – the ratio of R&D to sales exceeded 8%, but the large volume of sales generated by the banking, telecommunications and oil & gas sectors diluted the overall ratio across the UK.

In contrast, for the largest US R&D firms, the average ratio of R&D to sales stood at 4.6%. As discussed in previous Scoreboards, this is due to the different sector mix of UK and US firms. Globally, only three sectors – pharmaceuticals & biotechnology, software & computer services and technology hardware – had an R&D intensity of over 8%.

Overall, investment in R&D amongst the UK850 grew faster than sales over the last 12 months. The pattern varied, however, over the longer period across the leading R&D sectors:

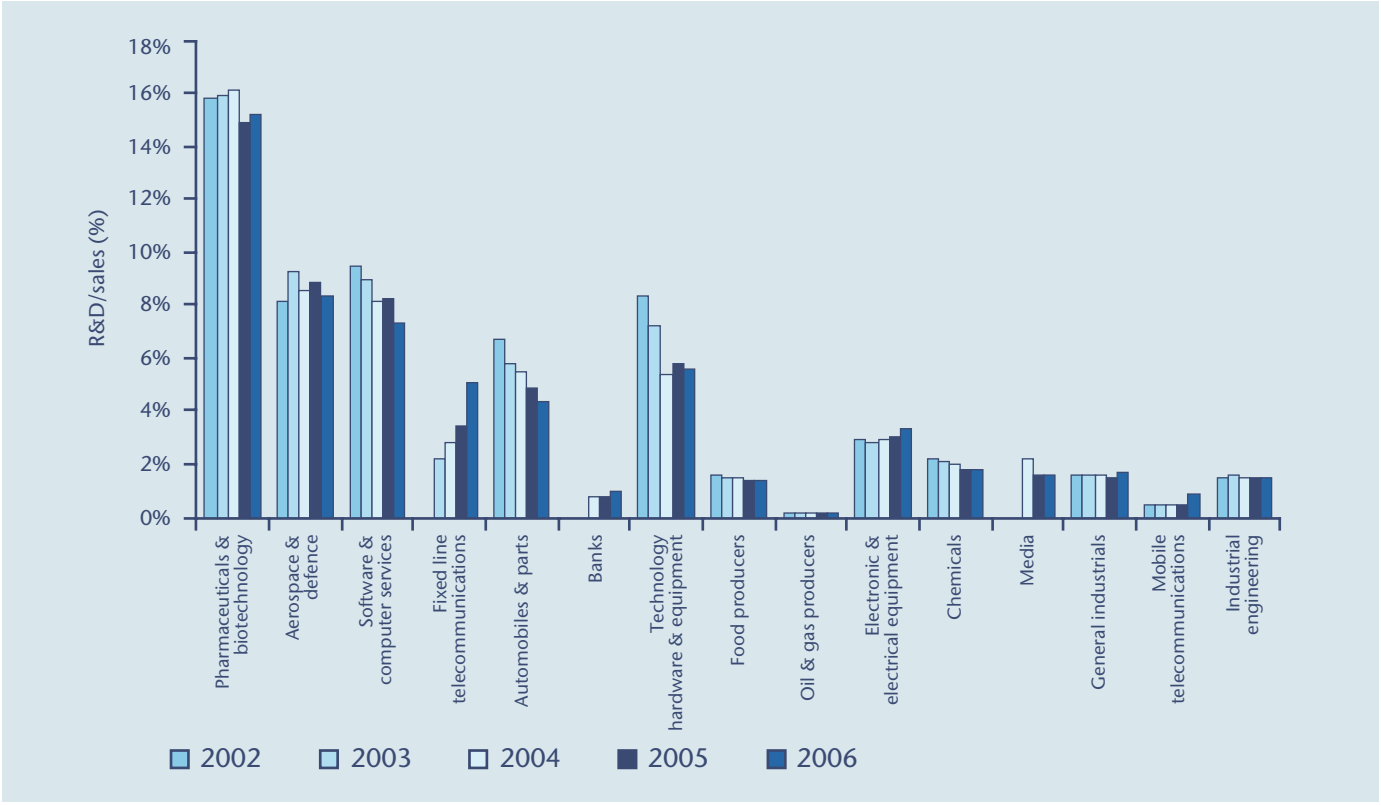
- investment in R&D grew faster than sales in both fixed line telecommunications and oil & gas production, and declined less

quickly than sales in the electronic & electrical equipment sector;

- in the two biggest sectors - pharmaceuticals & biotechnology and aerospace & defence – R&D growth mirrored that of sales; and
- sales grew faster than investment in R&D in four sectors: food producers, automobiles & parts, software & computer services and technology hardware & equipment.

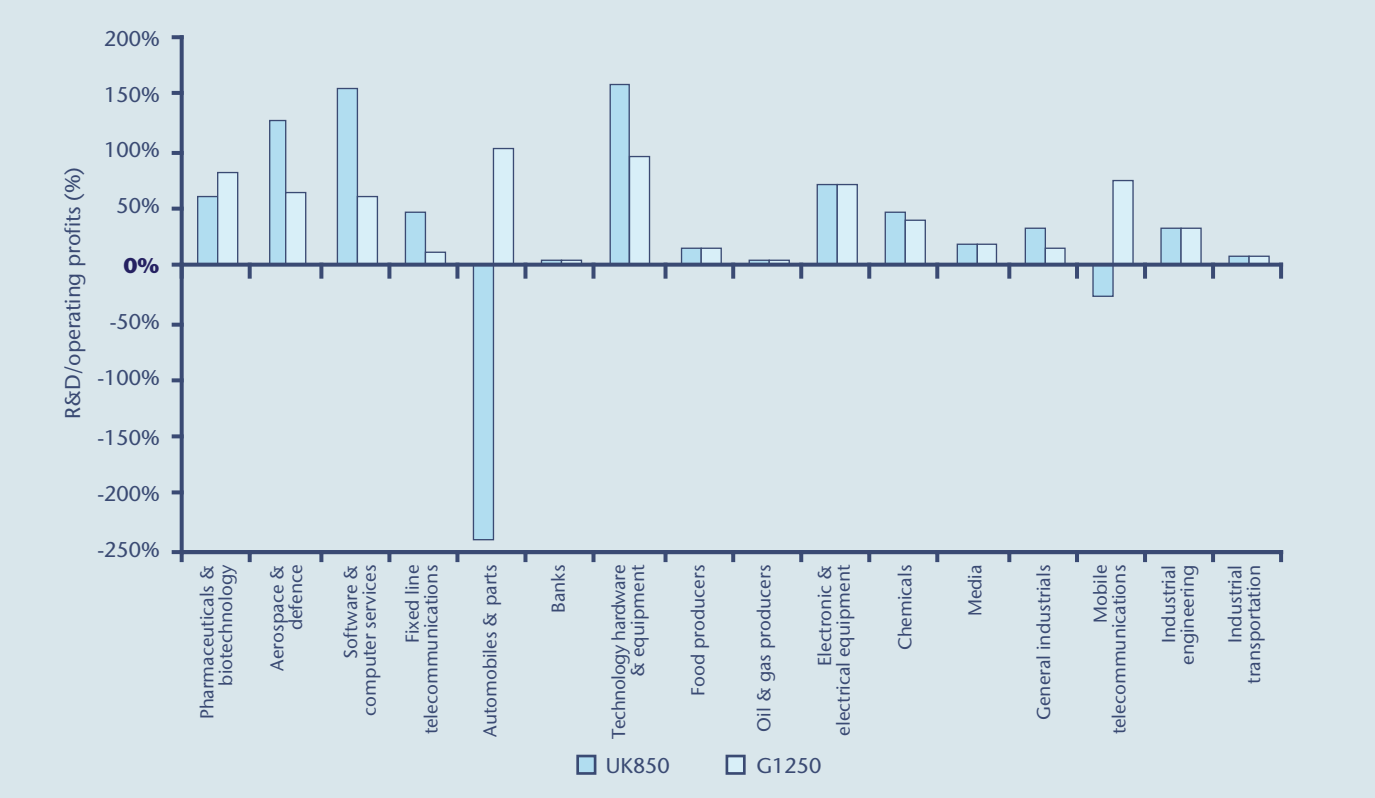
This pattern is reflected in Figure 8 which shows investment in R&D as a proportion of sales over the last four years.

Figure 8: R&D expenditure as a proportion of sales by sector for the UK850 (2002-2006)



It is also interesting to compare firms' levels of R&D investment with their profits. Figure 9 shows investment in R&D as a proportion of operating profits in 2006. For some of the UK's main R&D sectors, notably aerospace & defence, software & computer services and technology hardware & equipment, the value of their investment in R&D was substantially more than their operating profits. The technology hardware & equipment sector, for example, invested an amount equivalent to 158% of its profits in R&D, partly reflecting the fact that innovation is a critical value-adding activity and, for companies to survive longer term, they need to sustain their level of investment. In contrast, for companies in the banking and oil & gas producing sectors, the ratio of the level of investment in R&D to their operating profits was low (3.2% and 1.6% respectively).

Figure 9: R&D expenditure as % of operating profits across UK850 and G1250 (2006)

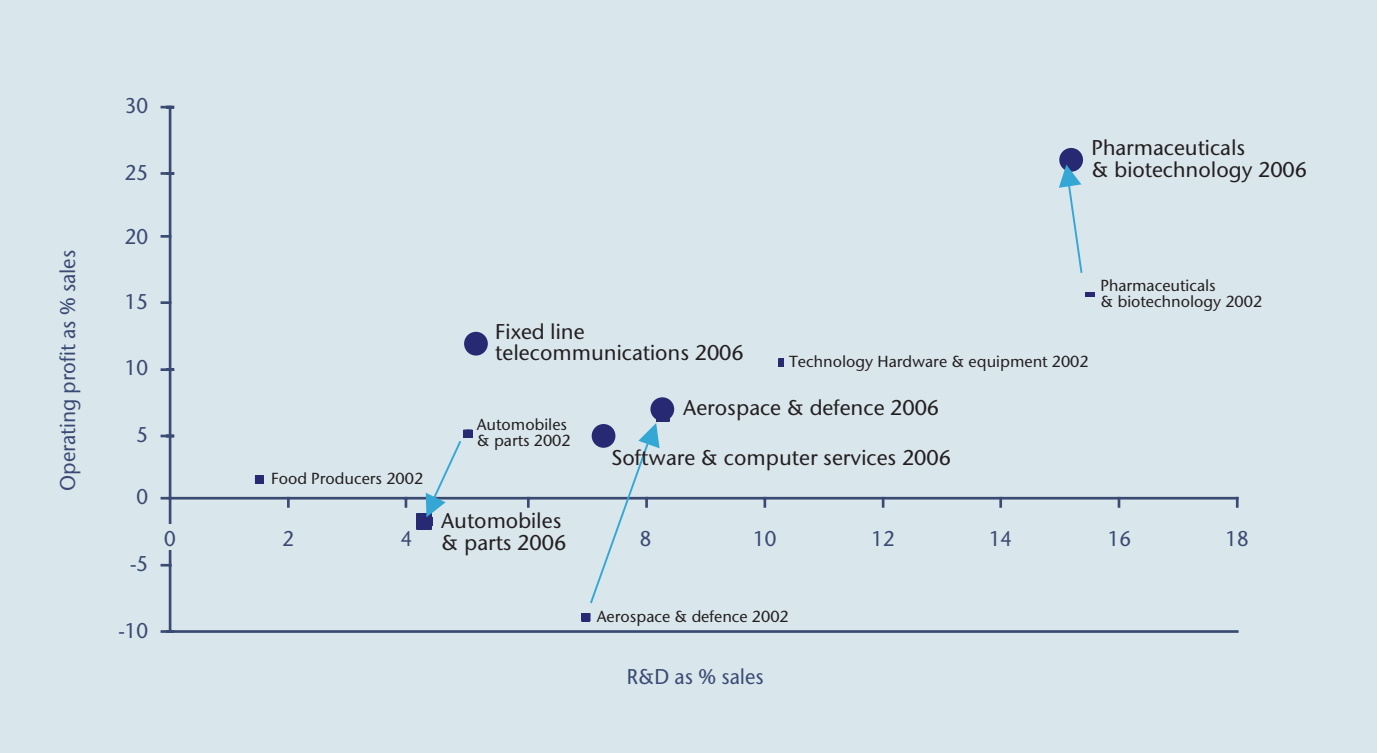


The experience of the UK850 firms contrasts with that of firms globally in the G1250. Figure 9 shows investment in R&D as a proportion of profits for firms in the G1250. Of the 15 sectors making the biggest global investments in R&D, only the leisure goods sector invested an amount equivalent to its operating profit in R&D. Again, this may reflect the differences in composition of the two lists.

R&D and profits

Both the pharmaceuticals & biotechnology and aerospace & defence sectors in the UK850 have improved their profit margins significantly over the last four years (see Figure 10). The aerospace & defence sector was loss-making in 2002, but increased its operating profit as a proportion of its sales to 6.6% in 2006 and also increased its investment in R&D as a proportion of sales over the same period to 8.3% in 2006. Although investment in R&D declined slightly as a proportion of sales in the pharmaceuticals & biotechnology sector, operating profit margins increased by more than 10%. Nonetheless, pharmaceuticals & biotechnology remained one of the most profitable sectors. In contrast, the automobiles & parts sector has experienced a very different set of trends: both operating profit margin and R&D as a proportion of sales have declined.

Figure 10: R&D as a proportion of sales and operating profit as a proportion of sales by sector for UK850 (2002 and 2006)



Benchmarking UK R&D performance

The R&D performance of the UK's leading investors in R&D can be analysed by comparing the investment of the UK850 in R&D (or those companies which reported their R&D investment for the five years from 2002 to 2006) with the level of R&D that they would have invested if they had increased their investment at the same rate as the relevant sector average for the G1250 excluding the UK. An adjustment has been made to reflect current exchange rates rather than fixed exchange rates.

The 2006 figures are compared with the moving average in sector R&D growth for the years 2002-2005.

- actual R&D by this group of UK firms as a whole was £18.6 billion in 2006 and, overall, this is £0.51 billion lower (in net terms) than would have been expected if all the UK firms in the UK850 had grown their spend at the rate of their global counterparts. The only major UK850 sector to grow faster than its equivalent G1250 sector was fixed line telecoms;
- however, on this basis R&D spend in the FTSE100 and 250 actually grew faster than the G1250, while the smaller firms and subsidiaries grew their R&D more slowly. This suggests that, despite the differences in performance between the UK850 and G1250 sectors, the UK's major companies are largely keeping pace over time with their global competitors' R&D investment.

Sector Summaries

Pharmaceuticals & biotechnology

In 2006, the pharmaceuticals & biotechnology sector was the largest investor in R&D in both the UK and globally. Although R&D spend has increased significantly over the past ten years, productivity as measured by the number of new molecular entities and biologics approved by the approval agencies) has declined.

The large UK companies are well positioned in the US, the largest pharmaceutical market (by value) in the world and the most profitable. GlaxoSmithKline and AstraZeneca generated approximately 48% and 54% of total sales in the US in 2006. This reflects the fact that R&D alone does not produce innovative products and there are numerous other important factors impacting the success of R&D.

Aerospace & defence

In the aerospace & defence sector...

- Positive sales and R&D picture in aerospace & defence reflects rising global defence spending and air travel;
- Global R&D expenditure is increasingly concentrated around larger companies;
- Current R&D spending driven by new commercial aircraft developments;
- UK aerospace & defence R&D is second largest in country by sector;
- UK R&D concentrated around few domestic champions but foreign investment also rising;
- UK R&D intensity is especially high amongst smaller more specialised companies.

Software & computer services

In the software & computer services sector, there are triple contrasts: the steep decline in R&D intensity in the sector sits alongside sales growth of 16.6% in 2006 (the highest sector sales growth that year) and at 15.3% over four years... yet the growth in its R&D is modest in 2006 (at 3.9%) and in decline over four years (at minus 6.5%).

- Positive sales and R&D picture in Software & Computer Services reflects robust demand from key customers in financial services, communications and healthcare;
- UK sector R&D efforts relatively fragmented with 117 companies outside the FTSE 100 and the FTSE Mid 250 accounting for 75% of the total sector's R&D.

Fixed line telecommunications

Fixed line telecommunications – exemplified individually by BT (see Commentary, p4) – bucked the trend when it comes to investment in R&D relative to sales among the top 15 UK sectors. Its ratio of R&D investment to sales has risen sharply over the last five years – and is unique in doing so; this matches the sector's growth in R&D investment (up 54% in 2006 and 94% over the average R&D in the four prior years).

The sector has had to invest heavily into Internet Protocol (IP) networks. In addition, investments in IP networks - BT's investment in an IP network is estimated to be about £21 billion and is called the Next Generation Network – are expected to significantly lower operating costs and to provide a more

flexible platform for new services. So while past growth and profitability have been disappointing, new investments are expected to deliver in the future.

The 5-year sales figures also show that Fixed Line Telecommunications sales are almost completely static, moving from £20.5 billion to just £22.2 billion over the period 2002-6. The figures also show the sector's operating profit increasing at just 4.4% over four years. Yet BT has chosen to dramatically increase investment in R&D. The sector has recently seen a frenzy of innovation in technologies related to the internet and to mobile communications. Combined with this, is a continued collapse in fixed line voice revenues and volumes (a core service in the past). In many cases, the fall in fixed line voice revenues has outweighed the increase in revenues from internet and mobile communications. The net effect is that headline revenues/profits for the sector have been lacklustre.

- Sales and R&D picture in Integrated Telecommunications sector reflects significant structural change driven by technology, deregulation and emerging markets;
- UK sector R&D significantly shaped by one company, BT;
- Next generation networks are significant focus of R&D investment for the sector and for the UK;
- BT's R&D focus is on its "new wave" services predominantly broadband, mobility and IT services;
- Excluding BT, R&D intensity in UK sector is relatively low and broadly similar to Global sector;
- BT's R&D intensity is relatively high reflecting a re-weighting of its business mix towards IT services (e.g. 66% of BT's R&D spend in 2006 was capitalised software development).

Automobiles & parts

- Global R&D rises in 2006 but at slower pace than 4 year growth rate;
- Industry restructuring has impacted R&D growth at 'Big 3' manufacturers;
- Four year growth in R&D spending mainly driven by Japanese manufacturers;
- UK 2006 R&D impacted by restructuring at Ford;
- UK R&D intensity still high despite industry restructuring;
- UK Automobiles & Parts sector R&D 5th largest in UK.

Banks

- Banking R&D relates purely to internally generated software; investment in this area is not widespread across the industry, which typically does not capitalise R&D expenditure;
- Within the UK banking sector, listed banks account for 94% of total R&D and two banks – RBS and HSBC – make up 79% of total spending;
- The same two banks also emerge as the two largest R&D spenders in the global banking sector, although differing accounting treatments may distort international comparisons;
- Banking R&D intensity is low compared with many other sectors, owing to the specialised nature of software investment and the sector's size and strong levels of profitability;
- Nonetheless, UK banking R&D intensity is slightly higher than the equivalent global data;
- It is impossible to verify the drivers of banking R&D; however the development of trading software and customer relationship management systems seem to be the most likely themes.

The pattern of R&D across different categories of firm in the UK

Introduction

This section analyses the pattern of R&D expenditure across different categories of firms in the UK, and, where relevant, globally. It starts by summarising the recent pattern of investment in R&D and other key business performance characteristics by category of firm across the UK850 and examines changes since the previous Scoreboard. It then looks at firms in different size groups and different ownership: it compares listed and unlisted firms and UK-owned and foreign owned firms. The final part of the section examines the characteristics of the most R&D intensive businesses and those firms in the UK850 which have increased and reduced their R&D investments by the most over the last 12 months.

Summary

Table 4 summarises the pattern of investment in R&D and other key business performance characteristics by category of firm across the UK850. The key points to note are that:

- The UK's 75 biggest R&D investors – which also form part of the G1250 largest R&D spenders worldwide – conducted two thirds of the UK850's R&D;
- The UK75 grew their R&D by 11.9% over the previous year whilst their global peers averaged a 9.9% increase;
- Smaller UK firms increased their R&D expenditure more slowly than the global leaders in their sectors. For example, the other 775 UK companies which form part of the UK850 increased their investment in R&D by only 3.4%;
- However, 95 more firms invested over £0.5m in R&D compared to last year's Scoreboard.

Table 4: Investment in R&D and other measures of business performance across UK850 and G1250 (2006)

Type of company		Number of companies	Total R&D (£ million)	Change in R&D over previous year (%)	Change in sales over previous year (%)	Operating profit as percentage of sales (%)
UK-owned	Listed	408	15,043	12.4	7.6	15.8
	Unlisted	145	987	0.9	5.9	5.8
Foreign owned		297	4,898	1.2	4.4	5.6
Total – UK850		**850**	**20,928**	**9.**	**6.9**	**13.4**
UK companies within G1250		75	14,125	11.9	6.6	15.3
Total – G1250		**1,250**	**243,943**	**10**	**9.8**	**11.8**

Differences between firms of different size

Table 5 shows the composition of firms in both the UK850 and G1250 broken down by the value of their sales. Companies with sales of less than £50 million were the largest proportion of the UK850 in 2006 (40.2%) followed by companies with sales between £50 million and £500 million (36.2%). 200 companies had sales over £500 million of which 43 achieved sales of over £5 billion.

Table 5 also shows the size of firms in the UK850 and G1250 in terms of their sales. It distinguishes UK firms from those from other countries. As expected, these companies are larger than those in the UK850. More of the 75 UK firms in the G1250 were at either end of the size distribution: the UK has proportionately more very large firms (with sales in excess of £5 billion), and more small firms (with sales below £50 million), than the G1250 as a whole.

Table 5: Size distribution of firms in G1250 and UK850 (2006)

	UK850		G1250					
	Number	% of total	Number	% of total	Non-UK firms	% of total	UK firms	% of total
More than £5 billion	43	5.1%	308	24.6%	284	24.2%	24	32.0%
Between £500 million and £5 billion	157	18.5%	610	48.8%	581	49.4%	29	38.7%
Between £50 million and £500 million	308	36.2%	283	22.6%	269	22.8%	15	18.7%
Less than £50 million	342	40.2%	49	3.9%	41	3.6%	7	10.7%
Total	**850**	**100%**	**1,250**	**100%**	**1,175**	**100%**	**75**	**100%**

Table 6 analyses investment in R&D as a proportion of sales for firms of different sizes in both the UK850 and the G1250. The evidence indicates that:

- smaller firms in the UK (as measured by their sales) invested significantly more in R&D than their larger peers in the UK: for example, the companies in the UK with sales of between £50 million and £500 million invested 4.8% of their sales in R&D whereas those with sales of more than £5 billion invested 1.5%; and
- UK firms invested significantly less in R&D (as a proportion of sales) than their counterparts globally: for example, the proportion of sales invested in R&D by the largest companies globally outside the UK was 3.2% compared with 1.5% for those with similar sales from the UK.

Both these results illustrate a sector mix effect: in the first case, smaller firms in the UK850 tend to be more R&D-intensive, being concentrated in high-tech sectors, while larger firms include banks and oil & gas companies, for example, with high absolute R&D numbers that represent a very small proportion of their sales. In the second case, as Figure 4 on page 14 illustrates, the UK's mix of

R&D businesses is quite different from other countries'. Previous Scoreboards have demonstrated how this accounts for the UK firms' lower R&D intensity.

Table 6: R&D and sales by size of firms (2006)

Sales (£ million 2006)	Number of companies	R&D (£ billion)	Sales (£ billion)	R&D as percentage of sales (%)
G1250 excluding UK				
More than £5 billion	284	165.0	5,106.7	3.2%
Between £500 million and £5 billion	581	53.1	1,093.5	4.9%
Between £50 million and £500 million	269	10.2	67.9	15.1%
Less than £50 million	42	1.5	0.7	228.6%
UK850				
More than £5 billion	43	12.2	840.3	1.5%
Between £500 million and £5 billion	157	4.6	253.1	1.8%
Between £50 million and £500 million	305	2.9	61.0	4.8%
Less than £50 million	345	1.2	5.1	24.4%

Differences between different types of ownership

Listed and unlisted companies

There was a marked difference between the performance of the listed companies in the UK850 and those which are unlisted (see Table 7). The listed companies increased their investment in R&D by more than 12% compared with the previous year, whereas the unlisted companies increased their R&D by less than 1%.

Table 7: Investment in R&D and other measures of business performance across listed and unlisted firms in the UK850 (2006)

Type of company	Number of companies	Total R&D (£ million)	Change in R&D over previous year (%)	Change in sales over previous year (%)	Operating profit as percentage of sales (%)
Listed	408	15,043	12.4	7.6	15.8
Unlisted	145	987	0.9	5.9	5.8

The listed companies also achieved the greatest increase in operating profits in the last year although private companies showed the highest growth over the last four years as a whole.

Operating profits expressed as a proportion of sales improved for listed UK-owned companies from 13.5% in last year's R&D Scoreboard to 15.8%. These companies generated a higher profit margin than their global peers in the G1250.

For the G1250, while R&D grew by 10%, profitability (as measured by operating profit) rose by 16.4%. Market capitalisation also increased by 19.6 % during 2005.

Relative performance of foreign owned firms in the UK850

Over three quarters of the investment in R&D in 2006 by the UK850 (77%) was made by companies which are UK-owned; nearly one quarter (23%) was invested by foreign-owned firms. The proportion of foreign-owned companies increased from 30.6% in last year's Scoreboard to 34.9%.

In sales terms, UK listed companies also outstripped their foreign-owned peers in the UK850, over the recent short and medium-term.

Over the last year, the UK listed companies in the UK850 have performed comparatively better than their foreign-owned counterparts (see Table 4):

- they increased their investment in R&D by over 12% whereas the foreign owned firms increased their R&D investment by only 1%;
- they achieved levels of profitability almost three times higher: their operating profits were almost 16% of their sales; and
- sales growth was slightly faster.

Foreign-owned companies in the UK850, however, spent a larger proportion of their operating profits on R&D (more than 48%) than UK-listed companies, which spent just under 11% of their operating profit on R&D. However, about two thirds of foreign-owned companies spent less than 4% of their sales revenue on R&D whilst among UK-owned companies, 60% invested more than 4% of their sales revenue in R&D.

The main factor at work here is the unequal comparison of global accounts for UK firms and UK accounts for foreign-owned companies. However, it does illustrate that changes in firms' global R&D do not necessarily translate directly into UK subsidiaries. For example, Ford's global R&D cut was 10%, while its UK subsidiary reduced its R&D by 15%; Pfizer's 2% global increase in R&D included a 6% increase in R&D in the UK.

R&D intensity of firms

Figure 11 shows R&D expenditure as a proportion of sales for four categories of firm in the UK850. On average, foreign owned firms spend a greater proportion of the value of their sales on R&D than either listed or unlisted companies.

Figure 11: R&D expenditure as a proportion of sales by ownership of firms in the UK850 (2006)[2]

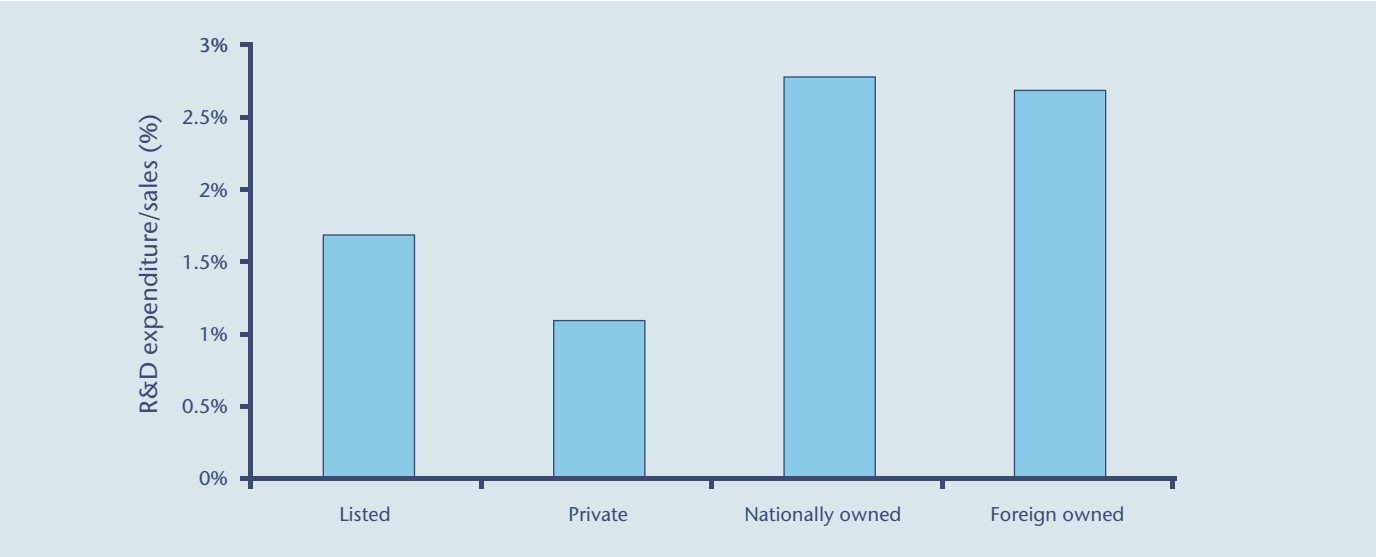


Table 8 lists the FTSE 100 and FTSE 250 companies with the highest ratios of investment in R&D to sales in 2006. Companies from the software & computer services and pharmaceuticals & biotechnology sectors dominate. Pharmaceuticals companies like Shire (16.8%), GSK (14.9%) and AstraZeneca (14.7%) top the list of FTSE 100 firms whereas technology hardware & equipment and software firms head the list of FTSE 250 firms.

Table 8: Companies with the highest ratio of R&D expenditure to sales (2006)

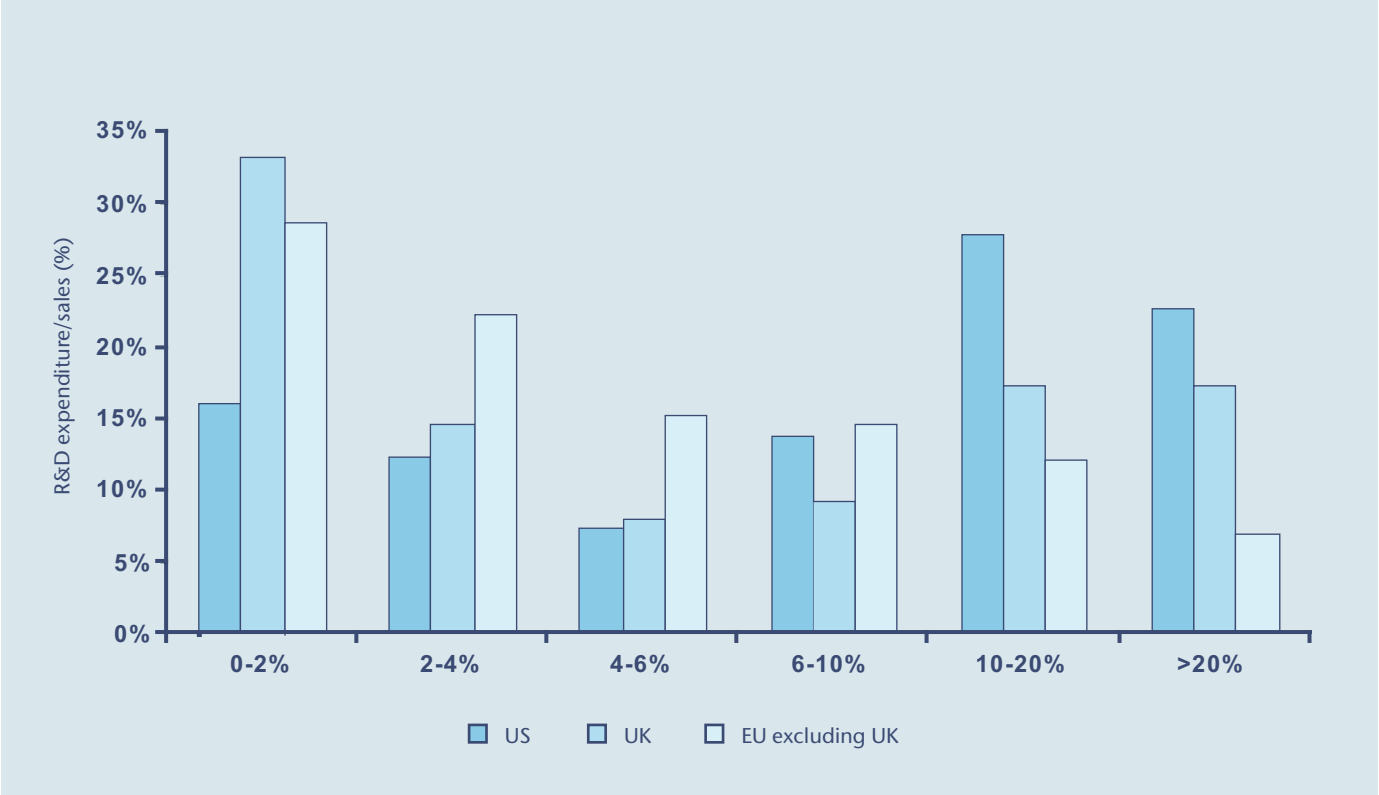
Company	R&D as a proportion of sales (%)	R&D (£ million, 2006)	Growth in R&D over last year (%)	Sector
ARM	32.1	84.5	5	Technology hardware & equipment
Autonomy	21.9	28.0	150	Software & computer services
Spirent Communications	19.4	58.0	-8	Technology hardware & equipment
AVEVA	18.6	17.6	26	Software & computer services
Renishaw	17.2	31.1	46	Electronic & electrical equipment
Shire	16.8	154.4	5	Pharmaceuticals & biotechnology
CSR	15.5	55.9	81	Technology hardware & equipment
Micro Focus International	15.4	11.3	-5	Software & computer services
GlaxoSmithKline	14.9	3,457.0	10	Pharmaceuticals & biotechnology
AstraZeneca	14.7	1,993.7	15	Pharmaceuticals & biotechnology
BAE Systems	10.1	1,248.0	-14	Aerospace & defence
Sage	10.1	94.9	16	Software & computer services
Misys	9.8	88.6	-15	Software & computer services
Gyrus	7.7	16.4	39	Health care equipment & services
Rightmove	7.2	2.4	52	Media

2 Nationally owned companies are UK firms which have a UK parent whose accounts could not be obtained.

Looking across the whole of the UK850, Symbian, a mobile telecommunication software & computer services company owned by wireless industry leaders, invested the highest proportion of its sales in R&D in 2006 (47.5%). It was followed by Ipsen 35.3%, SCI Entertainment 32% and Organon Labs 30.8%. Of these firms, only Symbian and Ipsen have remained in leading positions over the last four years.

Figure 12 also examines investment in R&D as a proportion of sales and compares companies of similar size from the G1250 which are owned in the US, UK and other parts of the EU. It shows that proportionately more US companies spent over 10% of the value of their sales on R&D than their counterparts in the rest of the EU. UK-owned companies were still behind their US-owned counterparts, but comfortably outstripped other EU countries. This reflects the growing number of UK companies operating in sectors characterised by high R&D intensity. At the other end of the scale, however, there were more UK-owned companies with the lowest ratio of R&D investment to sales: about a third invested in R&D at a rate of less than 2% of their sales. The pattern in the US was more consistent, in that there were proportionately fewer US companies with very low R&D intensity.

Figure 12: Distribution of firms by R&D expenditure as a proportion of sales (2006)



The biggest changes in the UK

Table 9 lists the 25 companies which have increased their investment in R&D by the most since the previous R&D Scoreboard.

One of the most notable increases over the last year is that of BT whose investment rose 54% (a £392 million increase), matching – some would argue, leading – the trend of the fixed line telecommunications sector. BT's strong injection of cash into its R&D is not, however, reflected in its R&D intensity (R&D spend as a proportion of its sales): it is 5.5%. Royal Dutch Shell also invested significantly more in R&D (a 51% increase).

Banks such as HSBC (£86 million), RBS (£53 million) and National Australia (£50 million) also showed some of the largest increases in R&D spend. However these increases may in part reflect the relatively recent introduction of IFRS reporting standards and more comprehensive reporting of existing levels of R&D activity, rather than actual changes in R&D activity.

Table 9: Biggest increases in R&D expenditure in the UK850 (2006)

Company	Sector	Increase in R&D (£ million)
BT	Fixed line telecommunications	392
GlaxoSmithKline	Pharmaceuticals & biotechnology	321
AstraZeneca	Pharmaceuticals & biotechnology	267
Royal Dutch Shell	Oil & gas producers	152
Airbus*	Aerospace & defence	102
HSBC	Banks	86
O2 *	Mobile telecommunications	80
Rolls-Royce	Aerospace & defence	59
Reuters	Media	55
Royal Bank of Scotland	Banks	53
National Australia *	Banks	50
Smiths	General industrials	49
SCI Entertainment	Software & computer services	36
Marks & Spencer	General retailers	36
Eli Lilly and Company *	Pharmaceuticals & biotechnology	35
Aventis (Dagenham)*	Pharmaceuticals & biotechnology	33
Serco	Support services	32
Syngenta *	Chemicals	31

* signifies foreign owned company

Table 10 shows the largest decreases in R&D spending over the last year. As might be expected given the underlying upward trend, the reductions are smaller in scale than the the increases. BAE Systems recorded a drop in investment in R&D of £201 million yet its R&D as a proportion of its sales remains healthy at 10%. In part, this may reflect the lumpy nature of R&D within the sector. Furthermore BAE Systems recently sold its stake in Airbus which had been in a period of high investment to develop the A380.

Table 10: Biggest decreases in R&D expenditure in the UK850 (2006)

Company	Sector	Reduction in R&D (£ million)
BAE Systems	Aerospace & defence	201
Ford *	Automobiles & parts	105
BP	Oil & gas producers	55
GEH *	Health care equipment & services	44
Telent	Software & computer services	40
Fujitsu Services *	Software & computer services	36
British Nuclear Fuels	Electricity	33
Unilever	Food producers	32
Generics UK *	Pharmaceuticals & biotechnology	31

* signifies foreign owned company

Business performance and R&D expenditure

Previous R&D Scoreboards have referred to evidence about the link between investment in R&D and business performance.

As part of the preparation for this R&D Scoreboard, an econometric/ statistical analysis has been undertaken using the Scoreboard dataset to examine whether there is evidence of a statistical relationship between investment in R&D and business performance.

The analysis focused on considering whether changes in business performance over the last five years – as measured by sales growth, profitability and stock market capitalisation – could be explained in terms of changes in investment in R&D over the same period, and other factors captured in this year's Scoreboard database.

Despite extensive analysis, no statistically significant relationships were found.

To some extent this is not surprising because:

- there may be long lags between changes in investment in R&D and subsequent company performance;
- the effects work at levels within companies that cannot be isolated at whole firm level; and
- there are important omitted variables in the data set available.

Our current conclusion here is that the relationship between R&D and firm performance is complex rather than non-existent. Certainly, the firms in the FTSE100 with higher R&D as a proportion of sales have been judged by the market to be more successful over the recent past than the index as a whole. Figure 13 illustrates this for a portfolio of the FTSE100 firms spending at least 4% of their sales on R&D[3]. The value of the portfolio has risen by 51% since 2001; the FTSE100 index rose by 27% over the same period.

Figure 13: Change in value of the FTSE100 R&D portfolio over time

3 The value of the R&D portfolio has been constructed using the sum of share price of each share in the portfolio. The portfolio is made up of AstraZeneca, GlaxoSmithKline, Shire, BAE Systems, Sage, Rolls Royce, Johnson Matthey, Reuters, Smiths, Smith & Nephew and BT. Johnson Matthey is included on the basis of its sales net of the cost of precious metals. The equivalent portfolio in 2006 did not include BT. A similar portfolio drawn up in 2001 was: ARM, AstraZeneca, GlaxoSmithKline, Shire, Misys, BAE Systems, Sage, Spirent, Rolls Royce, Johnson Matthey, Reuters and Smiths.

Appendix A – scope, definitions and limitations of the R&D Scoreboard

This Appendix explains the scope of the R&D Scoreboard, the definitions which underpin it and the limitations that result from the scope and definitions.

Scope of the R&D Scoreboard

The UK850 and G1250 have been prepared on the basis of annual reports and consolidated accounts received by Company Reporting Ltd up to and including 30 July 2007. Annual reports which have a year-end older than 30 months from this cut-off date or a publication date older than 24 months from cut-off date are excluded.

For companies that have prepared an annual report and accounts for a period not equal to 12 months, the figures in the R&D Scoreboard have been "annualised" to reflect a 12 month period. To ensure figures are not mis-represented, annual report and accounts for a period less than 4 month are not "annualised" and the companies are excluded from the Scoreboard.

For the UK850, the accounts used are the consolidated group accounts of the ultimate UK parent. Companies which are subsidiaries of other UK companies are not ranked separately, except for:

- some significant foreign owned companies that take advantage of the EC 7th Directive non-consolidation provision;
- companies that disclose R&D costs where the ultimate consolidating parent does not; and
- the ultimate UK parent does not produce consolidated accounts or has never published accounts.

For the G1250, the accounts used are the consolidated group accounts of the ultimate parent company. Companies which are subsidiaries of any other company are not ranked separately. These bases seek to maximise completeness while at the same time minimising double counting.

The R&D investment included in the Scoreboard is the cash investment which is funded by the companies themselves. It excludes R&D undertaken under contract for customers such as governments or other companies. It also excludes the companies' share of any associated company or joint venture R&D investment. However, joint venture companies that publish accounts and disclose R&D are included. Where part or all of R&D costs have been capitalised, to calculate the cash investment the additions to the appropriate intangible assets are included in the Scoreboard as R&D investment and any amortisation eliminated. For some foreign-owned UK

companies, R&D investment is incurred within the UK but funded by the parent or another group company. In such cases, where the R&D is noted in the UK company report, the scope of R&D investment included in the UK850 is broadened to include the activity taking place in the UK but funded from overseas.

Data on previous years' R&D investment are taken from the appropriate year's annual report and accounts. R&D investment for previous years does not take into account restated figures. Where a significant event, such as a merger or acquisition has taken place, comparative figures from the latest accounts are taken to give a more accurate reflection of company performance. In the case of mergers and acquisitions earlier year figures are taken in respect of the larger of the two constituent companies.

Where a company has reported under IFRS and disclosed a R&D figure for the first time, comparative figures are taken to give a R&D figure for the previous year and a one year growth rate. Where a company previously reported under its domestic GAAP and has disclosed under IFRS for the first time in the current year, and where there is a material difference in R&D between the two years, comparative figures have been entered to more accurately reflect the R&D spend for each year. Where there exists an information discontinuity between the current year and previous year comparative figure R&D disclosure, a "n/a" has been entered for the previous year R&D.

Definitions

The R&D investment included in the Scoreboard, being that disclosed in the annual report and accounts, is subject to the accounting definitions of R&D. In the UK, the definition is contained in Statement of Standard Accounting Practice (SSAP) 13 "Accounting for research and development". For international companies, the definition is governed by International Accounting Standard (IAS) 38 "Intangible assets". Both of these definitions are based on the OECD "Frascati" manual.

Companies are assigned to the appropriate sectors of the Industry Classification Benchmark (ICB) as of the year-end date of their accounts. Each company's national stock exchange has been consulted to obtain an industry classification. Companies listed on stock exchanges which do not use the ICB and unlisted companies are allocated to an industry sector that best suits their business as described in their annual accounts.

Companies are assigned to the country where they have chosen to incorporate the overall group with the exception of all FTSE 100 companies which are assigned to the UK for the purpose of the Scoreboard regardless of their country of incorporation.

The listing status of all companies has been taken as at 30 July 2007.

"Sales" – for banks, sales are defined as the "Total (operating) income" line from the profit & loss account and, for insurance companies, they are defined as "Gross premiums written" plus any banking income.

"Operating profit (or loss)" – profit (or loss) before taxation, less any Government grants, plus net interest paid (or minus net interest received), less gains (or plus losses) arising from the sale/disposal of businesses or fixed assets.

"Growth over last four years" – current year R&D minus previous four year average over the previous four year average .

"R&D investment plus capital expenditure" – current year investment in R&D plus additions to tangible fixed assets.

"Employees" – the consolidated average employees total, or year end employees if the average is not stated.

Exchange rates – all foreign currency amounts have been converted to their Sterling equivalent using the UK sterling exchange rates ruling at 31 December 2006. This applies also to the historical comparative data.

The market capitalisation figures in the R&D Scoreboard are the gross market capitalisation of each company as at 3 August 2007. The percentage change in market capitalisation is calculated from market capitalisation as at 4 August 2006.

In the data tables, n/l stands for 'not listed', n/m stands for 'not meaningful' (applied to certain ratios) and n/a stands for 'not available from accounts'.

Nationally owned – a UK company which has a UK parent whose accounts could not be obtained.

Sources

The database from which the R&D Scoreboard is drawn is owned and maintained by Company Reporting Ltd. The database consists of information from the audited annual reports and accounts of UK and international companies. The UK850 companies are those which are identified by Company Reporting as having an R&D activity and which respond to a request for their annual accounts; there are no known omissions.

In the case of the G1250, the Company Reporting database is supplemented by a feed service from Standard & Poor's Compustat Global Vantage database to identify potential new entrants to the ranking. The Amadeus database has also been used and recognised international stock exchanges are also monitored for potential new entrants.

Limitations

There are some limitations inherent in the approach used in preparing the data which underpin the R&D Scoreboard.

The main limitation is the reliance on disclosure of R&D investment in published annual reports and accounts. A significant minority of companies with evidence of R&D activities disclose no figures for R&D investment. In some cases, the R&D investment is not material enough to warrant disclosure; in others (e.g. small companies) this is permitted by current accounting standards.

Some significant European owned companies do not appear in the UK850 because they have taken advantage of the EC 7th Directive provision which allows them to not prepare consolidated accounts if their results are reflected in the consolidated accounts of a parent company within another member country of the European Union. Where there are no meaningful figures at group level, the accounts of the major UK operating subsidiary are used if these disclose R&D.

A few foreign-owned UK companies are known to have significant R&D investment but do not disclose this investment in their accounts and cannot, therefore, be included. Companies occasionally change the basis on which they calculate R&D and/or disclose it in their reports.

For many diversified groups, the R&D investment disclosed in their accounts arises from only part of their activities, whereas sales, operating profit and market capitalisation are in respect of all their activities. Unless all such companies disclose additionally their R&D investment with the other information in segmental analyses, it is not possible to relate the R&D more closely to the results of the individual activities which give rise to it. The impact of this is that some statistics for these companies, e.g. R&D as a % of sales, will be understated for the divisions that are active in R&D.

The focus of the R&D Scoreboard on the R&D investment reported in company accounts means that the results are independent of the location of the R&D activity. The UK850 indicates the overall level of R&D funded by UK companies, not all of which is carried out in the UK. This approach enables inputs such as R&D investment and capital expenditure to be related to outputs such as sales, value added, profitability, productivity ratios and market capitalisation.

The information in the R&D Scoreboard differs, however, from other information such as the Business Enterprise R&D (BERD) data generated by the Office for National Statistics (ONS). The ONS data focus on R&D activity within the UK, independent of the source of funding, and exclude R&D carried out by UK companies in other countries.

The companies of some countries are less likely than others to disclose R&D investment, or to disclose it consistently. As a result, the G1250 cannot capture systematically all companies with R&D activity. There is evidence to suggest that the distribution of R&D activity is highly skewed towards larger companies. The Scoreboard captures the more significant R&D investing companies and, in any case, the minimum R&D needed for inclusion in the G1250 is over £18.5m. The R&D Scoreboard, therefore, allows reasonable comparisons to be made.

Where companies have disclosed discontinued operations separately, the figures have been added to the continuing operations to give the full company figures for the fiscal year. Less detail may be given in the discontinued operations disclosure and this may lead to a underestimated R&D figure.

Appendix B – Summary for UK850

Sector	Number of firms	R&D (2006, £ million)	Change in R&D over last year (%)
Aerospace & defence	24	2,392	0.0%
Fixed line telecommunications	5	1,127	53.6%
Food & drug retailers	4	141	11.2%
Food producers	24	847	0.4%
Forestry & paper	1	1	-19.9%
Gas, water & multiutilities	10	31	9.5%
General financial	21	114	25.3%
General industrials	18	326	20.2%
General retailers	13	136	25.3%
Health care equipment & services	40	272	-6.6%
Household goods	15	171	31.6%
Automobiles & parts	23	1,087	-8.8%
Industrial engineering	45	285	13.9%
Industrial metals	5	87	23.4%
Industrial transportation	7	47	-37.7%
Leisure goods	13	87	2.3%
Life insurance	2	68	6.3%
Media	18	349	22.0%
Mining	5	76	46.9%
Mobile telecommunications	4	309	40.3%
Nonlife insurance	6	119	-22.6%
Banks	5	869	31.3%
Oil & gas producers	5	701	18.1%
Oil equipment, services & distribution	7	77	14.3%
Personal goods	8	26	8.5%
Pharmaceuticals & biotechnology	114	7,420	10.5%
Software & computer services	125	1,208	3.9%
Support services	39	230	11.1%
Technology hardware & equipment	61	862	1.3%
Tobacco	1	97	4.3%
Travel & leisure	12	60	54%
Beverages	6	26	-2.3%
Chemicals	60	557	11.9%
Construction & materials	15	54	-14.1%
Electricity	10	67	-29.7%
Electronic & electrical equipment	79	602	-3.8%
UK850	**850**	**20,928**	**9%**

Appendix C – Summary for G1250

Sector	Number of firms	R&D (2006, £ million)	R&D (2005, £ million)	Change in R&D over last year (%)
Aerospace & defence	39	10,796	9,526	12.5%
Fixed line telecommunications	18	4,907	4,346	12.9%
Food & drug retailers	6	523	416	13.1%
Food producers	26	2,572	2,365	7.8%
Forestry & paper	8	292	309	-5.5%
Gas, water & multiutilities	7	377	349	7.9%
General financial	6	236	177	33.8%
General industrials	36	5,910	5,446	8.5%
General retailers	6	862	570	51.2%
Health care equipment & services	47	4,169	3,541	17.7%
Household goods	24	2,557	2,367	8.0%
Automobiles & parts	78	40,961	40,328	1.6%
Industrial engineering	70	5,989	5,410	10.7%
Industrial metals	23	1,633	1,442	13.2%
Industrial transportation	6	224	231	-3.0%
Leisure goods	28	9,573	9,584	-1.0%
Life insurance	1	56	40	40.0%
Media	13	1,512	1,261	19.9%
Mining	3	308	179	72.3%
Mobile telecommunications	5	563	503	11.9%
Nonlife insurance	1	94	122	-23.0%
Banks	16	1,603	1,175	36.5%
Oil & gas producers	18	3,298	2,748	20.1%
Oil equipment, services & distribution	10	892	688	29.6%
Personal goods	15	1,408	1,310	7.5%
Pharmaceuticals & biotechnology	157	47,388	40,356	15.7%
Software & computer services	113	17,530	15,496	13.1%
Support services	14	913	819	8.6%
Technology hardware & equipment	207	43,121	38,087	13.2%
Tobacco	4	801	776	3.3%
Travel & leisure	11	685	622	10.1%
Beverages	2	158	159	-0.7%
Chemicals	91	11,399	10,250	9.9%
Construction & materials	23	1,211	1,167	3.8%
Electricity	16	1,489	1,489	0.0%
Electronic & electrical equipment	102	17,934	17,150	4.6%
Global 1250	**1,250**	**243,944**	**220,801**	**10%**

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

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