



BIS | Department for Business
Innovation & Skills

THE 2010 R&D SCOREBOARD

THE TOP 1,000 UK AND
1,000 GLOBAL COMPANIES
BY R&D INVESTMENT

COMMENTARY AND ANALYSIS

Contents

Ministerial foreword	2	Sector summaries	25
Summary	3	Aerospace & Defence	25
The R&D scoreboard	6	Automobiles & Parts	25
The pattern of R&D – an overview	6	CASE STUDY AXEON	26
CASE STUDY Intelligent Energy	9	Banking	27
Key sectoral trends in R&D – a comparison of UK and global performance	14	Fixed Line & Mobile Telecommunications	28
Introduction	14	Pharmaceuticals & Biotechnology	29
Summary	14	Software & Computer Services	29
CASE STUDY Creo Medical	14	Differences in R&D between firms by value of sales	31
The scale of R&D expenditure by sector	17	Differences in R&D between different types of ownership	32
Performance: R&D, sales and operating profits	19	CASE STUDY Marine Current Turbines	33
R&D and value added among leading UK investors	21	R&D intensity of firms	34
CASE STUDY Johnson Matthey Fuel Cells	22	The biggest changes in the UK	35
		CASE STUDY Novacem	38
		Appendix A Summary of UK 1000	40
		Appendix B Summary of Global 1000	41

Cover image: Aquamarine Power's Oyster wave energy converter in operation, Orkney, 2010. The Oyster has been developed through a collaborative R&D project co-funded by the Technology Strategy Board.
© Aquamarine Power

Although the global economic downturn was at its worst in 2009, the latest Scoreboard shows that R&D investment by the top 1,000 UK R&D-performing companies was only slightly lower than in 2008.

Investment was, in fact, 0.6% lower, totalling £25.3 billion. This compares favourably with investment by top companies in the US (-5%), France (-4%) Germany (-3%) and Sweden (-8%).

The Scoreboard case studies demonstrate how innovation enables UK companies to remain competitive. Many of our leading companies are well-positioned to seize opportunities as the economic climate improves.



For its part, the Government will create an environment in which business can flourish and can exploit the excellence of the UK research base. We are committed to delivering the most competitive corporate tax regime in Europe, and HM Treasury will be consulting business on taxation of intellectual property, R&D tax credits and the proposals contained in James Dyson's review (Ingenious Britain).

This is the 20th and final Scoreboard to be sponsored by the Government. While this useful tool has helped us to track progress on investment, both domestically and overseas, today's companies better understand the importance of R&D to their long-term success. At the same time, unprecedented financial pressures have made it necessary to reduce public spending. However, let this not prevent other potential sponsors from coming forward to ensure the continued publication of the Scoreboard.

A handwritten signature in black ink that reads "David Willetts".

David Willetts
Minister of State for Science and Innovation

This report summarises the findings of the 2010 R&D Scoreboard, an investigation of the financial performance of the top UK and global corporate investors in R&D.

About the 2010 R&D Scoreboard

This is the 20th annual edition of the R&D Scoreboard, which is published by the Department for Business, Innovation & Skills (BIS).

The Scoreboard is an international league table of the companies investing the most in R&D. It is designed as a benchmarking tool for companies, investors and policymakers. Fourteen leading business and professional organisations endorse the Scoreboard as a source of information for their companies and their shareholders when considering the amount to be invested in R&D as part of their innovation process and business strategy; a list of the endorsers is inside the back cover.

This report summarises the 2009 company data on investment in R&D and financial performance of the 1,000 UK companies most active in R&D, including foreign-owned companies whose R&D is conducted in the UK and reported in the UK1000 (the list of the 1,000 UK companies undertaking the most R&D). It also includes data on the 1,000 companies most active in R&D globally. The Scoreboard highlights the main trends discernible in the UK and global data.

The 2010 R&D Scoreboard

Key facts

- The 1,000 UK companies that invested the most in R&D spent £25.3bn in 2009, down 0.6% year on year.
- 80% of R&D carried out by the 1,000 top-performing companies is conducted by the 100 most active companies.
- Globally, the 1,000 companies most active in R&D spent a combined £344bn, a decrease of 1.9% year on year. The 50 UK companies in this group also decreased their R&D investment, albeit by only 1% overall.
- 78% of global R&D occurs in five countries: the US; Japan; Germany; France; and the UK.
- Global R&D intensity (R&D expenditure as a proportion of sales) stood at 3.6%. Among the UK's 1,000 leading companies R&D intensity stood at only 1.7%.

The UK's top R&D companies

In 2009 the UK1000 decreased their investment by 0.6% compared with the previous year, to £25.3bn. This overall decline, which could be attributed to the global economic downturn, was largely owing to decreased spending by firms in the fixed-line telecommunications, banking and aerospace and defence sectors.

However, upon closer inspection a more nuanced picture emerges, as R&D spending developed differently across the whole of the economy. Several of the top sectors by overall investment, including automobiles and parts, software and computer services, and technology hardware and equipment, increased their overall R&D spend, although some at a slower rate than in previous years.

The UK's 50 biggest investors—which also form part of the G1000 (the largest R&D spenders worldwide)—conducted 60% of the UK1000's R&D. They decreased their R&D by 1% year on year, while their global peers averaged a 2% year-on-year decrease.

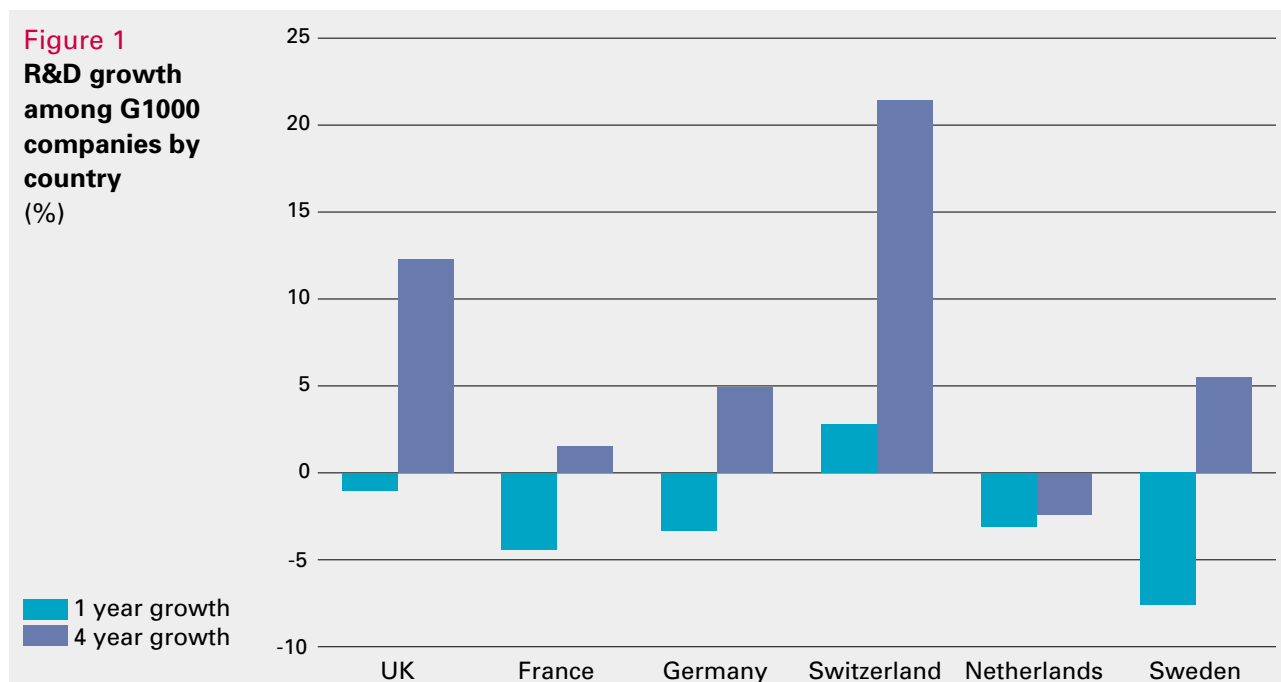
The global picture

Global R&D spending by the G1000 fell by 1.9% to £344bn. Companies registered in just six countries (the US, Japan, Germany, France, Switzerland and the UK), dominate this global spending. Together, they contributed 82% of R&D by the G1000.

In comparison, companies registered in China (including Hong Kong) and India contributed a joint 1.8% to the overall R&D investment by the G1000. However, unlike their global peers, these companies grew their R&D significantly in 2009. Chinese firms grew on average by 40% and Indian firms by 18%. Chinese R&D spending as part of the G1000 is concentrated in technology hardware and equipment, construction and materials and among oil and gas producers. Software and computer services and automobiles and parts companies together account for 73% of the overall R&D spend by Indian companies in the G1000.

Among European representatives in the G1000, UK companies have the fourth-highest R&D spend in absolute terms, behind Switzerland, France and the leader, Germany.

Figure 1 shows average R&D growth among companies in the six biggest EU countries by investment. Looking at growth in R&D investment over a four-year period, only Swiss companies increased their R&D at a faster rate than those from the UK. In 2009 UK companies in the G1000 avoided the bigger cuts to R&D undertaken by their German, French, Dutch and Swedish peers. Only companies registered in Switzerland managed to grow their R&D spending last year.



As in previous Scoreboards, pharmaceuticals and biotechnology remained the largest global R&D sector, growing by 5.5% in 2009. Among the ten largest sectors globally, only three—pharmaceuticals and biotechnology, electronic and electrical equipment, and chemicals—managed to grow their R&D investment. The automobiles and parts sector decreased its R&D spending by the largest percentage (11.6%), followed by technology hardware and equipment (6.3%).

Comparing the UK1000 companies with the G1000 according to their spending reveals divergent developments. R&D spending in the automobiles and parts, technology hardware and equipment, and software and computer services sectors declined globally, while it grew in the UK. The fixed-line telecommunications, oil and gas producing, and banking sectors all grew globally, while declining in the UK.

The pattern of R&D – an overview

Introduction

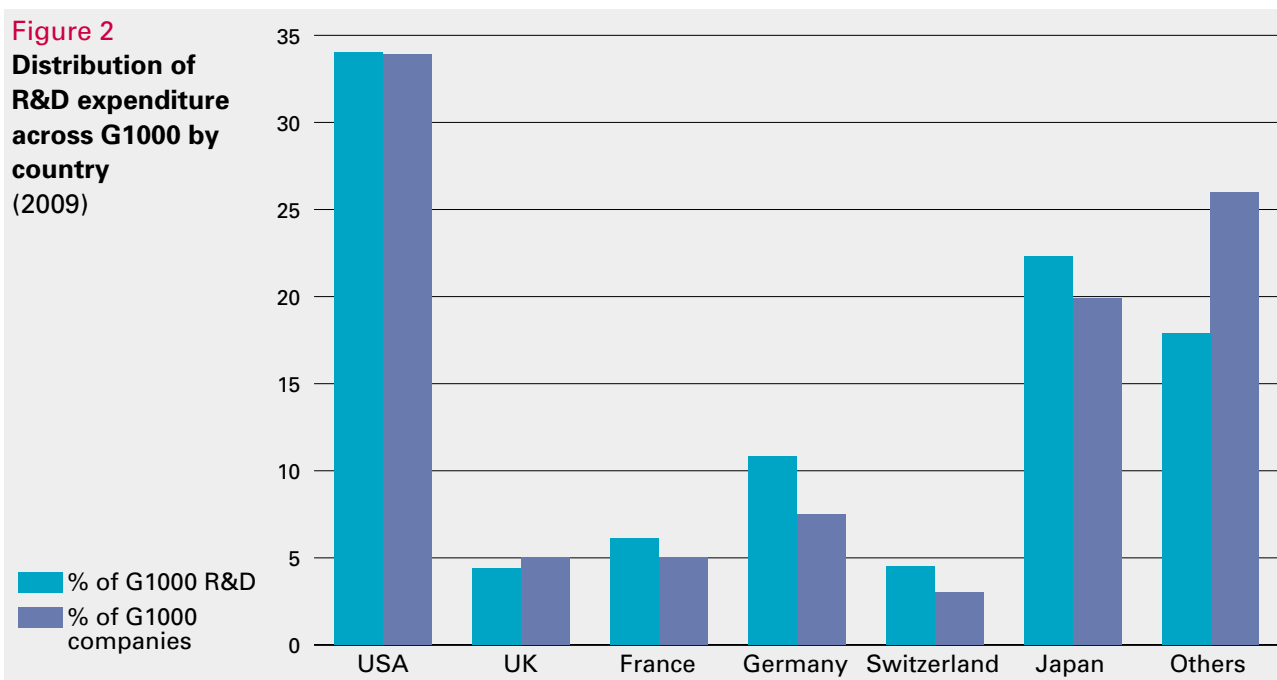
This section highlights the leading investors in R&D in the UK and globally, provides an overview of the pattern of investment in R&D in 2009 in the UK and globally by sector and summarises the key changes in R&D since the previous year.

The scale of R&D

The UK1000 (the UK's 1,000 largest corporate spenders on R&D) invested £25.3bn in 2009, 0.6% less than the previous year. This decrease is largely attributable to the global economic slowdown, which had not fully materialised by the end of 2008 and was therefore not visible in last year's Scoreboard.

The G1000 (the 1,000 companies in the world most active in R&D in 2009) invested £344bn, a decrease of 1.9% year on year. The spending was highly concentrated in firms based in six countries: 82% of the investment was undertaken by companies from the US, Japan, Germany, France, Switzerland and the UK, and 743 (74%) of the companies come from these countries (see Figure 2).

Figure 2
Distribution of R&D expenditure across G1000 by country (2009)

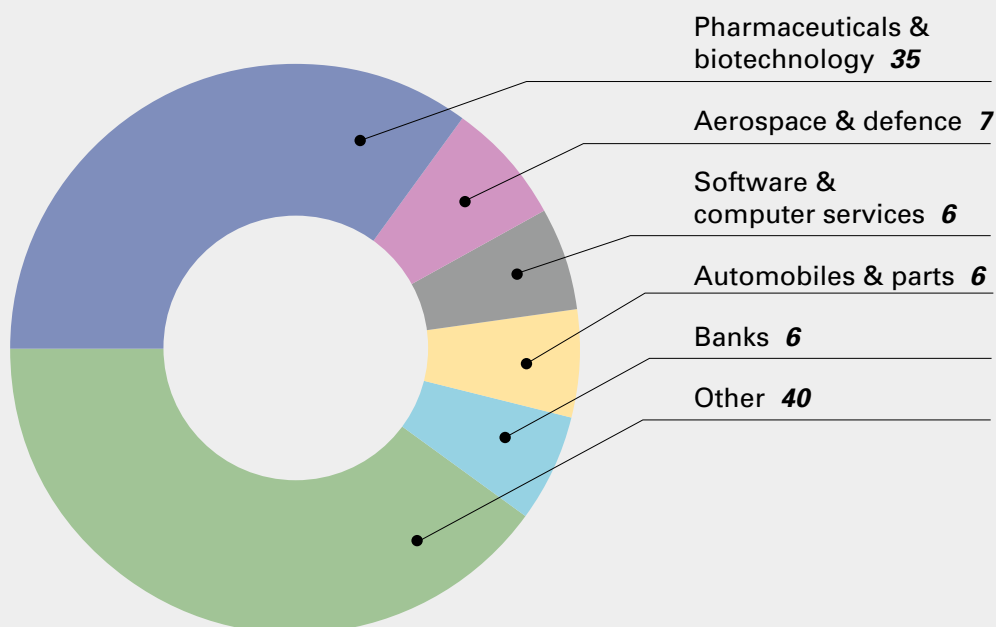


The sectoral distribution of R&D

R&D spending by companies in the UK1000 was dominated by five sectors: pharmaceuticals and biotechnology; aerospace and defence; software and computer services; automobiles and parts; and banks. Together, these accounted for 60% of R&D (see Figure 3). In a change to last year's Scoreboard, two of the top five sectors (banking and aerospace and defence) decreased their spending. Both the software and computer services and automobiles and parts sectors increased their R&D investment by around 9%.

As in previous Scoreboards, the pharmaceuticals and biotechnology sector was by far the largest investor, accounting for 35% of the UK1000 total. It invested more than five times as much as the second-largest sector.

Figure 3
Distribution of UK1000 R&D expenditure, by sector (2009, %)



The five biggest sectors together account for 60% of all the money spent on R&D by the UK1000 in 2009. This is similar to the previous year's results.

Globally, five sectors continued to dominate expenditure by the world's leading R&D investors. Three of the sectors were also among the five largest-spending sectors in the UK – pharmaceuticals and biotechnology, software and computer services and automobiles and parts. Technology hardware and equipment and electronic and electrical equipment rounded out the global top five.

The pharmaceuticals and biotechnology sector remained the largest sector globally, just ahead of technology hardware and equipment and automobiles and parts. In contrast with the UK,

no sector dominated overall R&D spending. However, while the three biggest sectors have broadly similar shares of total R&D investment among the G1000, only the pharmaceuticals and biotechnology sector increased its R&D spending in 2009. Together, the top five sectors accounted for more than 66% of the investment by the G1000 (see Figure 4). This is down slightly from the results of last year's Scoreboard (68%).

Figure 4
Distribution of G1000 R&D expenditure (2009, %)

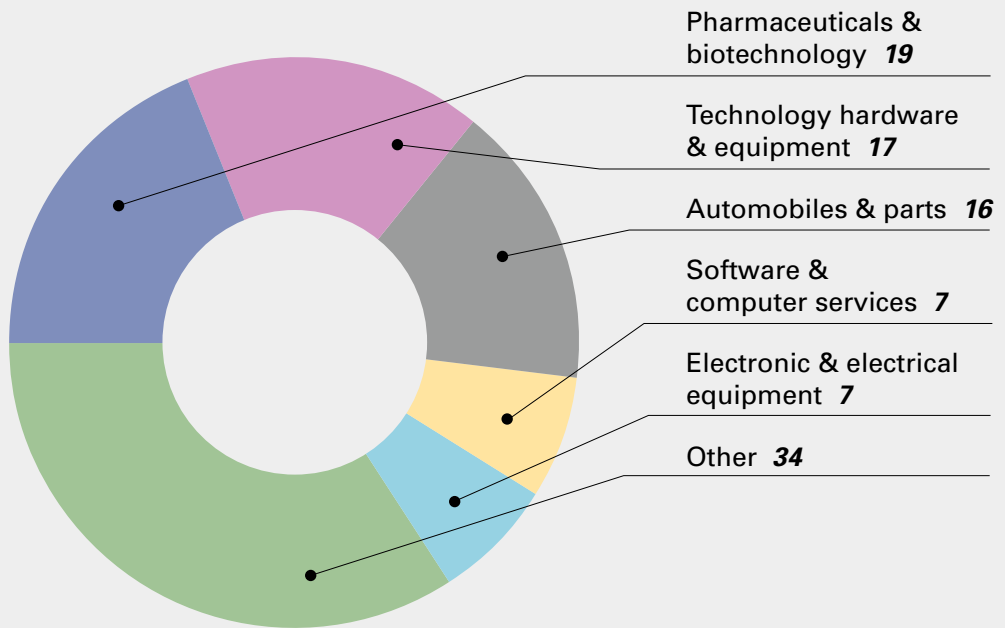
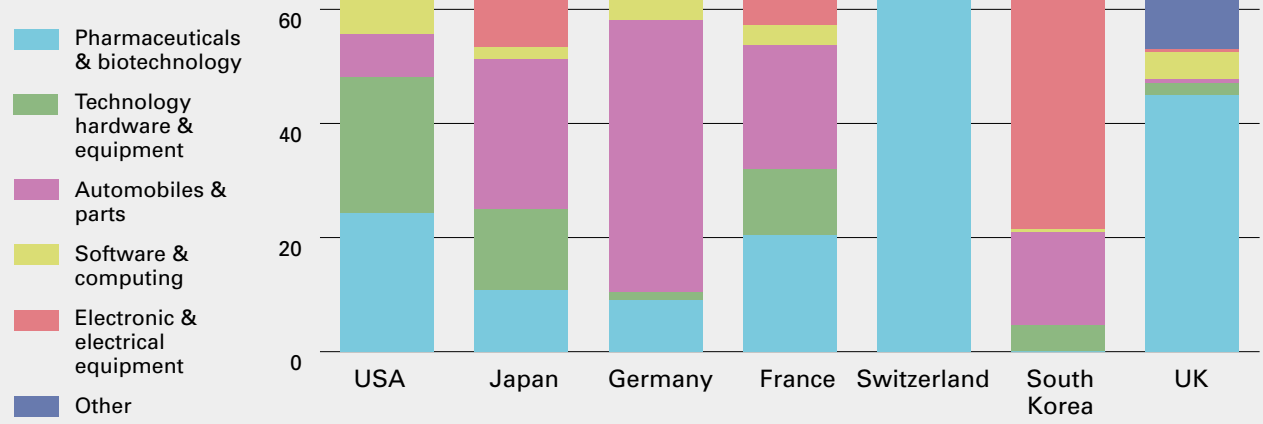


Figure 5
R&D expenditure by sector and country in the G1000 (as % of country total)



As in previous Scoreboards, the most important sectors by R&D investment vary significantly between the leading countries (Figure 5). France, Japan and the US had relatively diversified portfolios, with at least three sectors contributing a significant amount of overall R&D spend. Germany's R&D continued to be more concentrated, particularly in the automobiles and parts sector. R&D in Switzerland and South Korea remained highly concentrated in pharmaceuticals and biotechnology and electronic and electrical equipment, respectively.

Among the 50 UK firms in the G1000, R&D was heavily concentrated in the pharmaceuticals and biotechnology sector. Owing to a comparatively healthy growth in 2009, the software and computer services sector played a bigger role in diversifying the UK's R&D portfolio. However, the UK also had the largest amount of R&D (51%) outside the major sectors of all the leading countries covered by the analysis.

The concentration of R&D in the UK

In 2009, 80% of total R&D expenditure by the UK1000 was attributed to its 100 biggest investors. Of these, the 50 UK firms in the G1000 accounted for 60% of R&D by the UK1000. These 50 firms spent over 60% of their R&D investment in the three largest sectors: pharmaceuticals and biotechnology; banks; and oil and gas producers. They spent just under 6% in the aerospace and defence sector.

CASE STUDY Intelligent Energy: the long and short view of R&D

By 2050 the number of vehicles worldwide is forecast to reach 2bn, up from around 800m in 2010. Transportation accounts for around 20% of global CO₂ emissions and is the fastest-growing contributor to man-made atmospheric CO₂. So the UK's "green" fuel cell technology currently under development will be competitive worldwide. At present, more than 100 UK companies are contributing to the growth of the world's fuel cell industry and over 50% of the country's production is exported.

The UK's first kilowatt-level proton exchange membrane (PEM) fuel cell was developed in the early 1990s by a team of researchers working between the departments of chemistry and

Founded: 2001

Chief executive: Dr Henri Winand

Ownership: privately held public limited company

Revenue: Currently in closed period
2009 revenue: £4.5m

R&D spending: 2009 £5.9m

aeronautical and automotive engineering at Loughborough University. A new company, Advanced Power Sources, was spun out in the mid 1990s—the first company in the country specifically established to address the development and commercialisation of PEM fuel cells.

In 2001 Intelligent Energy was founded and attracted private finance capital when it acquired Advanced Power Sources (APS), a university spinout, and secured a worldwide licence to exploit its fuel cell technology. Since then, Intelligent Energy has made two further, privately funded

strategic acquisitions.

The company is taking a two-pronged approach to its R&D: applied long-term projects of over five years and market-led short-term projects of up to three years. Its long-term R&D is focused on the pure research area, with Intelligent Energy investing its own cash and some government funding in university-based research on specific areas to ensure it has a strong technology base for the future and a long-term growth plan.

Intelligent Energy's Chief Executive, Dr Henri Winand, explains that a long gestation period (normally 20 years) is usual in the development of innovative technologies such as the internal combustion engine, batteries and now the fuel cell: "When we do the pure research with the universities, I can't afford to stop thinking about that 20-year development period. If I do, we might find that in the future we have a serious slowdown in growth."

No time to waste

"However," Dr Winand continues, "I can't just allocate large amounts of cash for things that are 20 years away. And because we're growing rapidly, we're at the stage where we have the biggest cash consumption. So we also need to be more focused and agile and that is what we do inside the business itself. Here we carry out

shorter-term research that we know will give us a competitive advantage sooner and create a lot of usable intellectual property for us."

This research—more than three-quarters of which is carried out in the UK, with the rest carried out in the US—is conducted within a three-year time frame. "It has to be quick", says Dr Winand, "because we're not yet a huge company with a vast cash flow. We're not necessarily going so far as to sell items on a vast scale, but certainly at the level of trial units that our customers can pull to market."

Intelligent Energy has been getting "terrific" support for its in-house R&D from the Technology Strategy Board. The government understands that technologies such as fuel cells take time and effort to bring to market. He notes that once you've committed assets "it's very difficult to change horse mid-stream", but, if you win, then you are making money for the long term.

But once the technology has been developed, the business "needs to be flooded with cash" to get marginal costs down. He adds: "It's critical in the UK that we don't just have innovation, but have that innovation delivered in the marketplace, globally. We really should...ensure that research, whether long-term or short-term, is not wasted."

The UK's biggest investors in R&D

Table 1 lists the 25 UK companies investing the most in R&D in 2009. The top seven remain unchanged from the previous year's Scoreboard, although, of these, only GlaxoSmithKline increased its overall R&D investment. As in 2008 GlaxoSmithKline and AstraZeneca, both in the pharmaceuticals and biotechnology sector, retained their lead in the list by a healthy margin. Between them, they invested £6.4bn, down from £7.2bn last year. Their joint share of the UK1000 total R&D investment was around 25%, down 2 percentage points from last year's Scoreboard.

The biggest climbers in the Top 25 were Nokia, Land Rover and Roche Products, although they each improved their ranking only

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

Rank 2010	Company	Sector	R&D (£m)	Growth in R&D over last year (%)	Rank 2009
1	GlaxoSmithKline	Pharmaceuticals & biotechnology	3,629	9.5	1
2	AstraZeneca	Pharmaceuticals & biotechnology	2,746	-12.0	2
3	BT	Fixed line telecommunications	1,029	-8.0	3
4	Unilever	Food producers	792	-3.9	4
5	Royal Dutch Shell	Oil & gas producers	679	-11.1	5
6	Royal Bank of Scotland	Banks	559	-7.1	6
7	HSBC	Banks	472	-0.1	7
8	Rolls-Royce	Aerospace & defence	471	-3.9	9
9	Airbus Operations*#	Aerospace & defence	367	-26.0	8
10	BP	Oil & gas producers	363	-1.3	10
11	Shire#	Pharmaceuticals & biotechnology	347	16.2	12
12	Pfizer*#	Pharmaceuticals & biotechnology	326	3.0	13
13	Land Rover*#	Automobiles & parts	314	38.0	16
14	Ford Motor*#	Automobiles & parts	313	-25.0	11
15	Vodafone	Mobile telecommunications	303	8.2	14
16	Barclays	Banks	264	-3.7	15
17	BAE Systems	Aerospace & defence	234	9.9	18
18	Bentley Motors*#	Automobiles & parts	230	119.0	n/a
19	Roche Products (1)*	Pharmaceuticals & biotechnology	208	15.0	22
20	Nokia*#	Technology hardware & equipment	197	34.0	24
21	Jaguar Cars*#	Automobiles & parts	181	-6.0	20
22	Reed Elsevier	Media	179	55.7	n/a
23	Sage	Software & computer services	175	25.0	25
24	BAT	Tobacco	152	10.1	n/a
25	Eisai Europe*	Pharmaceuticals & biotechnology	151	42.0	n/a

* foreign-owned firms (Data used are taken from the published annual reports and accounts of the UK subsidiary and not from the overseas parent company.)
 # accounts not prepared using IFRS
 Note: Land Rover and Jaguar Cars are listed separately because they each produce their own sets of accounts, although both are subsidiaries of Tata Motors of India

marginally. In the 2010 Scoreboard there are two more foreign-owned companies among the leading UK investors than last year. Having decreased its spending by 26%, Airbus Operations dropped one place in the ranking, but remained as the largest R&D investor among those foreign-owned UK companies (£367m).

Last year's Scoreboard observed a downward trend among automobiles and parts companies in the Top 25. This year's Scoreboard indicates that this trend may have been halted, a finding that is in line with the observed overall growth in R&D expenditure in the automobiles and parts sector. While Ford Motor and Jaguar Cars decreased their R&D spend, Bentley Motors, a new entrant to the list, and Land Rover, significantly grew theirs, by 119% and 38%, respectively.

Apart from Bentley Motors, two companies from the media and tobacco sectors, respectively, were the highest new entrants to the list: Reed Elsevier and BAT between them invested £331m, with the former increasing its investment by more than 50% year on year. Finally, Eisai Europe joined the Top 25, bringing the total number of pharmaceuticals and biotechnology companies in the list to six.

The global leaders in R&D

As in the previous Scoreboard, there were major changes in the Top 25 global companies by R&D expenditure. Toyota continued to invest the most of any company, remaining firmly in first place. However, other companies representing the automobiles and parts sector gave ground, with General Motors dropping seven places and Ford dropping 14.

The pharmaceuticals and biotechnology sector fares best in this year's global leader ranking. Roche, Novartis, Sanofi-Aventis and Merck all improved their standing over last year, although this can perhaps be attributed less to their increased investments than to the comparative weakness of their competitors from other sectors, most of which decreased their R&D spending in 2009.

In a further change to last year's Scoreboard, GlaxoSmithKline is now the only remaining UK firm in the Top 25 largest global investors in R&D. Along with other pharmaceuticals and biotechnology companies, GlaxoSmithKline climbed six places from 21st to 15th, reversing the downward trend of recent years.

The 2010 R&D Scoreboard

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

Rank 2010	Company	Sector	Country	R&D (£m)	Growth in R&D over last year (%)	Rank 2009
1	Toyota Motor #	Automobiles & parts	Japan	6,014	-6	1
2	Roche, Switzerland	Pharmaceuticals & biotechnology	Switzerland	5,688	9	4
3	Microsoft#	Software & computer services	USA	5,396	-3	2
4	Volkswagen	Automobiles & parts	Germany	5,144	-2	3
5	Pfizer #	Pharmaceuticals & biotechnology	USA	4,802	-2	6
6	Novartis	Pharmaceuticals & biotechnology	Switzerland	4,581	2	10
7	Nokia	Technology hardware & equipment	Finland	4,440	-6	8
8	Johnson & Johnson #	Pharmaceuticals & biotechnology	USA	4,326	-8	7
9	Sanofi-Aventis	Pharmaceuticals & biotechnology	France	4,060	0	12
10	Samsung Electronics #	Electronic & electrical equipment	South Korea	4,007	8	18
11	Siemens	Electronic & electrical equipment	Germany	3,805	2	20
12	General Motors USA #	Automobiles & parts	USA	3,758	-24	5
13	Honda Motor #	Automobiles & parts	Japan	3,746	-4	11
14	Daimler	Automobiles & parts	Germany	3,700	-6	13
15	GlaxoSmithKline	Pharmaceuticals & biotechnology	UK	3,629	10	21
16	Merck #	Pharmaceuticals & biotechnology	USA	3,619	22	25
17	Intel #	Technology hardware & equipment	USA	3,501	-1	17
18	Panasonic	Leisure goods	Japan	3,445	-7	14
19	Sony #	Leisure goods	Japan	3,308	-4	16
20	Cisco Systems #	Technology hardware & equipment	USA	3,225	1	22
21	Robert Bosch	Automobiles & parts	Germany	3,179	-9	19
22	IBM #	Software & computer services	USA	3,061	-10	15
23	Ford Motor #	Automobiles & parts	USA	3,034	-33	9
24	Nissan Motor #	Automobiles & parts	Japan	3,030	0	23
25	Takeda Pharmaceutical #	Pharmaceuticals & biotechnology	Japan	3,014	64	n/a

accounts not prepared using IFRS

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

Introduction

This section analyses the key trends in R&D expenditure across different sectors, both globally and in the UK. Firstly, it considers the changing scale of R&D expenditure and compares this to that of other business inputs, notably capital expenditure and employment. Secondly, it examines the ratio of companies' investment in R&D to their sales and profits.

Summary

Table 3 summarises significant changes in R&D and other measures of business performance among the UK1000 (the UK's 1,000 largest corporate spenders on R&D in 2009) over the last year. Key points are:

- R&D investment by the UK1000 decreased by 0.6% over the last year;
- the fastest-growing of the key sectors were automobiles and parts, which increased its spending by over 9%, and software and computer services, which increased its spending by 8.6%;
- the sector with the biggest decline in R&D spending was fixed-line telecommunications, which decreased its spending by 8%, followed by the oil and gas producing and banking sectors, both of which decreased their spending by around 7%;
- pharmaceuticals and biotechnology companies account for more than 35% of all R&D investment in the UK1000;
- three of the four biggest sectors (pharmaceuticals and biotechnology, software and computer services, and automobiles and parts) grew their R&D investment, while the aerospace and defence sector decreased its investment;
- six of the ten biggest sectors by R&D investment reported operating losses in 2009; the automobiles and parts and technology hardware and equipment sectors reported the biggest losses;
- compared to last year's Scoreboard, companies in the biggest sectors invested broadly similar amounts of R&D as a percentage of their capital expenditure.

CASE STUDY Creo Medical: a change in strategy for growth

Despite having the third-largest medical device market in Europe, worth just under US\$8.4bn in 2010, UK market growth is predominantly import-led. But with the market predicted to grow by 3.6% annually to reach a value of US\$10bn¹ by 2014, the opportunity is there for innovative UK-based medical device companies to stimulate export-led growth from the home market.

Making waves is Creo Medical, which has six full-time staff and 20 part-time associates and consultants. Founded as MicroOncology in February 2003, the company was set up to provide consultancy services and develop medical devices for cancer treatment. The original business plan was to sell the intellectual property on to large medical device maker, which would then place contracts back with MicroOncology for technology development. Although it signed a deal worth around £3m over four years to sell IP to one company, MicroOncology found it difficult to get additional investors on board. As a result, the company realised that, while it could grow modestly through selling its IP, this was not going to be transformational. In 2008 it decided to abandon this business plan, rebrand itself as Creo Medical and focus on the development and commercialisation of its products for the UK and the EU, as well as the US and other major international markets.

Good intentions, financed

Creo Medical's Operations Director, Steve Morris, explains the change of strategy: "The company was originally set up with inquisitive, altruistic reasons in mind and not to make lots of money. But while our customer was very keen to take more IP

Founded: 2003

Chief executive: Chris Hancock

Ownership: Founder, shareholdings, investors

Revenue: Pre-revenue

R&D spending: £1m+

from us and develop more prototypes, we realised that to survive we needed real investment. And to get that, we needed to articulate a clear strategy about how we were going to turn our ideas into products that would give our investors a clear return."

The company is now wholly focused on R&D and is working in two areas: a family of products for endoscopic surgery, which is 2-3 years away from market, and the development of a "non-thermal plasma" means of disinfecting hands to combat infection problems in hospitals.

Creo Medical's change of strategy has paid dividends. It has raised over £1m in two rounds of private investment and is planning another round of fundraising in 2011. "We've changed our whole approach", says Mr Morris. "We now ask all the questions right at the beginning when we have an idea, such as, can we sell this, for what price, what are the market hurdles. So we've got full control and the direction of development can go the right way."

In addition, in early 2009 the company won £100,000 in a TSB Small Business Research Initiative competition to do a proof-of-concept study on its plasma-based hand sterilisation technology. It was then chosen for phase two of the project and in April this year was awarded £750,000 in a two-year contract to develop the technology for the Department of Health.

"This has been really helpful," says Mr Morris. "This funding not only strengthened our case in the eyes of private investors, but has given us extra clout. It allows us to keep ownership of our IP, which will allow us to raise further private funds in future."

As to the future, Mr Morris remains optimistic, although he agrees that bigger revenue streams will be needed when the

1. The Medical Device Market: UK, Jul 2010, Espicom business intelligence report.

The 2010 R&D Scoreboard

products are ready for commercialisation. “What happens depends on the way we do this”, he says. “Do we manufacture our products ourselves and sell them under our own name, or do we do a trade sale to

a larger manufacturer? What we have to remember is that the earlier you do a deal like this, the less you will walk away from the table with. And that could affect our R&D capability in the future.”

Table 3: Key sectoral trends across UK1000 (2009)

Rank 2010	R&D in 2009 (£m)	Change in R&D over last year (%)	R&D as % of capex (%)	Change in employees over last year (%)	Change in sales over last year (%)	Change in profits over last year (%)
Pharmaceuticals & biotechnology	8,922	0.9	321%	-2.2	11.1	14.1
Aerospace & defence	1,643	-5.0	127%	1.4	14.8	-14.9
Software & computer services	1,621	8.6	281%	-1.5	0.2	-18.2
Automobiles & parts	1,529	9.1	157%	-5.3	-7.6	-152.4
Banks	1,390	-7.0	16%	1.3	44.8	n/a
Oil & gas producers	1,119	-7.3	3%	-5.7	-36.0	-45.3
Technology hardware & equipment	1,067	2.1	278%	-2.0	-0.7	-59.4
Food producers	1,034	-3.4	40%	-4.5	-1.0	8.2
Fixed-line telecommunications	1,031	-8.0	55%	-8.1	-2.7	512.7
Electronic & electrical equipment	647	1.4	254%	-5.4	2.6	-31.2
Total*	25,262					

* Including all other sectors.

Table 4 summarises significant changes in R&D and other measures of business performance among the UK1000’s fastest-growing sectors by R&D in 2009. Measured in absolute terms, these sectors invested significantly less in R&D than the UK’s leading sectors, listed above. The top four gas, water and multi-utilities companies each grew their R&D investment, although the significant growth in this sector can be attributed in large part to the biggest company by R&D spend, Centrica.

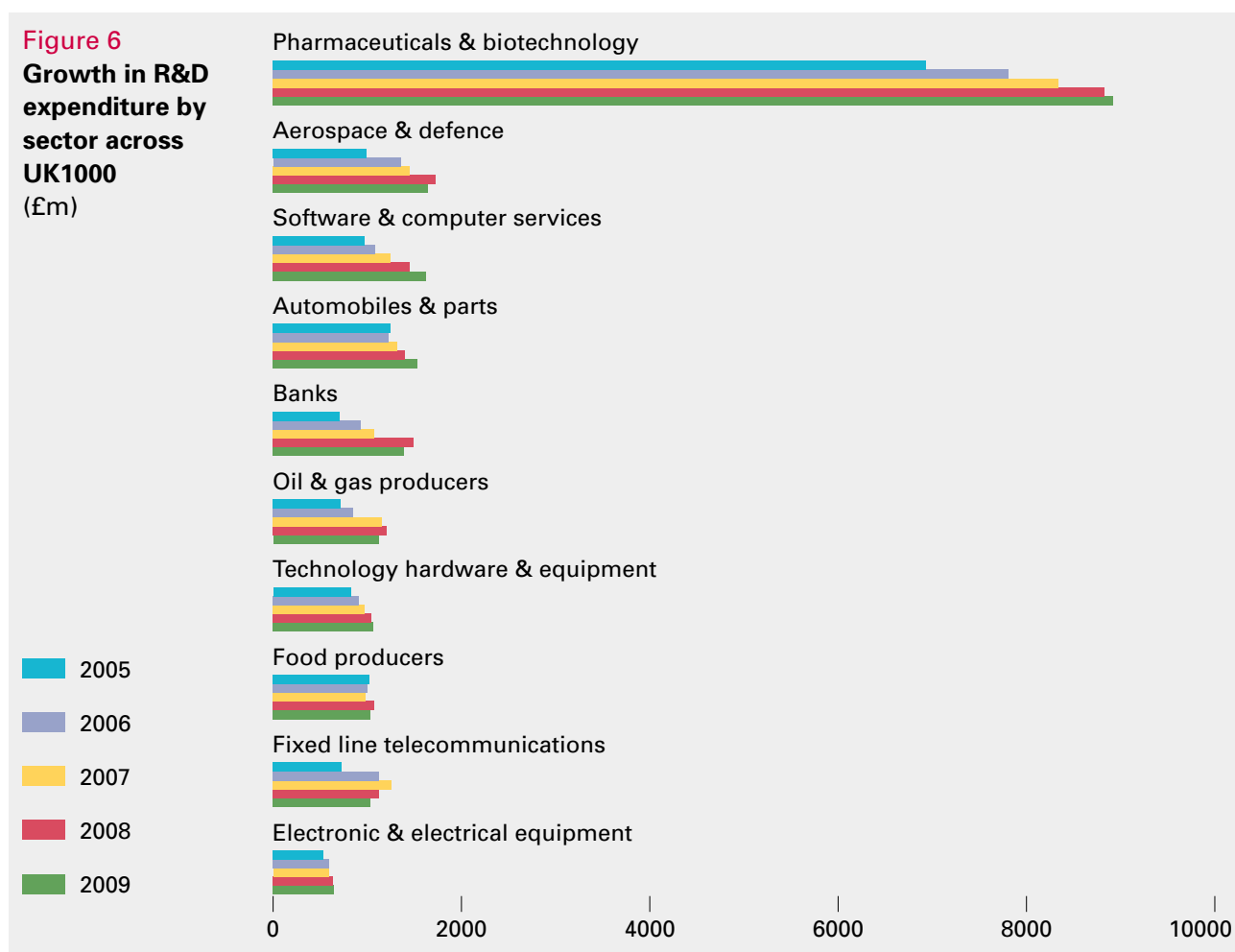
R&D growth among non-life-insurance companies was driven primarily by RSA Insurance, the largest company in this sector. In a continuation of last year’s Scoreboard, the travel and leisure and oil equipment, services and distribution sectors remained in the list of fastest-growing sectors. McLaren and Thomas Cook grew their R&D investment the fastest among travel and leisure companies, while Baker Hughes was the top performer among oil equipment, services and distribution companies.

R&D as a percentage of capital expenditure was significantly smaller across four of the five fastest-growing sectors than across the three leading sectors—pharmaceuticals and biotechnology, aerospace and defence and software and computer services—according to absolute investment in R&D. At 200% of R&D as a percentage of capital expenditure, only the non-life-insurance sector approached similar levels.

Rank 2010	R&D in 2009 (£m)	Change in R&D over last year (%)	R&D as % of capex (%)	Change in employees over last year (%)	Change in sales over last year (%)	Change in profits over last year (%)
Gas, water & multi-utilities	90	94.6	1%	2.0	3.8	26.3
Non-life insurance	128	40.4	200%	2.5	6.6	-8.0
Travel & leisure	205	36.8	27%	-2.7	9.7	47.4
Financial services	277	27.5	24%	-2.6	-1.2	-38.6
Oil equipment, services & distribution	62	15.6	55%	-5.3	-46.3	-36.4

The scale of R&D expenditure by sector

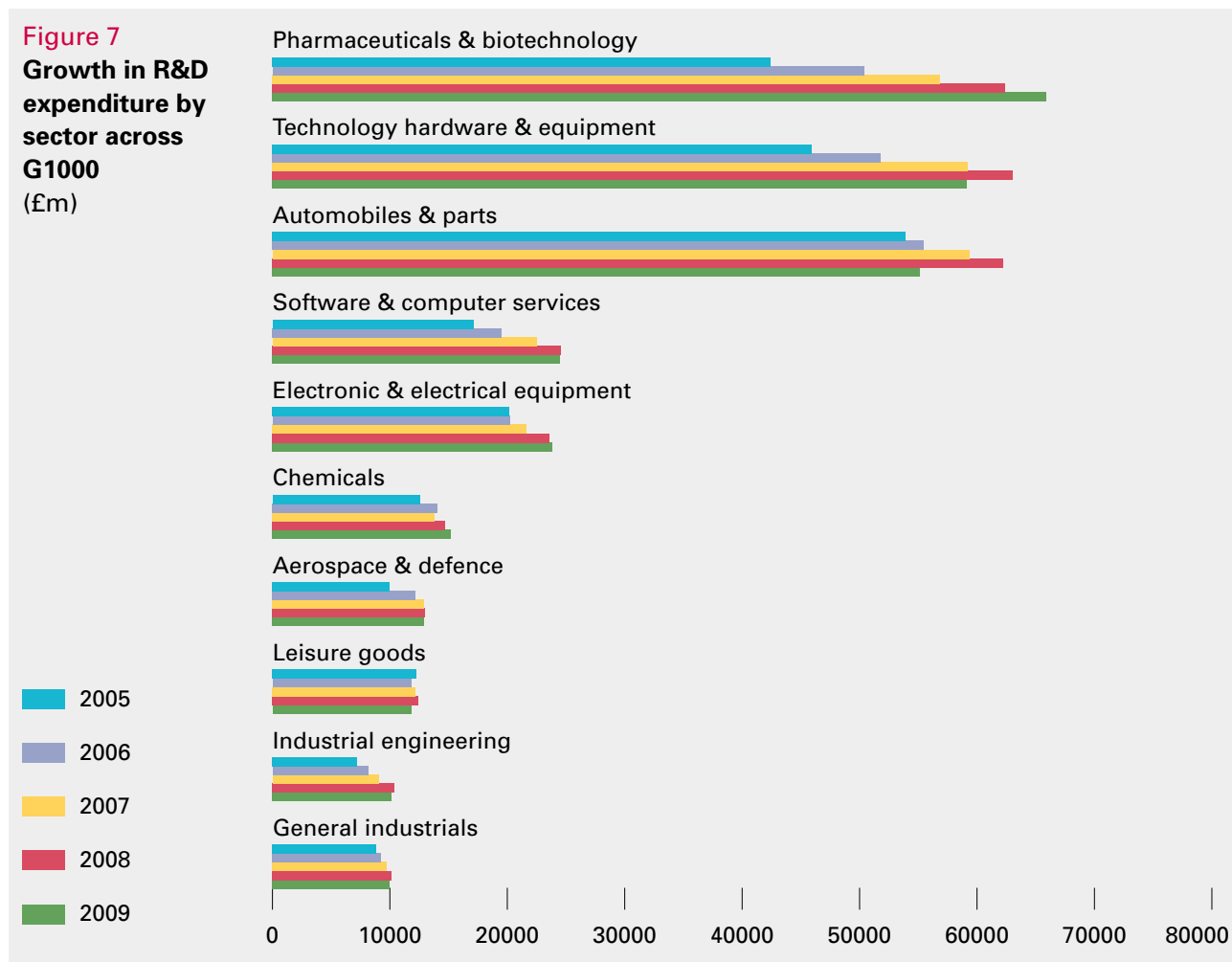
Figure 6 traces the pattern of change in the level of R&D investment over the last five years among the ten largest sectors in the UK1000, as defined by their investment in R&D. The pharmaceuticals and biotechnology sector continues to dominate R&D spending in the UK1000, but in 2009 it grew much more slowly than in previous years. Software and computer services and technology hardware and equipment firms continued a steady growth in R&D investment throughout the period. In relative terms, automobiles and parts companies increased their investment the most over last year.



Following a steady growth period, aerospace and defence firms and banks cut their R&D investment in 2009. Oil and gas producers and food producers fell back to levels of spending recorded two years ago. After years of increasing investment, the fixed-line telecommunications sector first cut its spending in 2008. The decrease in investment continued this year and in absolute terms R&D spent in the sector fell below values recorded in 2006.

Figure 7 shows the pattern of change in the level of R&D investment over the last five years across the ten largest sectors in the G1000 (the 1,000 largest corporate spenders on R&D globally in 2009), defined by their investment in R&D. Of the big three sectors, only the pharmaceuticals and biotechnology sector has continued to grow throughout the period. After years of growth, technology hardware and equipment and automobiles and parts suffered a significant decline in R&D investment in 2009.

The other large sectors within the G1000 did not record significant changes in 2009. Software and computer services, electronic and electrical equipment remained largely static compared with results recorded in last year's Scoreboard, while leisure goods and industrial engineering companies in the G1000 decreased their overall R&D slightly.



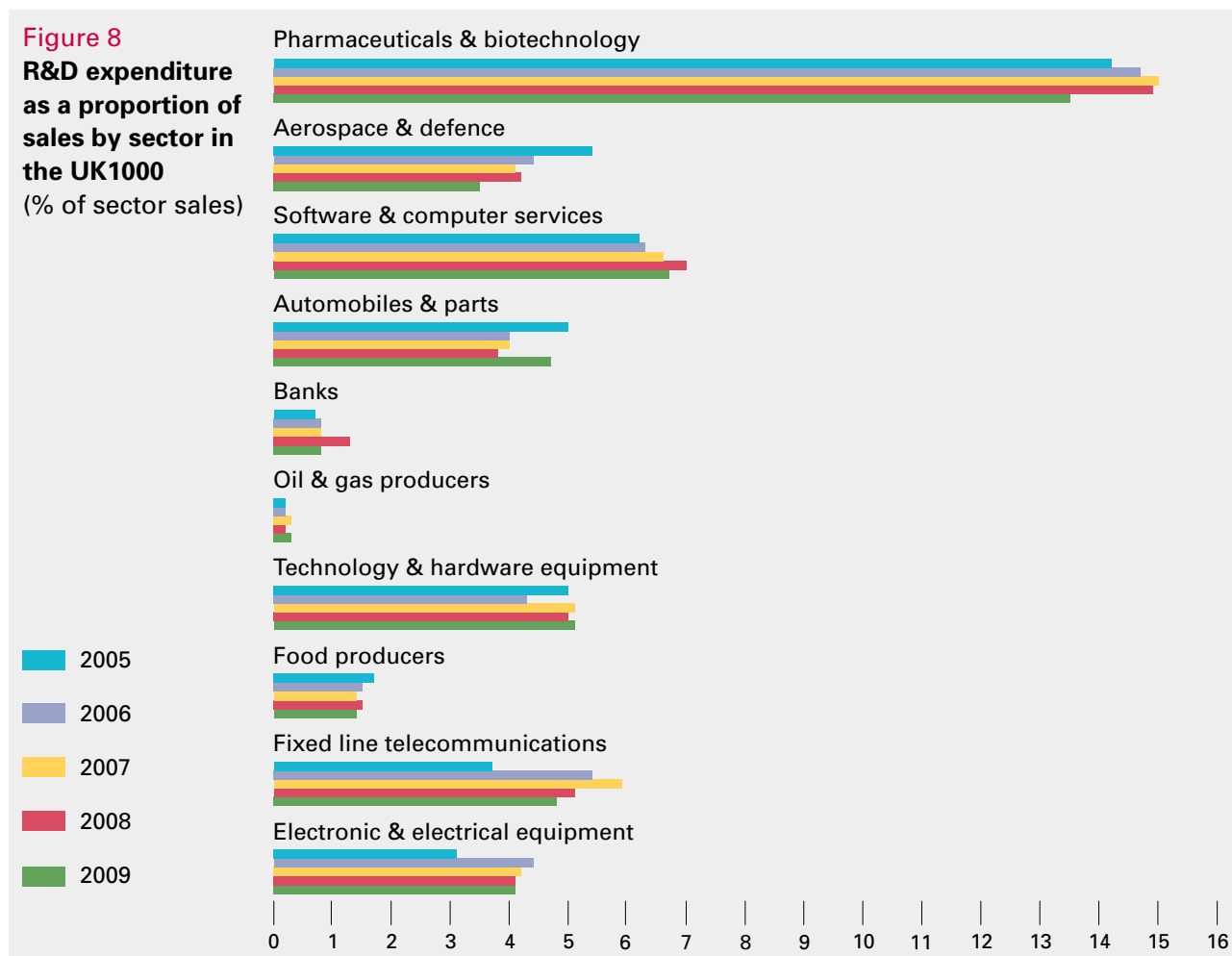
Performance: R&D, sales and operating profits

R&D and sales

The ratio of investment in R&D to sales among the UK1000 averaged 1.7% in 2009. As in past Scoreboards, there was considerable variation across sectors: the comparatively high R&D to sales ratio of over 13% in the pharmaceuticals and biotechnology sector is offset by the large volume of sales generated by the oil and gas, banking and telecommunications sectors relative to their investment in R&D.

Overall, sales decreased at a faster rate among the UK1000 than R&D investment during 2009. This is in contrast with developments observed in last year's Scoreboard. However, the ratio of (negative) growth in sales to R&D is different from sector to sector:

- Investment in R&D grew faster than sales only in the software and computer services sector. Sales decreased among automobiles and parts and technology hardware and equipment firms. However, these sectors increased R&D investment over 2008 by 9% and over 2%, respectively.



- Sales grew faster than investment in R&D in pharmaceuticals and biotechnology and electronic and electrical equipment.
- Banks and firms in the aerospace and defence sector cut their R&D spend while reporting strong sales growth. Oil and gas producers, food producers and fixed-line telecommunications all decreased both their R&D investment and overall sales.

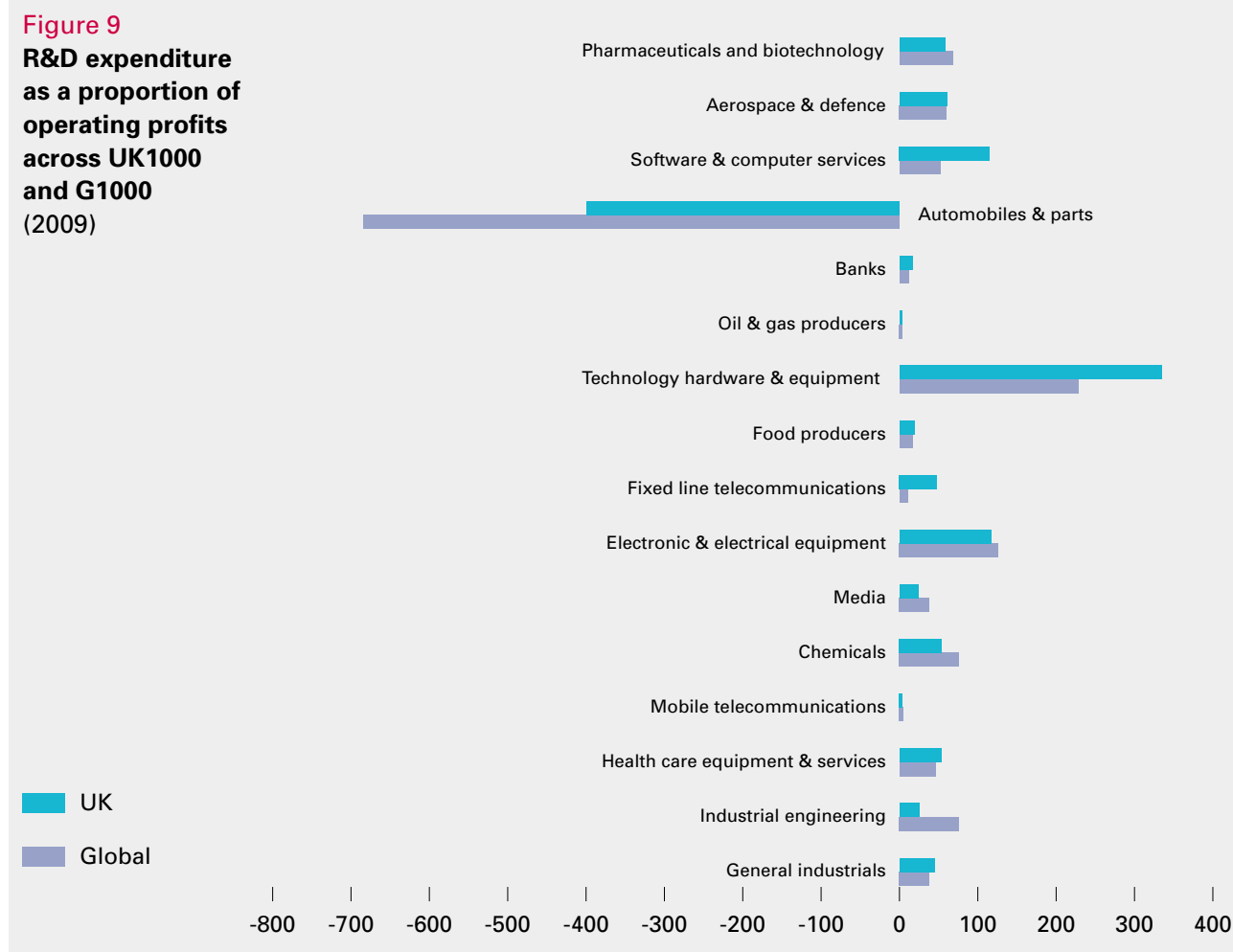
This changed pattern is reflected in Figure 8, which shows investment in R&D as a proportion of sales over the last five years.

R&D and profits

Figure 9 shows firms' investment in R&D as a proportion of their operating profits in 2009 by sector for both the UK1000 and the G1000. Three of the UK's main R&D sectors, technology hardware and equipment, software and computer services and electronic and electrical equipment, invested more than their operating profits. Of those, the technology and hardware sector invested by far the most, at 335% of its profits. The software and computer services and electronic and electrical equipment sectors invested 115% and 177% of their profits, respectively. Each of the three sectors increased their investment year on year and only in the electronic and electrical equipment sector does global spending edge past UK investment slightly (126%).

In a change to last year, the UK's fixed-line telecommunications sector invested noticeably less in R&D than its operating profit (48%). While it cut spending on R&D by just over 8%, operating profits grew by 513%. As in previous Scoreboards, the ratio of the level of investment in R&D to operating profits was lowest among mobile telecoms and oil and gas producing companies (4% and 3%, respectively). The automobiles and parts sector reported big net losses in 2009, both in the UK and globally. Figure 9 reflects this in the negative figures for investment in R&D.

The performance of the UK1000 firms both contrasts and compares with that of firms in the G1000. Globally, only two of the major sectors, technology hardware and equipment and electronic and electrical equipment, invested more than their operating profits (282% and 126%, respectively). Apart from this, two sectors, chemicals and industrial engineering, substantively grew their investment in R&D as a proportion of profits (both to 76%). Other sectors, such as software and computer services, pharmaceuticals and biotechnology and healthcare equipment and services retained an investment in R&D as a proportion of profits that was around the same as in previous years.



R&D and value added among leading UK investors

This section looks at the leading R&D investors in the UK by their value-added contribution to the economy. Value added is the difference between a company’s sales and the cost of providing its goods and services, and it is a useful way to measure broadly the amount of wealth created by a company. Companies with high levels of R&D expenditure generally contribute the most in value added to the economy.

Table 5 lists the top 50 UK R&D investors by their value-added contributions. Similarly to last year, the two oil and gas producers, Royal Dutch Shell and BP, added the most value, together adding £63bn to the economy. Unlike last year, however, value added for these two companies in absolute terms dropped by £30bn. GlaxoSmithKline and AstraZeneca, the two pharmaceuticals and biotechnology companies that lead the UK in 2009 R&D investment, are ranked sixth and eighth place in value-added contribution, accounting for £29.1bn. This is comparable to their value-added total of £28.3bn in 2008.

CASE STUDY Johnson Matthey Fuel Cells: Slowdown in the downturn

Fuel cells, which use hydrogen to create electricity with the help of electro-catalysts, were first demonstrated in the 1830s. But it was only in the 1960s that a practical application was found: the provision of electricity and water for manned spacecraft. Today, the potential market for fuel cells is huge, with applications for vehicles, boats, bicycles, heating and cooling of buildings, and electronics products.

The economic downturn has slowed some product-commercialisation, although not so much in the car market, which operates on a longer and often more thoroughly planned, development timescales. However, the downturn has hurt Johnson Matthey Fuel Cells, a manufacturer and supplier of fuel cell components. Director, Jonathan Frost, agrees that the move to market has been held back, with most companies in the sector delaying plans: "While our large customers just slow their development, it has been very tough for our start-up customers, as they only have so much cash. Fortunately, not many went bust." The company has been able to grow owing to sustained investment in R&D and by winning business from new customers.

JMFC, a subsidiary of the Johnson Matthey Group, has around 150 employees. It spends a high proportion of its revenue on R&D, much of which is carried out at its own facility in Swindon, with some work being contracted to Johnson Matthey's research centre near Reading.

Smaller, cheaper, faster

The company's R&D efforts are focused on making its components smaller, cheaper

Founded: 2000

Chief executive: Jonathan "Jack" Frost

Ownership: Johnson Matthey 82.5%,
Anglo Platinum 17.5%

Revenue: 2009: £7m

R&D spending: £3.5m + £1m of grant income

and more efficient, which should drive the acceptance of fuel cell technology in more cost-conscious countries, such as China and India, as well as in richer economies. It receives R&D grants of around £1m a year and is currently involved in three major funded programmes with other companies: a project funded by the US Department of Energy to build a new, low-cost MEA; a programme funded by the Technology Strategy Board to develop new designs, materials and production processes for MEA use in vehicles; and the "Hydrogen and Fuel Cell Technologies for Road Transport" project funded by the EU.

Although the company is small, it holds its own against heftier competitors because of its continuity of purpose and consistent year-on-year R&D investment. "This has made us the world's leading company in this area", says Dr Frost. "We train and retain our own staff and so are our own skills-generator, which enables us to compete against big companies such as Dupont and 3M."

"It's an exciting time, certainly, because, broadly speaking, fuel cells are better than batteries, which can't hold so much energy. They are better than internal combustion engines because they are quiet and efficient and they don't have a great environmental impact.... By 2018-20 they will be as common as hybrids are now." However, he adds, "the real thing that drives commercialisation is having a market that wants to buy what you've made and here the UK is very conservative."

Out of the top 50 value-added contributors, the top ten companies accounted for 54%, or just under £188bn of the total, a decrease of £49bn from 2008. While mining companies made some of the largest increases in value-added contributions last year, this year they made some of the largest decreases. Other companies contributing less include several oil and gas producers and a bank.

Of the top 50 companies adding value to the British economy, 42 are UK-owned. Compared to the 2008 Scoreboard, there are four new members in the top 50: Scottish and Southern Energy; JP Morgan Capital; Serco; and E.ON. They replace Tata Steel Europe, Experian, PricewaterhouseCoopers and Mondi.

Table 5: Top 50 UK R&D companies by value added (2009)

Company	Value added (£m)	Change in value added over last year (%)	VA per employee (£ 000's)	VA / costs (%)	R&D (£ m)
BP	31,698	-12	372	211	363
Royal Dutch Shell	31,170	-34	309	165	697
Vodafone	23,351	7	275	284	303
HSBC	17,391	-35	56	139	472
Barclays	17,086	42	111	149	264
GlaxoSmithKline	16,799	9	170	199	3,629
BHP Billiton	15,423	-22	376	196	97
AstraZeneca	12,324	6	193	270	2,746
Rio Tinto	11,466	-31	120	165	120
Tesco	10,797	7	23	148	111
Lloyds Banking	10,517	132	80	125	63
Royal Bank of Scotland	10,222	73	53	91	559
Unilever	10,105	0	60	187	792
BT	9,570	11	94	131	1,029
BAE Systems	8,102	19	86	136	234
BAT	7,511	19	123	272	152
Anglo American	6,203	-23	58	139	21
National Grid	5,917	12	211	191	19
Xstrata	5,903	-22	156	135	1
BG	5,829	-13	959	307	10
Network Rail	5,353	187	148	188	1
G4S	5,344	15	9	110	14
SABMiller	4,122	2	59	228	2
Diageo	4,091	12	169	278	17
Rolls-Royce	3,703	13	96	154	471
Centrica	3,473	38	102	160	29
Reed Elsevier	3,411	13	102	176	179
Reckitt Benckiser	3,031	22	122	271	122
Old Mutual	3,015	8	56	169	20
Thomson Reuters*	3,012	121	89	120	107
Scottish and Southern Energy	2,946	213	153	261	4
Pearson	2,890	19	78	145	35
JP Morgan Capital*#	2,757	-21	595	261	2

The 2010 R&D Scoreboard

Table 5: Top 50 UK R&D companies by value added (2009) continued

RSA Insurance	2,547	2	112	245	96
Marks & Spencer	2,531	15	33	151	57
Logica	2,328	6	59	109	23
Wittington Investments (aka Associated British Foods)	2,304	16	24	142	23
Balfour Beatty	2,282	15	54	118	4
KPMG Europe	2,171	1	104	123	28
Esso*#	2,125	-37	332	201	28
TUI Travel*	2,031	6	41	107	23
International Power	2,029	21	515	364	9
Serco	1,917	27	33	115	64
INEOS*	1,856	44	155	139	52
British Sky Broadcasting	1,832	14	123	208	63
Cadbury (now part of Kraft Foods, USA)	1,799	-19	40	145	72
Telefonica O2*	1,785	4	157	220	48
Total Upstream*#	1,735	-30	2849	309	6
John Lewis	1,725	7	25	132	31
E.ON*	1,700	58	100	190	10

* - foreign-owned firms

- accounts not prepared using IFRS

Sector summaries

Aerospace & Defence

- There are 43 aerospace and defence companies in the UK1000, of which only seven are part of the G1000. R&D expenditure in this sector decreased by 5%, more than the global decrease of 0.7%.
- The aerospace and defence sector is the second-largest contributor to R&D in the UK1000 and the seventh-largest in the G1000 in 2009.
- The leader in R&D investment in the aerospace and defence sector for the G1000 is EADS, followed closely by Boeing; in global terms, they rank 30th and 36th, respectively, in size.
- In the UK1000 Rolls Royce, Airbus, and BAE systems dominate spending on R&D, together composing 65% of the sector total and just over 4% of the overall UK spend.
- While Rolls Royce experienced a small decrease of 4% in R&D investment, Airbus cut back its spending even more, by 26%. Conversely, BAE, the smallest of the three, increased its R&D spend by 10% in 2009. In terms of sales, both Rolls Royce and BAE systems increased over the previous year, while Airbus fell by 7%.

Automobile and Parts

- There are 31 automobile and parts companies in the UK1000 and 72 in the G1000. While UK1000 R&D investment in automobile and parts increased by 9% despite sales falling by 7.6% during 2009, the global sector experienced a decrease in both, as investment in R&D fell by 11.6% and sales fell by 16.1%.
- The automobile and parts sector is the fourth-largest contributor to UK R&D spending in 2009. In comparison, the sector is the third-largest contributor to R&D in the G1000. Eight of the top 25 global and four of the top 25 UK R&D investors are from the automobile and parts sector.
- Foreign companies in 2009 accounted for 93% of R&D investment in the UK automobile and parts sector, an increase of 1% from 2008, and they account for 5.6% of UK1000 investment in R&D. GKN continues to be the only UK-owned company in both the UK1000 and the G1000.

- Of the three largest R&D investors in the 2009 UK automobile and parts sector, Land Rover’s spending grew by 38%, Ford Motors cut back by 24.6%, while Bentley made an increase of 119% in R&D expenditure in 2009. Increases were also recorded by smaller companies such as Perkins Engines and Delphi Diesel Systems, which increased R&D spending by 66% and 61%, respectively.
- Sales grew more rapidly than investment in R&D for only two companies in the top ten UK automobile and parts sector, while investment in R&D grew more quickly for five companies. Ford and GKN experienced negative growth rates for both R&D and sales, while Mercedes Benz HighPerformanceEngines recorded no change in sales, but a fall in R&D investment.

CASE STUDY AXEON: First-mover advantage

The UK market for electric vehicles remains untapped. However, owing to technological advances and the need to reduce CO₂ emissions, of which transport accounts for around 20%, the sector is expected to boom. Projected figures from Credit Suisse, a financial services company, show the market growing by 100% annually for the next ten years.

Penetration of electric vehicles in the UK is low at fewer than 10,000, with the main brake on market growth being their cost—around £10,000 more per unit than a conventional car of similar size. Despite minimal running, costs this capital expenditure is putting off companies and individuals, who are cutting spending. Current buyers are early adopters, those with green credentials and operators of vehicle fleets. The government’s “Plugged-in” grant of up to £5,000, available from January 2011 to individual buyers, may boost the market.

In a prime position to take advantage of coming market growth is Axeon, Europe’s largest independent supplier of lithium-ion battery systems for electric and hybrid vehicles, mobile technologies, such as wheelchairs and lifts, and power tools.

The company, now with revenue of £64m

Founded: 1998

Chief executive: Lawrence Berns

Ownership: Private company, fully owned by Ironshield LLP

Revenue: £64m

R&D spending: around £4m

and 450 staff, has grown since 2005 when Axeon, a software company, merged with M Power, a battery manufacturer. The two were a good fit: lithium-ion batteries require sophisticated software-based battery management systems in order to work correctly.

Funded by ITI Energy, the two companies began a joint R&D project to create battery-management systems for electric vehicles. In 2006 AIM-listed Axeon acquired M Power. In 2007 the company bought a Swiss manufacturer with a factory in Poland. In April 2009 Ironshield, Axeon’s biggest shareholder, acquired complete ownership of Axeon.

Headquartered in Dundee, Axeon has operations in Switzerland, Germany and Poland, sales offices in Italy and America and supply-chain management in Asia. It processes 70m cells a year (a “battery” comprises multiple cells).

Recharged batteries

Although its power tool business contributes the largest share of revenue,

Sector summaries

the main focus of Axeon's R&D operation, in which it invests around £4m annually, is the electric vehicle segment, from which its future growth will come. Around 25 Dundee-based staff work almost exclusively on R&D for electric vehicle battery systems.

The company has several R&D projects underway in the segment. One, in collaboration with the University of St Andrews and Nexeon, a cell manufacturer, is the development of newer, cheaper, higher-capacity materials for the electrodes within cells, which account for 60% of their cost.

Axeon is also a member of the ReEvolution consortium set up to develop "range extended" battery-powered vehicles, which incorporate a small internal combustion engine used to charge the battery. The consortium (other members are Jaguar Land Rover, Lotus Engineering, Nissan, THINK, EVO Electric and Xtrac) has been awarded £9.5m by the TSB. The consortium will add a further £11m and collaborate over the next two years to develop electric power trains and broaden their understanding of the commercial

requirements for electric vehicles.

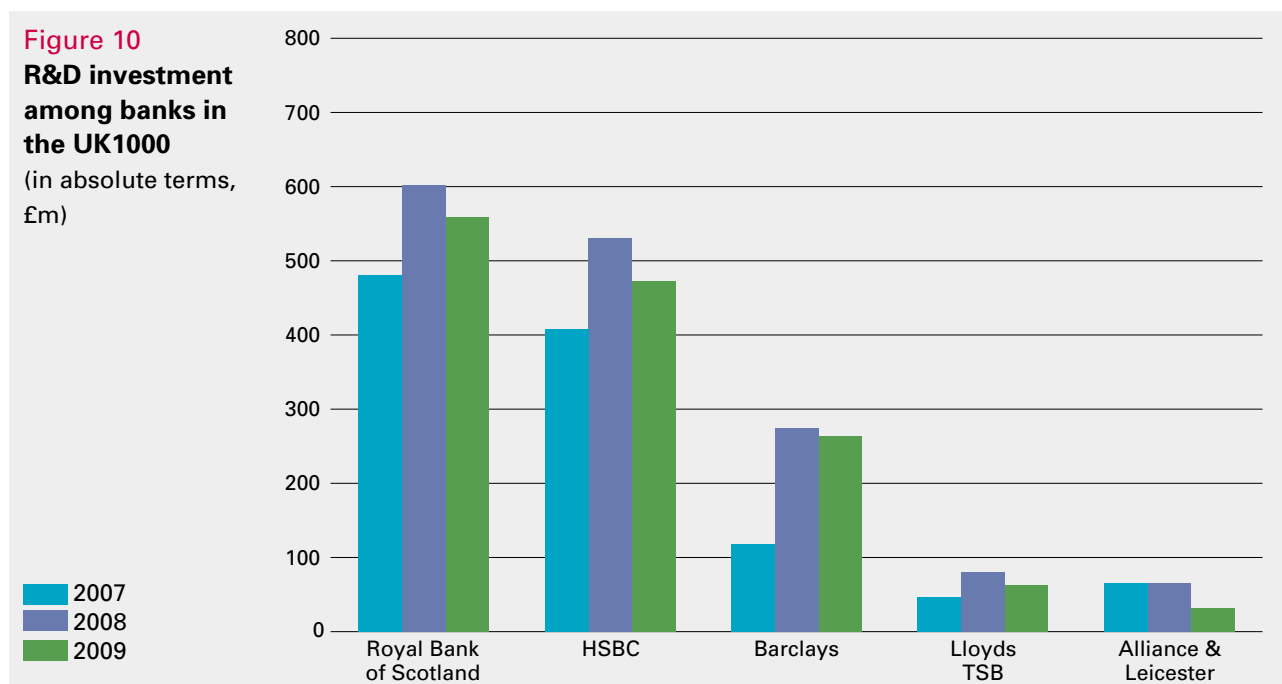
Axeon has also received over £2m in government funding (mostly from the TSB), which has financed research into advanced electric vehicle batteries that can deliver material benefits in terms of range, size, weight and cost.

Axeon's Marketing Director, Rebecca Trengove, acknowledges that this funding has allowed the company to accelerate its R&D and "retain its first-mover advantage," so it can move quickly when the electric vehicle market takes off. But she cautions that, while the UK is a "reasonably good" environment for R&D, it could be better. Axeon's future R&D efforts will remain focused on the electric vehicle market, and potentially also at other applications, such as the use of batteries to power trains, ferries, and specialist vehicles, or in applications such as mining. Markets such as the US, Africa and Asia may also require batteries for energy storage. "Part of the strategic question for Axeon is, where do the limits of our interests lie?" Ms Trengove says. "How much can we take on and how much do we need to focus?"

Banking

- The banking sector was the fifth-largest contributor to R&D in the UK1000 and the fifteenth-largest in the G1000 in 2009.
- Royal Bank of Scotland, HSBC, and Barclays are all in the top 25 in the UK1000. These three banks dominate the sector, with 93% of R&D expenditure in 2009, an increase of 5% from 2008, and contribute 5% to overall UK spend.
- Compared with the previous year, when seven banks were part of the UK1000, only five banks are included in 2009. All except for HSBC, which remained at a constant level, decreased their R&D investment, and the greatest cuts were made outside of the big three. R&D expenditure fell by 21% at Lloyds Bank and by 51.5% at Alliance and Leicester.
- While investment in R&D fell in the UK by 7%, it grew by 8.6% globally. In the G1000, Banco Santander showed the strongest growth, increasing its spending by 18% over 2008.

- Despite mixed results in operating profits for banks in the UK1000, all except for HSBC managed to increase sales in 2009. In total, UK sales in the banking sector grew by 44.8%, reflecting this sector's improving outlook after the global financial crisis. This is despite government ownership of Royal Bank of Scotland.



Fixed-line & mobile telecommunications

- Fixed-line and mobile telecommunications are the ninth and 14th-largest contributors to R&D in the UK1000 in 2009, respectively.
- BT and Vodafone dominated the fixed-line and mobile telecoms sectors. Together, they account for 92.5% of the sector total for R&D investment and 5% of overall UK1000 spend.
- BT retains third place and Vodafone drops one place to 15th in the 2009 UK1000 rankings. These two are the only telecoms companies in the top 25 UK R&D investors and are among the ten telecoms firms in the G1000.
- UK R&D and sales in the fixed-line telecoms sector fell by 8% and 2.7%, respectively, closely mirroring the decrease in BT's R&D expenditure. R&D and sales increased by 4.1% and 7%, respectively, in the mobile telecoms sector. Both BT and Vodafone recorded an increase in operating profit in 2009, of 370% and 64%, respectively.

Pharmaceuticals & Biotechnology

- Six of the 25 largest investors in R&D in the UK and eight of the 25 largest global investors are pharmaceuticals and biotechnology companies. Roche and Pfizer lead the way in the G1000 at second and fifth place, respectively. Only one UK company, GlaxoSmithKline, is in the 25 largest global R&D investors.
- The global pharmaceuticals and biotechnology sector increased R&D expenditure by 5.5%. The UK sector, however, recorded growth of just 0.9% in 2009.
- The pharmaceuticals and biotechnology sector continued to be the largest contributor to R&D in both the UK1000 and G1000 in 2009. There are 129 pharmaceuticals and biotechnology firms in the UK1000 and 112 in the G1000. Shire and Merial join GlaxoSmithKline and AstraZeneca as the only UK pharmaceuticals and biotechnology companies in the G1000.
- R&D spending by pharmaceuticals and biotechnology companies based in the UK is highly concentrated. GlaxoSmithKline and AstraZeneca account for 71.4% of R&D expenditure in the sector, and 25% of overall UK1000 R&D spending.
- There are significant differences between the two largest spenders in the UK. GlaxoSmithKline saw its R&D expenditure and sales increase by 10% and 16%, respectively, for a boost in operating profit of 6%. AstraZeneca, however, reduced its R&D expenditure by 12%, while growing sales by 4%, resulting in an increase in operating profit of 24%.
- Smaller UK companies also did well. In particular, Shire grew its R&D spend by 16% and although sales decreased by 1%, operating profit grew by 90%. Another high performer was Eisai Europe, which increased its R&D by 42%, sales by 30%, and recorded a growth in operating profit of 125%.

Software & Computer Services

- One hundred and fifty-two software and computer companies are in the UK1000, more than any other sector. Out of 74 software and computer services companies in the G1000, only six are from the UK.
- Two of the 25 largest R&D investors globally are software and computer services companies. Microsoft is the third and IBM is the 22nd-ranked companies in terms of global R&D expenditure. By comparison, the highest placed UK company is Sage, in 337th place.

Sector summaries

- In 2009 the software and computer services sector was the third-largest contributor to R&D in the UK1000 and the fourth-largest in the G1000. While R&D in the sector fell by 0.4% globally, investment increased by 8.6% in the UK. This positive growth rate is greater than the pharmaceuticals and biotechnology and aerospace and defence sectors, both ranking higher in terms of overall R&D spend.
- R&D spending by companies in the UK software and computer services sector is more evenly distributed than other sectors. The six largest companies represent 48% of the sector total in 2009, closely matching the findings in 2008.
- Similarly to 2008, R&D expenditure in the UK software and computer services sector grew more quickly than sales in 2009. Of the six companies that invested more than £100m in R&D in this sector, Amdocs is the only one to reduce its R&D spend. However, only Sage and Misys managed to grow sales. In terms of operating profit, Misys recorded the most, at 164%, and Invensys increased by 27%. Conversely, Symbian Software and NDS made losses of 108% and 72%, respectively.

Differences in R&D between firms by value of sales

Table 6 shows the composition of firms in both the UK1000 and G1000, broken down by the value of their sales in 2009. Companies with sales of less than £50m were the largest proportion of the UK1000 in 2009, at 42%, followed by companies with sales between £50m and £500m at 34%. Two hundred and forty-one companies had sales over £500m, of which 54 achieved sales of over £5bn.

Almost all of the companies in the G1000 had sales in excess of £500m. Compared with their global peers, proportionately more of the 50 UK companies in the G1000 had sales over £5bn; 46% of UK companies had sales in excess of £5bn compared with 38% of the other 950 G1000 companies. The same proportion of G1000 global and UK firms had sales between £500m and £50m. There are no UK companies with less than £50m in value of sales in the G1000.

Value of Sales	UK1000		G1000					
	Number	% of total	Number	% of total	Non-UK firms	% of total	UK firms	% of total
More than £5 billion	54	5%	380	38%	357	38%	23	46%
Between £500 million and £5 billion	187	19%	491	49%	470	49%	21	42%
Between £50 million and £500 million	349	34%	117	12%	111	12%	6	12%
Less than £50 million	419	42%	12	1%	12	1%	0	0%
Total UK1000	1000	100%	1,000	100%	950	100%	50	100%

Table 7 analyses investment in R&D as a proportion of sales for firms of different sizes in both the UK1000 and G1000. It shows that:

- firms in the UK1000 invested significantly less in R&D as a proportion of sales than their global peers. For instance, global companies with sales of more than £5bn, excluding the UK firms in the G1000, invested 3% of their sales in R&D, compared with just 1% for those with similar sales in the UK;
- this difference is more drastic for firms that make between £50m and £500m in sales: those in the G1000 invest 23% of their sales in R&D, whereas those in the UK1000 only invest 6% of sales in R&D. For the 12 companies in the G1000 that make

Differences in R&D between firms by value of sales

less than £50m in sales, R&D as a proportion of sales is even greater. Eleven of these firms are from the pharmaceuticals and biotechnology sector, a reflection of the investment-intensive nature of the sector;

- the results reflect the mix of firms in the UK1000 and G1000. Smaller firms in both the UK1000 and the G1000 tend to be more R&D-intensive, being concentrated in high-tech sectors such as pharmaceuticals and biotechnology and software and computer services, while larger firms include banks and oil and gas producers with high absolute R&D numbers that represent a very small proportion of their total sales. In addition, the sectoral mix among UK companies in the G1000 is quite different from that of other countries. Together, these reasons account for the lower R&D intensity among UK firms.

Table 7: R&D and sales by firms' value of sales (2009)

Sales	Number of companies	R&D (£ m)	Sales (£ m)	R&D as % of sales
UK1000				
More than £5bn	54	13,755	1,161,781	1%
Between £500m and £5bn	187	6,282	280,921	2%
Between £50m and £500m	340	3,734	67,828	6%
Less than £50m	419	1,491	7,167	21%
G1000 (excluding 50 UK firms)				
More than £5bn	357	256,621	7,648,576	3%
Between £500m and £5bn	470	63,790	989,057	6%
Between £50m and £500m	111	7,700	32,834	23%
Less than £50m	12	697	199	350%

Differences in R&D in terms of types of ownership

Table 8 compares the characteristics of UK-owned and foreign-owned firms in the UK1000. The UK-owned firms are also broken down by their listing status, including a row on the 24 nationally owned companies. As in the previous Scoreboard, slightly less than three-quarters (73%) of the investment in R&D in 2009 by the companies most active in R&D was made by UK-owned companies. 44% of the top 1,000 UK companies by R&D are foreign-owned, up slightly from 2008.

In 2009 only private UK-owned firms increased their investment in R&D. They are also the only firms that collectively increased their sales (by 7.7%). R&D investment and sales decreased most significantly among the UK's nationally owned companies and these companies also achieved the lowest level of profitability

(operating profit as percentage of sales). On average, however, UK-owned companies are more profitable than their foreign-owned peers.

Table 8: Investment in R&D and other measures of business performance across UK-owned and foreign-owned firms in the UK1000 (2009)

Ownership status		Number of companies	R&D (£ m)	Change in R&D over previous year (%)	Change in sales over previous year (%)	Operating profit as percentage of sales (%)
UK-owned	Listed	345	16,701	-1.0	-6.7	10.6
	Private	191	1,439	5.2	7.7	9.8
	Nationally owned	24	188	-12.8	-31.3	2.6
Foreign-owned		440	6,960	-0.3	-4.8	4.4
UK1000 total		1,000	25,262	-0.6	-6.3	9.4

CASE STUDY Marine Current Turbines: Tidal change for marine energy

Marine Current Turbines (MCT) is a leading innovator in marine current and tidal stream energy. The company installed the world's first offshore tidal turbine, "SeaFlow", off the coast of Devon in May 2003 and then completed the installation and commissioning of the first commercial-scale tidal turbine, the 1.2-mw "SeaGen", in Strangford Narrows in Northern Ireland in 2008.

MCT's next project is for a tidal energy farm off the coast of Anglesey in an area of fast-flowing open sea known as the Skerries. The company plans to take the project forward as a joint-venture with npower, a UK energy provider, through a newly created development company, Sea Generation Wales Ltd. MCT has also signed an agreement with Canada's Minas Basin Pump and Power to harness the huge tidal currents of the Bay of Fundy in Nova Scotia.

In the longer term, MCT plans to develop a 99-mw tidal farm in the waters around the Orkney Islands—enough power for nearly 100,000 homes. It is also planning a scheme of a similar size off the Antrim coast in Northern Ireland in partnership with ESB

Founded: 2002

Chief executive: Martin Wright

Ownership: The Carbon Trust, EDF Energy, BankInvest, ESB International, Guernsey Electricity, Triodos Bank, venture capitalists, founders, private investors

Revenue: Pre-revenue

R&D/working capital spend: £38m

International. All of these projects require significant levels of investment.

One of the main advantages of marine currents is that they are a low-carbon energy resource capable of making a significant contribution to the electricity grid, while reducing the industry's carbon emissions. A 2006 Carbon Trust report estimated that tidal stream energy could meet 5% of the UK's electrical energy needs, thereby reducing its dependence upon carbon-intensive imported fossil fuels. Technology and development costs are estimated at £100m, which puts tidal energy on a par with offshore wind machines. In addition, tides are more predictable than wind and, as SeaGen has demonstrated, twice as productive in terms of the amount of electricity generated.

MCT, which has 18 employees, has two primary interests: technology development and commercial project development and installation. The company has so far

Differences in R&D between firms by value of sales

raised £38m in combination grants and equity from its investors, which funded the development and installation of MCT's prototypes and has enabled the company to get to where it is today.

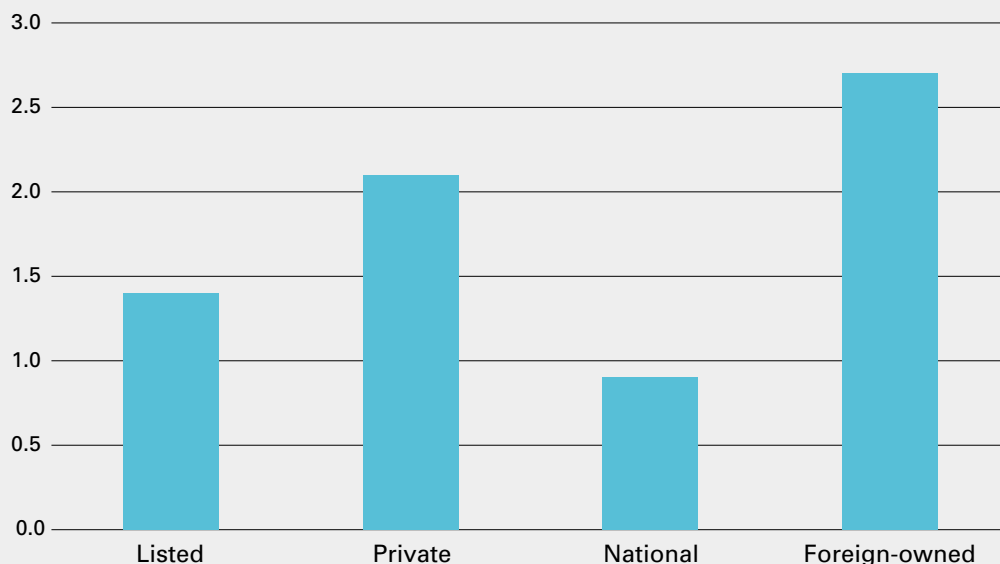
MCT's Managing Director, Martin Wright, is passionate about developing an efficient and reliable means of capturing the kinetic energy in the sea and believes the market could be huge: in the UK alone, marine turbines could produce annually around 3 gw of power, worth around £12bn. "That means our R&D doesn't stop. We are

concentrating on developing the technology, working out how we can commercialise the technology and looking at installation costs, which we want to drive down as soon as we can." However, he explains, "because there is no clear market signal at the moment in the UK, we are doing the initial project development, but MCT should not take the project risk in future. So our approach is to develop the technology, and the initial stages of projects, in order to bring in a suitable balance-sheet investor to take it on from that point."

R&D intensity of firms

Figure 13 shows R&D expenditure as a proportion of sales for the four categories of firm in the UK1000 discussed above. On average, foreign-owned firms spent a higher proportion of the value of their sales on R&D (2.7%) than listed, private or nationalised UK-owned companies.

Figure 11
R&D expenditure
as a proportion of
sales by owner-
ship of firms in
the UK1000
(%)



Differences in R&D between firms by value of sales

Table 9 lists UK1000 companies with a comparatively high ratio of investment in R&D to sales in 2009. As in past Scoreboards, companies from the pharmaceuticals and biotechnology sector dominate the list. Generally, high-tech sectors have a considerably higher ratio of R&D expenditure to sales than other sectors.

Company	R&D as a proportion of sales (%)	R&D (£ m)	Growth in R&D over last year (%)	Sector
Reliance GeneMedix*	960	5.2	17	Pharmaceuticals & biotechnology
Prosurgics	844	2.1	n/a	Pharmaceuticals & biotechnology
CDT*#	773	8.6	23	Electronic & electrical equipment
ViaLogy	716	0.9	-26	Software & computer services
Ultronics*#	693	1.2	0	Electronic & electrical equipment
Alizyme	605	11.2	-64	Pharmaceuticals & biotechnology
Energetix	571	1.5	-36	Industrial engineering
Ceres Power	563	5.4	28	Alternative energy
Ark Therapeutics	525	15.6	-5	Pharmaceuticals & biotechnology
Lipoxen	523	2.5	-32	Pharmaceuticals & biotechnology
Syntopix	453	0.9	-14	Pharmaceuticals & biotechnology
Phytopharm	373	3.2	104	Pharmaceuticals & biotechnology
Renovo	357	18.1	-3	Pharmaceuticals & biotechnology
SpinVox*	326	12.1	18	Mobile telecommunications
Airvana*#	302	2.6	106	Technology hardware & equipment
Proximagen	298	2.8	22	Pharmaceuticals & biotechnology
Silence Therapeutics	294	5.1	-24	Pharmaceuticals & biotechnology
Pursuit Dynamics	289	3.3	-7	Industrial engineering
Osmetech	285	1.8	-32	Healthcare equipment & services
ZincOx Resources	268	3.2	-14	Mining

* - foreign-owned firms
- accounts not prepared using IFRS

The biggest changes in the UK

Table 10 lists the 20 companies in the UK1000 that have increased their investment in R&D the most over the previous year. It is important to note that only 50% of these companies are UK-owned, down from 75% last year, while three of the top five companies are foreign-owned. As in last year's Scoreboard, GlaxoSmithKline comes out on top.

In an important change to last year's Scoreboard, banks and aerospace and defence companies did not make the list. AstraZeneca, the UK's second-largest investor in R&D, also failed to place this year. The biggest relative increase over last year is that of Bentley Motors, which increased its R&D investment by 119% (an equivalent of £125m). Other significant increases in R&D investment included:

Differences in R&D between firms by value of sales

- Land Rover, which increased its investment by £87m, is, together with the performance of Bentley Motors, reflecting the comparatively strong growth in R&D in the automobiles and parts sector in 2009;
- Reed Elsevier, which increased its spend by 56% (an increase of £64m), causing it to move from 19th to fourth place in the list of fastest-growing companies by R&D in the UK1000; and
- Northgate Information Solutions, Sage and Symbian Software, which reflected the comparatively strong growth across the software and computer services sector.

In contrast, Table 11 lists the 20 firms in the UK that reduced their investment in R&D by the largest absolute amount over the last year. AstraZeneca, showing one of the bigger increases only last year, recorded the biggest drop in 2009. Its investment in R&D fell by £373m, yet AstraZeneca remained as the second-largest investor overall in the UK. BT continued its slide from last year, decreasing R&D spending by a further £90m. The company is almost solely responsible for the further drop in R&D spending in the fixed-line telecommunications sector in 2009.

Table 10: Biggest increases in R&D expenditure in the UK1000 (2009)

Company	Sector	Increase in R&D (£m)
GlaxoSmithKline	Pharmaceuticals & biotechnology	315
Bentley Motors*#	Automobiles & parts	125
Land Rover*#	Automobiles & parts	87
Reed Elsevier	Media	64
Nokia*#	Technology hardware & equipment	50
Shire#	Pharmaceuticals & biotechnology	48
Eisai Europe*	Pharmaceuticals & biotechnology	45
Northgate Information Solutions*	Software & computer services	37
Sage	Software & computer services	35
LCH Clearnet	Financial services	34
McLaren#	Travel & leisure	33
Time Warner*#	Media	31
ARM	Technology hardware & equipment	28
Roche Products*	Pharmaceuticals & biotechnology	27
Centrica	Gas, water & multi-utilities	27
RSA Insurance	Non-life insurance	26
Perkins Engines*#	Automobiles & parts	25
Symbian Software*#	Software & computer services	24
PowderMed*#	Pharmaceuticals & biotechnology	23
Vodafone	Mobile telecommunications	23

* - foreign-owned firms
- accounts not prepared using IFRS

Differences in R&D between firms by value of sales

Other large companies, such as Airbus Operations and Royal Dutch Shell, also cut their R&D investment significantly. The two large mining companies in the UK1000, Rio Tinto and BHP Billiton, did not manage to replicate their large growth of 2008 and instead decreased their spending by £71m and £54m, respectively. Overall, more UK-owned than foreign-owned firms reduced their investment by a large absolute amount, a change from last year.

Table 11: Biggest decreases in R&D expenditure in the UK1000 (2009)

Company	Sector	Decrease in R&D (£m)
AstraZeneca	Pharmaceuticals & biotechnology	373
Airbus Operations*#	Aerospace & defence	127
Ford Motor*#	Automobiles & parts	102
BT	Fixed-line telecommunications	90
Royal Dutch Shell	Oil & gas producers	87
Thomson Reuters*	Media	83
Tesco	Food retailers	81
Imperial Chemical Industries*#	Chemicals	73
Rio Tinto	Mining	71
Old Mutual	Life insurance	62
Marks & Spencer	General retailers	62
BHP Billiton	Mining	54
Royal Bank of Scotland	Banks	43
Motorola*#	Technology hardware & equipment	38
Alliance & Leicester*	Banks	34
Unilever	Food producers	32
SELEX Sensors and Airborne Systems*	Electronic & electrical equipment	27
Alizyme	Pharmaceuticals & biotechnology	20
BEIG Topco (aka Birds Eye)	Food producers	19
TTP Communications*	Technology hardware & equipment	19

* - foreign-owned firms
- accounts not prepared using IFRS

CASE STUDY Novacem: Partners and funding needed

Worth US\$170bn, the cement industry is a vital part of economic development around the world. The downside is its environmental impact: it is currently responsible for 5% of man-made CO₂. While the industry in some countries is making efforts to become cleaner through new blending methods, alternative fuels and increased kiln efficiency, its reliance on limestone-based Portland cement means it will continue to contribute to greenhouse gases; for every tonne of traditional cement, 800kg of CO₂ is released into the atmosphere.

Founded in 2007 as a spinout from Imperial College, London, Novacem has developed a carbon-negative cement that reduces carbon emissions in three ways: the cement is made from magnesium silicate that, unlike limestone, contains no carbon; the manufacturing process uses lower temperatures and requires less energy; and the method produces magnesium carbonate, a compound that absorbs CO₂, which is used in the final product. The net result is carbon negative.

Novacem's investors are Imperial Innovations, which combines technology transfer, company incubation and investment; the Royal Society Enterprise Fund, set up to make investments in early stage science-based businesses (Novacem was the first company in which an investment was made); and the London Technology Fund, a specialist investor in new technology companies.

The company's activities and most of its staff of around 20—an international group of top-flight engineers and scientists—are currently focused on R&D, and support from the Technology Strategy Board and the Carbon Trust has been crucial in

Founded: 2007

Chief executive: Stuart Evans

Ownership: Imperial Innovations, Royal Society Enterprise Fund, London Technology Fund

Revenue: Pre-revenue

R&D/working capital spend: Grants, venture capital, Green Cement bond £3.57m

enabling it to develop many aspects of the technology. The funding has also enabled Novacem to create over 20 jobs, with many more expected.

In August 2010 Novacem completed the first step on the road to product commercialisation with the completion of a project funded by the Technology Strategy Board (TSB) worth £1.5m. This is a collaborative project, with Rio Tinto, a mining company; Laing O'Rourke, a UK construction firm; WSP Group, an engineering company; and Imperial College as academic partner. It has resulted in the construction of a pilot plant that is now producing small amounts of cement for testing and development.

Other funding includes venture capital investment of over £1m, a smaller, but important, grant from the Carbon Trust Incubator Programme, which funds business development and research up to the value of £70,000, and Novacem's own Green Cement Bond aimed at accelerating the development and commercialisation of its product. The world's biggest cement producer, Lafarge, has come on board as the first subscriber to the bond, which has a nominal value of £1m. The introduction of new European regulations on emissions caps has led to other traditional cement companies showing an interest in the service.

The next step for Novacem is to build a semi-commercial facility producing around 25,000 tonnes of cement each year, to support a broader testing and development programme and take the first cement to

Differences in R&D between firms by value of sales

market in fiscal year 2012/13 (April-March). After that, Novacem plans to license its technology to new plants around the world that will produce cement in commercial quantities.

Money in the mix

According to Novacem's marketing manager, Dr John Prendergast, future funding is vital for the company to be able to commercialise the service and the key issue is creating the right "eco-system" of partners and funding support to allow it to continue on its "scale-up journey". This means getting both public and private investors on board, as well as industrial partners who can add resources and development support. "Our development

journey still has hurdles ahead, and we hope we can access further public funding to allow us overcome them," says Dr Prendergast.

"It's really crucial for us to bring in more funding, and both public and private sources will be important. In addition to money, private funding also contributes experience in building up companies to tackle R&D challenges successfully. Public funding is critical to overcome aspects of technology risk inherent in many 'cleantech' ventures, which private funding does not cover. We are looking at possible sources of public funding in both the UK and Europe and, as this is such a great business opportunity, we are very hopeful of successfully winning it."

Summary of UK1000

Sector	Number of firms	R&D 2009 (£ m)	Change in R&D over last year (%)
Aerospace & defence	43	1,643	-5.0
Alternative energy	5	20	11.6
Financial services	27	277	27.5
Fixed-line telecommunications	2	1,031	-8.0
Food & drug retailers	4	120	-42.8
Food producers	30	1,034	-3.4
Forestry & paper	2	8	-17.4
Gas, water & multi-utilities	9	90	94.6
General industrials	8	218	5.1
General retailers	14	150	-29.0
Healthcare equipment & services	46	396	11.0
Household goods & home construction	12	267	6.6
Industrial engineering	52	351	7.5
Industrial metals & mining	2	79	-13.3
Industrial transportation	12	62	-22.4
Leisure goods	16	235	-1.4
Life insurance	4	35	-66.2
Media	23	523	4.3
Mining	8	249	-34.6
Mobile telecommunications	12	409	4.1
Automobiles & parts	31	1,529	9.1
Non-life insurance	7	128	40.4
Oil & gas producers	6	1,119	-7.3
Oil equipment, services & distribution	10	62	15.6
Personal goods	6	27	-4.9
Pharmaceuticals & biotechnology	129	8,922	0.9
Software & computer services	152	1,621	8.6
Support services	59	524	-0.8
Technology hardware & equipment	72	1,067	2.1
Banks	5	1,390	-7.0
Tobacco	2	158	9.7
Travel & leisure	16	205	36.8
Beverages	4	22	-9.0
Chemicals	57	477	-11.0
Construction & materials	17	103	-0.4
Electricity	9	64	-2.1
Electronic & electrical equipment	87	647	1.4
Total UK1000	1,000	25,262	-0.6

Summary of G1000

Sector	Number of firms	R&D 2009 (£ m)	Change in R&D over last year (%)
Aerospace & defence	33	12,918	-0.7
Alternative energy	3	308	24.1
Financial services	7	409	17.6
Fixed-line telecommunications	16	7,633	1.2
Food & drug retailers	3	494	-11.5
Food producers	19	4,612	0.5
Forestry & paper	3	203	-0.4
Gas, water & multi-utilities	7	766	19.3
General industrials	34	10,007	-1.6
General retailers	6	1,802	5.9
Healthcare equipment & services	40	6,821	5.4
Household goods & home construction	16	3,136	-1.9
Industrial engineering	63	10,129	-2.2
Industrial metals & mining	17	2,351	-2.9
Industrial transportation	2	154	-23.1
Leisure goods	25	11,817	-4.9
Life insurance	1	117	-68.6
Media	8	1,921	13.1
Mining	4	939	-15.6
Mobile telecommunications	4	696	7.5
Automobiles & parts	72	55,128	-11.6
Nonlife insurance	1	96	37.1
Oil & gas producers	22	6,185	2.5
Oil equipment, services & distribution	9	1,521	-1.1
Personal goods	13	2,086	1.0
Pharmaceuticals & biotechnology	112	65,881	5.5
Software & computer services	74	24,473	-0.4
Support services	11	1,115	8.1
Technology hardware & equipment	152	59,111	-6.3
Banks	21	4,407	8.6
Tobacco	4	784	-0.7
Travel & leisure	10	1,118	2.3
Beverages	4	824	17.3
Chemicals	69	15,178	3.1
Construction & materials	23	2,909	18.9
Electricity	13	2,114	-3.5
Electronic & electrical equipment	79	23,855	1.1
Total G1000	1,000	344,017	-1.9

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.



First published November 2010.

Department for Business, Innovation & Skills.
www.bis.gov.uk/randscoreboard

© Crown Copyright. URN 10/31A