EU R&D SCOREBOARD

The 2014 EU Industrial R&D Investment Scoreboard

Report EUR 26903 EN

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Summary

The 2014 "EU Industrial R&D Investment Scoreboard" (the *Scoreboard*) contains economic and financial data for the world's top 2500 companies ranked by their investments in Research and Development (R&D). The sample contains 633 companies based in the EU and 1867 companies based elsewhere. The *Scoreboard* data are drawn from the latest available companies' accounts, i.e. usually the fiscal year 2013/14.

Highlights

- In 2013, the world top 2500 R&D investors, which account for about 90% of global industrial R&D, continued to increase their investment in R&D (4.9%), well above the growth of net sales (2.7%). The 633 EU companies among the top world 2500 R&D investors show an annual R&D investment growth rate of 2.6%, well below the world average. This is accompanied by a decrease in sales (-1.9%) and operating profits (-6.6%).

- The EU based carmaker Volkswagen leads the global ranking for the second consecutive year, showing again a remarkable increase of R&D investment in 2013 (23.4%, up to €11.7bn). Second continues to be Samsung, showing a very impressive R&D increase of 25.4%.

- An examination of *Scoreboard* company patent portfolios shows that the patents to R&D ratios are very much sector-specific. This is combined with a wide variation within sectors, determined by the individual technological profiles of companies and their degree of specialisation. The Pharmaceutical sector, one of the most technologically concentrated, is a good example, with some companies focused purely on pharmaceuticals but others specialised in medical technologies (Johnson & Johnson) or chemistry (Bayer) and some with substantial patenting activity in biotechnology (Roche).

- EU companies in the automobile sector, accounting for one quarter of the total R&D invested by the EU-633 *Scoreboard* companies, continued to increase significantly their R&D investments in 2013 (6.2%). This reflects the good performance of automobiles companies based in Germany (9.7%) that account for three quarters of this sector's R&D in the EU.

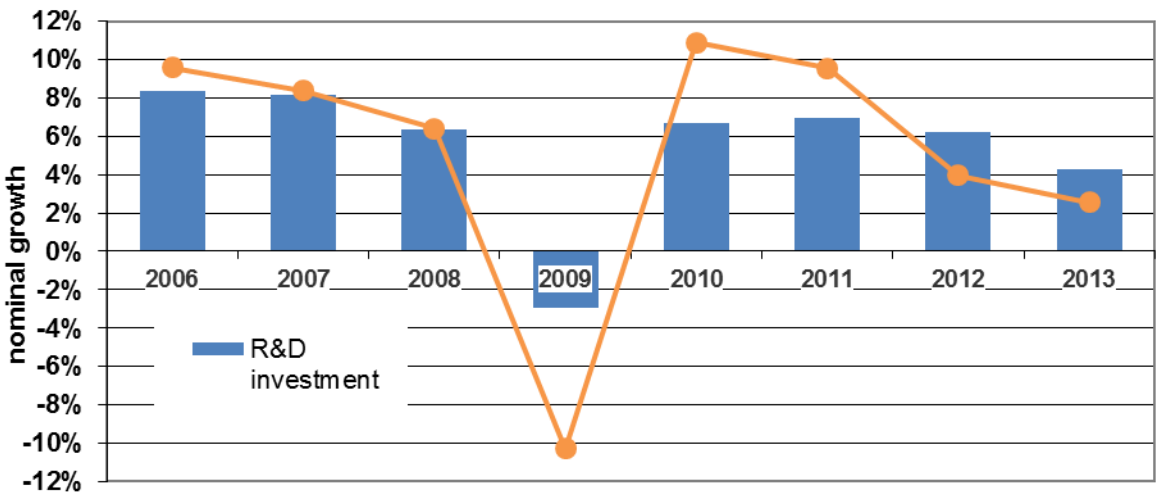
- The poor R&D growth performance of EU companies in relevant high-tech sectors such as Pharmaceuticals & Biotechnology (0.9%) and Technology Hardware & Equipment (-5.4%) weigh down the total average R&D increase of the EU sample. The overall amount invested in R&D by EU based companies in high-tech sectors represents 43.4% of the amount invested by their US counterparts and the gap between the two company samples is increasing with time.

- The analysis of an extended EU-1000 sample shows a significant number of companies in high and medium-high R&D sectors with a healthy growth record of R&D and sales over the last several years. But more rapid growth of middle-size potential future leaders in key high-tech sectors is required to achieve the shift of the European industrial structure towards more knowledge-intensive and higher value added sectors.

In 2013, the top world R&D investors continued to increase their Research and Development investments by 4.9%, more than the growth of net sales (2.7%). This suggests the importance of R&D investments in a context of increased competition and economic uncertainty.

Following the strong rebound in sales and R&D investments observed in the two years following the 2009 financial crisis, the sample of the 2500 Scoreboard companies that account for about 90% of the world's industrial R&D entered a period of marked sales growth slow-down in 2012 and 2013 (see Figure S.1). Despite this downward trend in sales, companies continue to show a quite remarkable resilience in the level of their R&D investments which increased 4.9% in 2013. Capital expenditures seemed to be more affected, showing an annual growth rate of 2.5% in 2013. The number of employees for the world sample has remained stable (-0.1%). Figure S1 below shows the longer-term R&D trends for a subset of *Scoreboard* companies with available data for the past nine years.

Figure S1. One-year R&D investment and net sales growth in the *Scoreboard*.



Note: For 1886 out of the top world 2500 companies in the Scoreboard with data for the whole period.

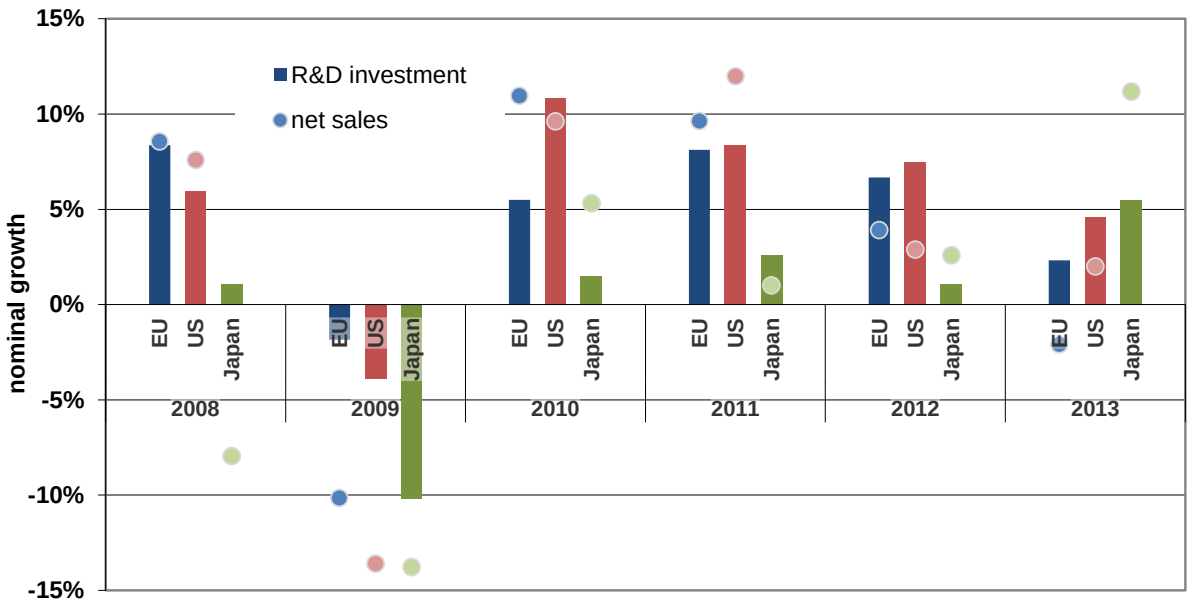
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

The 633 EU companies among the top world 2500 R&D investors in 2013 show an annual R&D investment growth rate of 2.6%, well below the world average. This is accompanied by a decrease in both sales (-1.9%) and operating profits (-6.6%).

This R&D growth rate of *Scoreboard* EU based companies is lower than that of their counterparts in the US (5.0%, despite a significant slow-down in sales growth, 2.0% in 2013) and Japan (5.5%, in this case coupled with a robust sales increase of 11.2% and an exceptional increase of profits, 63.7%). Figure S2 shows the R&D and sales trends since the start of the crisis in 2009 until 2013 for a subset of companies based in these three regions (which account for 82% of the total R&D investment made by the 2500 *Scoreboard* sample: USA 36.0%, EU 30.1% and Japan 15.9%).

Companies based in other world regions continue to show in 2013 strong levels of R&D investment increases (8.1%), with South Korean ones leading the performance (16.6%), followed by the Chinese (9.8%) and the Taiwanese (7.5%). The sample of companies based in these three Asian countries account for more than 50% of the R&D invested in the "other world" region sample (18% of the *Scoreboard* total).

Figure S2. One-year R&D investment and net sales growth in the *Scoreboard*, by main world region.

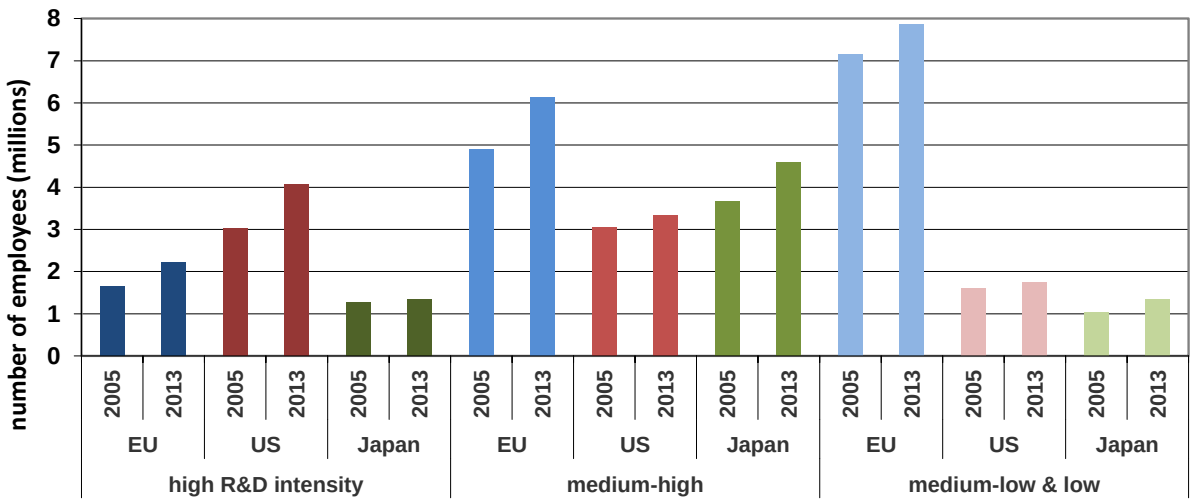


Note: For 564 EU, 724 US and 375 Japanese out of the top world 2500 companies in the Scoreboard with data for the whole period.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

In 2013, the number of employees decreased for the US sample (-3.1%), remained stable for the EU one (-0.6%) and increased for the Japanese (2.8%). For the period 2005-2013, the employment increase observed for the set of EU companies for which data is available (18.2%), is led by increases in high R&D-intensive sectors (34.2%) and medium-high sectors (25.1%). Note from figure S3 the very large fraction of EU employment contributed by low R&D intensity sectors.

Figure S3. Employment figures in the *Scoreboard*, by sector group and main world region.



Note: For 477 EU, 525 US and 362 Japanese out of the top world 2500 companies in the Scoreboard with data for the whole period.

Sectors are split into four groups according to the R&D intensity of the sector worldwide:

High R&D intensity sectors (R&D intensity above 5%) include e.g. Pharmaceuticals & biotechnology; Health care equipment & services; Technology hardware & equipment; Software & computer services; Aerospace & defence.

Medium-high R&D intensity sectors (between 2% and 5%) include e.g. Electronics & electrical equipment; Automobiles & parts; Industrial engineering & machinery; Chemicals; Personal goods; Household goods; General industrials; Support services.

Medium-low R&D intensity sectors (between 1% and 2%) include e.g. Food producers; Beverages; Travel & leisure; Media; Oil equipment; Electricity; Fixed line telecommunications.
Low R&D intensity sectors (less than 1%) include e.g. Oil & gas producers; Industrial metals; Construction & materials; Food & drug retailers; Transportation; Mining; Tobacco; Multi-utilities.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

The EU based carmaker Volkswagen continues to lead the world R&D ranking, showing again a remarkable increase of R&D investment in 2013 (23.4%, up to €11.7bn). The second in the ranking, Samsung Electronics from South Korea, keeps the pace, and increases R&D by 25.4%, up to €10.2 bn. The highest riser in the top 10 is Google at #9 in the 2014 ranking but it was only #182 in the 2005 *Scoreboard*.

Two companies enter the top 10 ranking in this *Scoreboard* 2014 edition: Google (9th) from USA (after climbing 173 positions since its entry into the *Scoreboard* ranking) and Daimler (10th) from the EU. These two companies replace the US based pharma companies Pfizer (now 15th, from 10th last year) and Merck (now 12th, from 8th last year). The USA based ICT companies Microsoft and Intel retain the third and fourth position, followed by the two Swiss pharma companies Novartis (5th) and Roche (6th). Toyota (7th) from Japan and Johnson & Johnson (8th) complete the top 10.

Among the top R&D companies, those showing the largest increase in R&D are Celgene, US (39.0%); Apple, US (32.4%); Otsuka, Japan (29.4%); Qualcomm, US (26.9%); Samsung Electronics, South Korea (25.4%). Those showing the largest decrease in R&D are Abbot

Laboratories, US (-66.4% due to a demerger); Peugeot (PSA), France (-20.8%); STMicroelectronics, The Netherlands (-19.2%); Texas Instruments, US (-18.9%), Nokia, Finland (-17.1%).

The top 100 companies, accounting for 53.1% of the total R&D investment made by the 2500 *Scoreboard* companies, include 31 based in the EU, 39 in the US and 17 in Japan. For these companies, only around one third of the ones based in the EU have increased their R&D investment in 2013, compared to more than two thirds in the case of companies based in the US and Japan.

Among the top 100 group, 31 companies have at least doubled their R&D investment since 2005 (8 companies based in the EU and 15 from the US). This group of companies is mainly from high R&D-intensive sectors, 23 of them have increased net sales by more than 100% and 16 companies increased employment by more than 100%. A number of the large increases are for companies that have made substantial acquisitions.

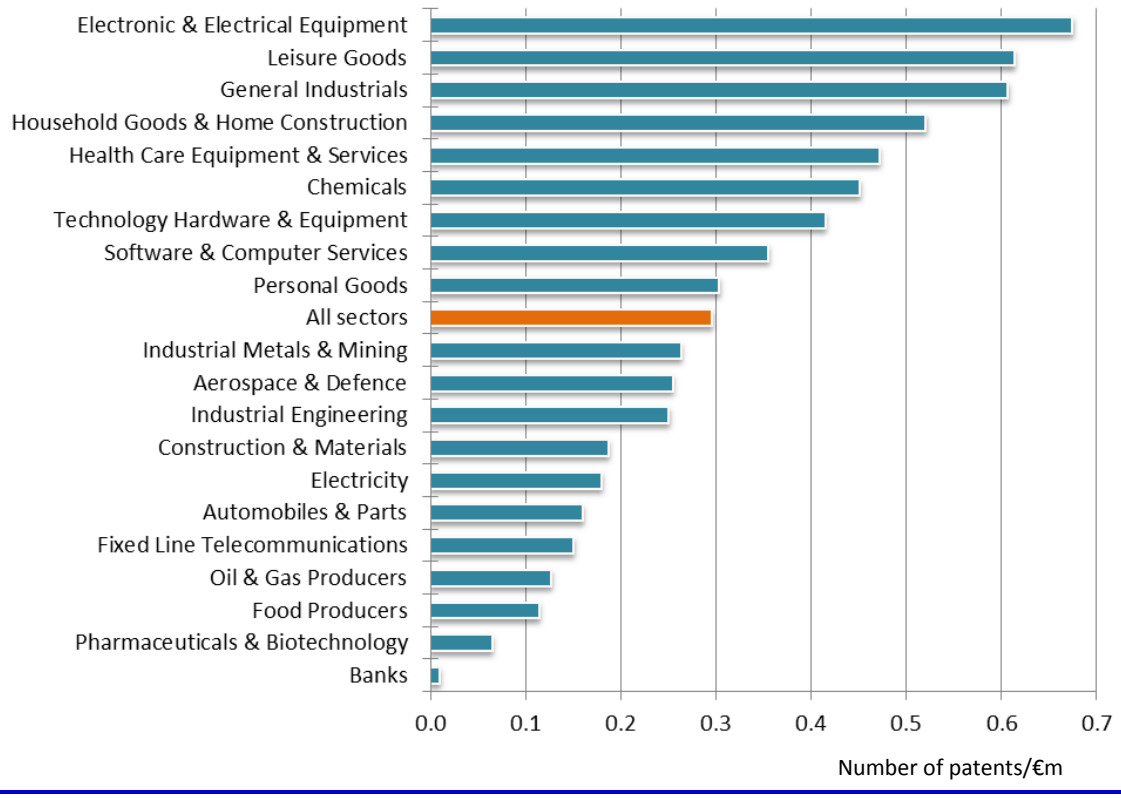
World top 100 R&D investors in the *Scoreboard* ranking are responsible for an important portion (around one third) of all the patents filed at the US and EU patent offices. Companies in the Electronic and Electrical Equipment sector show the highest patent propensity, with Samsung Electronics being, together with IBM, the most active among the top 100 R&D investors.

This Scoreboard edition includes for the first time an analysis of the patent portfolios of the top 100 R&D investors (based on the 2013 Scoreboard ranking and for the period 2010-2012). Results show that the patent propensity (patents to R&D ratio) is very much sector specific with the Electronic and Electrical Equipment sector showing the highest patent propensity, about ten times larger than that of the Pharmaceuticals & Biotechnology sector (see figure S4). This explains many of the differences observed in patent statistics between countries and regions; they are due to sector mix effects.

At the same time, the patent propensity observed for companies classified in the same industrial sector can vary substantially, as this depends on the individual technological profiles of companies, characterised by multiple degrees of specialisation/diversification. The sectors with the higher degree of technological specialisation are Technology and Hardware Equipment and Pharmaceutical and Biotechnology.

Further analysis of Scoreboard companies' patent portfolios could help in the future to improve its characterisation and to analyse their role in the development of important technologies. From this first analysis of the top 100 R&D investors, we observe that companies in the Chemicals, Electronic & Electrical Equipment, General Industrials and Pharmaceutical & Biotechnology sectors have the highest proportions of patents related to key enabling technologies (industrial biotech, nanotechnology, micro- and nano-electronics, advanced materials and advanced manufacturing technologies.

Figure S4. Patent Propensity of the 2013 *Scoreboard* companies by main industry



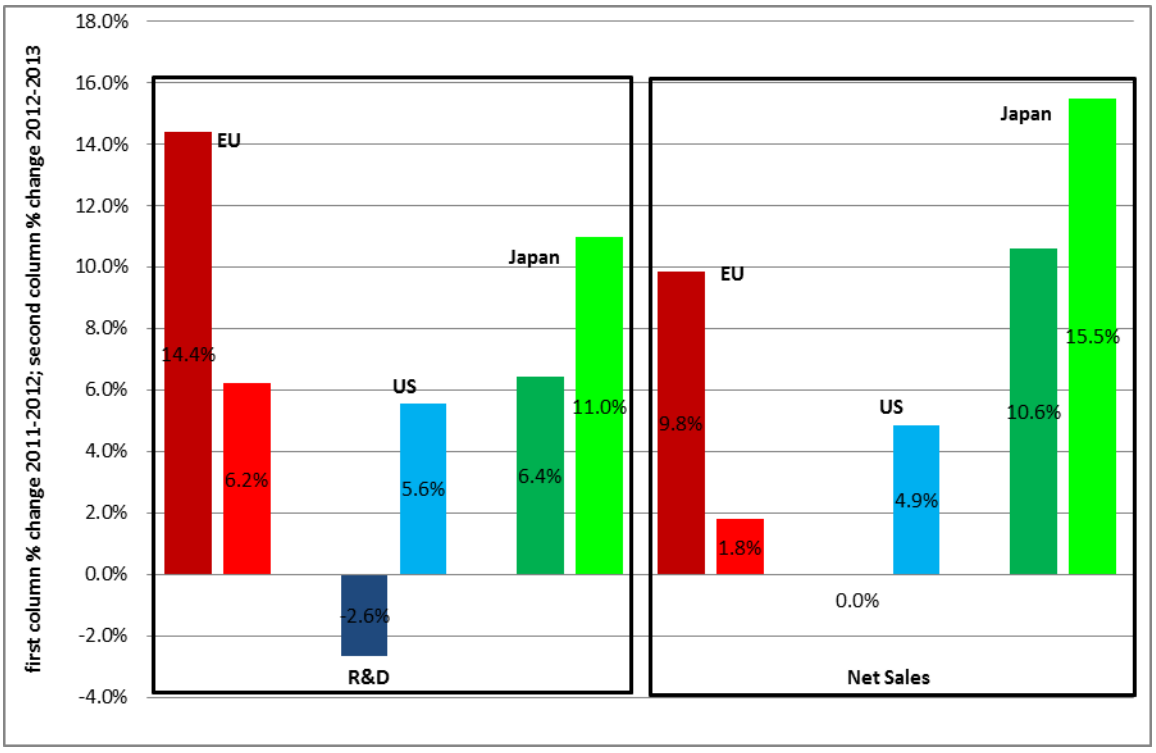
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

EU companies in the automobile sector, accounting for one quarter of the total R&D invested by the EU-633 *Scoreboard* companies, continue to increase their R&D investments in 2013 but at a slower pace than in 2012, in the context of a marked slowdown of sales growth.

EU companies in the automobiles and parts sector showed a slow-down in the pace of their R&D investment growth (6.2%, well below last year's growth rate of 14.4%), which remains however well above sales growth (1.8%). While companies based in Germany and the UK showed strong R&D growth (9.7% and 9.5% respectively), French automobile firms decreased R&D by 8.9%. Japanese counterparts showed in contrast remarkably higher R&D and sales growth rates (11.0% and 15.5% respectively), with USA ones performing well in sales (4.9%) and with R&D growth of 5.6%, below the world sector's average (7.1%).

EU companies in other relevant medium high-tech sectors show moderate R&D growth rates (Industrial Engineering 0.9%, Chemicals 3.1%, Electronic & Electrical Equipment 5.4%), in all cases above the results shown by their US counterparts. This corresponds to sluggish (or slightly negative) sales growth in these sectors.

Figure S5. R&D and Net Sales growth in the Automobiles & Parts Sector – 2011-2012 vs 2012-2013 for EU, US and Japan based companies



Note: The left hand bar refers to 2011/12, the right hand to 2012/13.
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Companies in high-tech sectors showed mixed results across world regions. Software & Computer Services significantly increased R&D and sales (11.4% and 7.2%) while Pharmaceuticals & Biotechnology (2.4% and 2.8%) and Technology Hardware & Equipment (3.3% and 2.2%) showed much modest figures.

The poor R&D performance of EU companies in relevant high-tech sectors such as Pharmaceuticals & Biotechnology (0.9%) and Technology Hardware & Equipment (-5.4%) weighed down the total average R&D increase of the EU sample. The continued good performance of the EU Software and Computer Services (8.4%) has limited impact in overall trends given the significant relative smaller size of its companies.

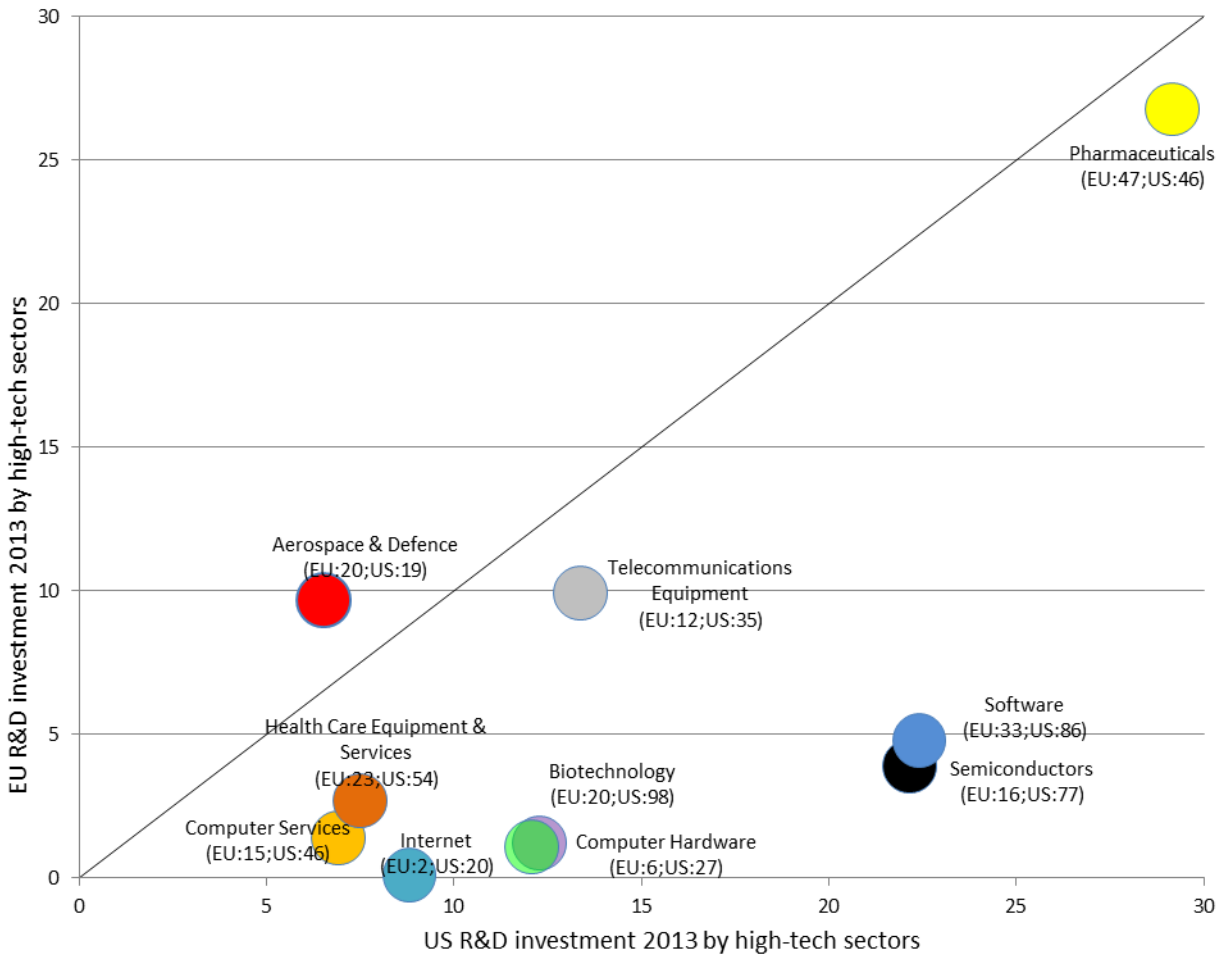
The share of high-tech companies in the US *Scoreboard* sample continues to increase, with Software and Computer Services (accounting for 19.7% of the R&D invested by the total US sample) and Technology Hardware and Equipment (accounting for 24.8% of total US) showing R&D investment growth of 12.0% and 6.5% respectively. The good performance of these two

ICT sectors compensates the stagnating pace of R&D of the US pharma sector (-6.6%). The relatively slow growth of the US pharma sector masks the high R&D growth (over 20% per year) of the main US therapeutic biotech companies.

The result of the above described trends is an increasing negative gap between the overall amounts invested in R&D by EU based companies in high-tech sectors and the amounts invested by their US counterparts (Figure S7).

Except for the sector of Aerospace & Defence, US *Scoreboard* companies operating in high R&D intensive sectors invest more than their EU counterparts, as illustrated in figure S6. More striking differences, both in terms of number of companies and overall R&D investment values correspond to the ICT sectors of Software, Semiconductors, Computer Hardware, Internet and Computer Services and to the health related sector of Biotechnology. In 2013, the overall R&D investment in high-tech sectors of the EU *Scoreboard* companies was €61.9bn well below the total amount invested by their US counterparts, €142.9bn.

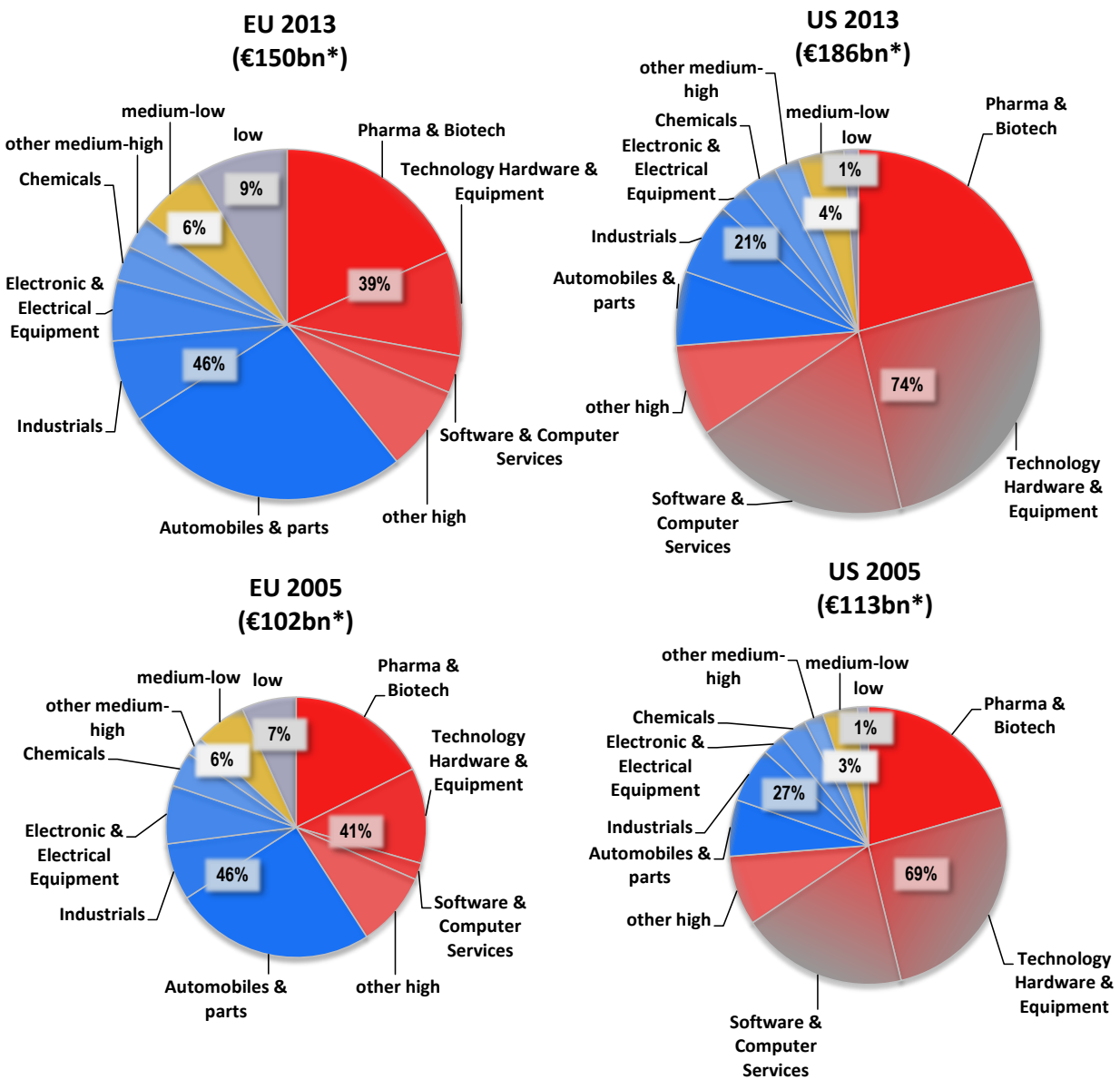
Figure S6. US-EU R&D gap 2013 in the high-tech sectors (€ billion)



Note: Between brackets the number of companies for each country. Leisure Goods and Electronic Office Equipment not represented in the figure due to the low number of companies.
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Analysing the R&D investment trends for the period 2005-2013 for a subsample of EU and US companies in this year *Scoreboard* ranking (Figure S7), we observe a rather static picture in terms of sectoral specialisation in the EU (with 46% of investments by the medium-high R&D intensive sectors) and a reinforcement of the high-tech sector prominence in the US (74% of the total's sample R&D investment vs. 68% in 2005). The US automotive sector has at the same time decreased in importance with GM and Ford in the top 6 global companies in the 2005 Scoreboard but at the #11 and #17 positions this year.

Figure S7. R&D investment of EU and US companies by sector group.



*Note: * R&D amounts for 503 EU and 681 US of the top world 2500 companies in the Scoreboard with data for the whole period.*

Sectors split according to figure S3.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

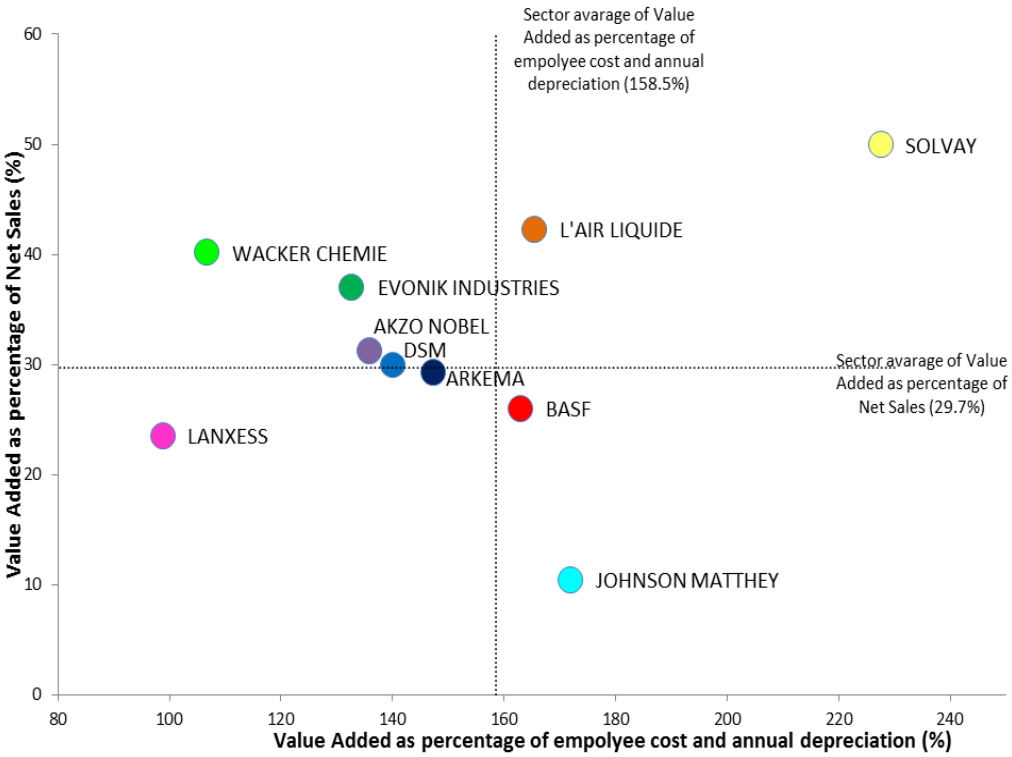
A more detailed analysis of an extended sample of the top EU-1000 R&D investors shows that the current population of top R&D investors could constitute a good basis on which to promote the necessary shift of the European industrial structure towards more knowledge-intensive sectors. Stronger economic efficiency for some of the current leading innovators and more rapid growth of middle-size potential future leaders in key high-tech sectors will be required.

An analysis of the middle-sized companies populating the bottom half of the EU 1000 sample, shows a substantial number of companies in high and medium-high R&D sectors with a healthy growth record of R&D and sales over the last years. The sectors of Software & Computer Services, Pharmaceuticals & Biotechnology, Industrial Engineering and Electronic & Electrical Equipment concentrate the largest number of good performers in this subsample. In the bottom half of the 1000 sample, the number of good performers located in Sweden is particularly high.

It is worth mentioning that despite the relatively high number of entries and exits for the 500 companies in the lower part of the EU-1000 ranking, 38% of companies present in the ranking before the crisis (2007) have survived and 26% have been acquired. Among the survivors, one fifth managed to climb to the top EU-500 part of the ranking.

The analysis of company performance in terms of the Value Added (VA) created by the EU companies shows significant differences both between and within industrial sectors. The ratio of VA to net sales of the Software & Computer Services sector is more than twice that of the Automobiles & Parts sector. The largest ratio of VA to costs of resources (wealth creation efficiency) is found in Pharmaceuticals & Biotechnology, three times more 'efficient' than the Electronic & Electrical Equipment sector. At company level, great differences are observed within the sectors. For example, among the top 10 R&D investors in the Chemicals sector (Figure S8), Solvay shows the highest ratios of VA to net sales and cost of resources (50.0% and 227.5% respectively) whereas Lanxess shows the lowest ones (23.6% and 98.8% respectively).

Figure S8. Ratio of VA to net sales vs VA to cost of resources for the top 10 R&D investors in the EU Chemical sector.



Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Introduction

In 2014, we increased the scope of the "EU Industrial R&D Investment Scoreboard" (the *Scoreboard*)[1] improving its capacity to monitor and analyse worldwide trends in industrial R&D. For background information on the *Scoreboard* please see Annex 1.

In this year's edition, the *Scoreboard* comprises the **2500 companies investing the largest sums in R&D in the world** and an additional number of companies to cover the **top 1000 R&D investing companies based in the EU**[2]. In total, there are 2867 companies incorporated in the 2014 *Scoreboard.*

In order to avoid double counting, The *Scoreboard* considers only data from parent or independent companies. Normally, these companies integrate into their consolidated accounts the data of their subsidiary companies. An analysis of the ownership structure of the parent companies included in the 2014 *Scoreboard* finds that they have more than 600.000 subsidiary companies (controlled companies with more than 50% ownership).

Companies' R&D rankings are based on information taken from the companies' latest published accounts. For most companies these correspond to calendar year 2013, but significant proportions have financial years ending on 31 March 2014 (Japanese companies in particular). There are few companies included with financial years ending as late as end June 2014 and a few for which only accounts to end 2012 were available.

The representativeness of the *Scoreboard* has improved in terms of industrial coverage and geographic scope. This edition includes companies based in 48 countries of which 20 are Member States of the EU. A wide range of manufacturing and services sectors is represented, including more than 50 industries with a special focus on most innovative ones such as ICT, health, transport and engineering related industries. However, it should be noticed that the *Scoreboard* relies on disclosure of R&D investment in companies' published annual reports and accounts and that due to different national accounting and disclosure practices, companies of some countries are less likely than others to disclose R&D investment consistently. For these reasons, companies from some countries such as Southern or Eastern European countries might be under-represented while others such as the companies from the UK over-represented.

The overall coverage in terms of total R&D is similar as in previous editions. The total amount of R&D investment of companies included in the *Scoreboard* is equivalent to more than 90% of the total expenditure on R&D financed and performed by the businesses sector worldwide[3].

The *Scoreboard* collects key information to enable the assessment of the R&D and economic performance of companies. The main indicators, namely R&D investment, net sales, capital expenditures, operating profits and number of employees are collected following the same methodology, definitions and assumptions applied in previous editions. This ensures comparability so that the companies' economic and financial data can be analysed over a longer period of time.

[1] The EU Industrial R&D Investment Scoreboard is published annually by the European Commission (JRC-IPTS/DG RTD) as part of its Industrial Research and Innovation Monitoring and Analysis activity (IRIMA).

[2] In this report, the term EU company refers to companies whose ultimate parent has its registered office in a Member State of the EU. Likewise, non-EU company applies when the ultimate parent company is located outside the EU (see also the glossary and definitions in Annex 2 as well as the handling of parent companies and subsidiaries).

[3] According to the latest figures reported by Eurostat, i.e. BERD financed by the business enterprise sector in 2010 compared with R&D figures in the 2011 *Scoreboard*.

The data have been collected by Bureau van Dijk Electronic Publishing GmbH, following the same approach and methodology applied since the first *Scoreboard* edition in 2004. Please see the main methodological limitations summarised in Box I.1 and detailed methodological notes in Annex 2.

The capacity of data collection is being improved by gathering information about the ownership structure of the *Scoreboard* parent companies and the main indicators for their subsidiaries. In 2014, we have collected available indicators reported by the more than 600.000 subsidiary companies involved in this *Scoreboard* edition. This allows a better characterisation of companies, in particular regarding the sectoral and geographic distribution of their research and production activities and the related patterns of growth and employment.

Companies' behaviour and performance can be analysed over longer time periods using our history database that contains information on the top R&D companies since 2003. This enables benchmarking analyses of companies across sectors and countries, for example the identification of companies showing outstanding economic or innovation results and the analysis of the main factors underlying such successful dynamics.

This report concentrates on the analysis of the world's top 2500 companies that all invested more than €15.5 million in R&D in 2013. The sample comprises companies based in the EU (633), the US (804), Japan (387) and other countries (676) including China, Taiwan, South Korea, Switzerland, the Cayman Islands, India, Canada, Australia, Israel, Norway, Bermuda, Brazil and a further 14 countries (see Figure I.1).

A sample consisting of the top 1000 R&D investing companies based in the EU is analysed separately in chapters 5 and 6; these all have R&D investments exceeding €5.0 million.

The characteristics of the sample of 2500 companies used for most of the analysis are summarised in Table I.1.

Table I.2 presents the distribution of the sample by groups of companies in terms of number of employees. This table shows the high concentration of R&D and net sales by large companies, i.e. companies with more than 5000 employees concentrate 90% of R&D investment and 95% of net sales.

The sector and country composition of the EU 1000 sample is found in Annex 3.

This edition shows that companies continued to increase R&D investments in 2013 at a significant pace, higher than the growth rate of revenues. This report also shows a great variety in company R&D and economic patterns across industries and between countries, reflecting important differences in market conditions and economic background throughout the world.

Report structure

Chapter 1 presents the worldwide trends of industrial R&D. It provides an overview of the main indicators for the top 2500 companies ranked by level of R&D investment and the main changes that took place over the last year. An analysis of the main indicators of the company data aggregated by world regions is included together with the performance of companies over the past 10 years.

The performance of individual companies among the top R&D investors is provided in chapter 2. The list of the top world 100 R&D companies is examined highlighting those companies showing remarkable R&D and economic results and improvement in the R&D ranking over the last 10 years.

Chapter 3 presents an analysis of the technological specialisation of companies based on the examination of the patent portfolio of the top R&D investors focussing on the assessment of company capacity to develop relevant technologies. The analysis includes the comparison of R&D investment and patent activity of the top R&D companies aggregated by main industry.

Chapter 4 presents an analysis of the main R&D and economic indicators of companies aggregated by industrial sector, with comparisons of EU companies and their main worldwide counterparts.

Chapter 5 discusses the trends on R&D and economic performance of the companies included in the extended sample comprising the top 1000 R&D investors based in Member States of the EU.

Chapter 6 identifies potential leading innovators in the EU. It is based on a sample of the 500 companies at the lower reach of the EU 1000 ranking. It analyses their R&D and economic performance over the years and underlines the main dynamics of their investment strategies.

Annex 1 provides background and methodological information about how the *Scoreboard* is prepared. The methodological approach of the *Scoreboard*, its scope and the limitations are described in Annex 2 and the listing of companies ranked by their level of R&D investment is provided in Annex 3.

The complete data set is freely accessible online at:
http://iri.jrc.ec.europa.eu/scoreboard14.html

In the next edition, this website will allow user-friendly and interactive access to the individual company data or to groups of companies aggregated by industrial sector and country.

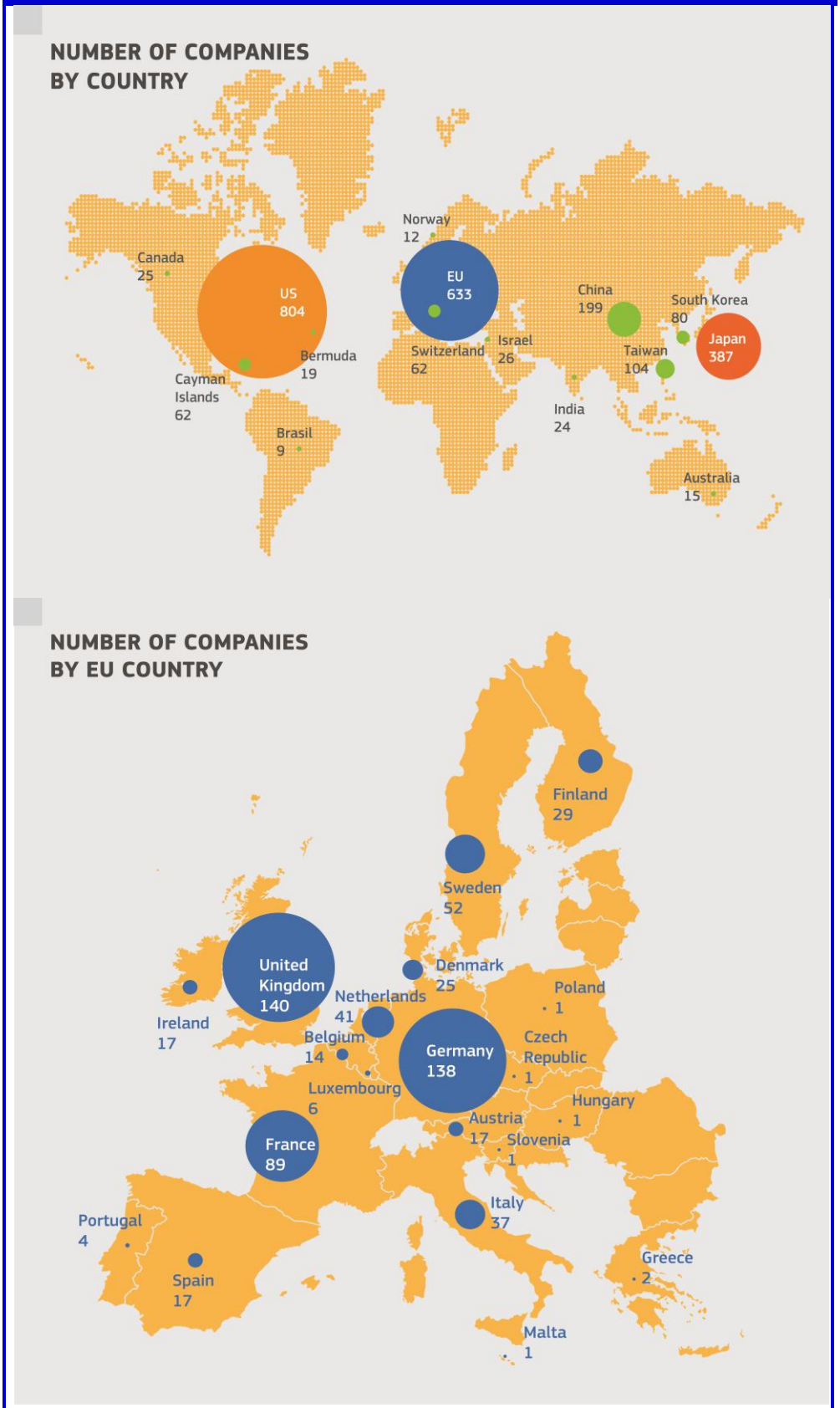
Table I.1 Distribution of the 2014 *Scoreboard* companies by country and sector.	
633 companies based in the EU	
Companies by country	United Kingdom 140; Germany 138; France 89; Sweden 52; Netherlands 41; Italy 37; Finland 29; Denmark 25; Austria 17; Ireland 17; Spain 17; Belgium 14; Luxembourg 6 ; Portugal 4 ; Greece 2; Czech Republic 1 ; Hungary 1; Malta 1; Poland 1; Slovenia 1
The 10 most numerous sectors	Industrial Engineering 72; Pharmaceuticals & Biotechnology 67; Software & Computer Services 50; Electronic & Electrical Equipment 49; Automobiles & Parts 39; Technology Hardware & Equipment 35; Chemicals 27; General Industrials 24; Banks 23; Health Care Equipment & Services 23. The top 5 sectors account for 43.8% of the 633 EU companies.
1867 companies based in non-EU countries	
Companies by country	US 804; Japan 387; China 199; Taiwan 104; South Korea 80; Cayman Islands 62; Switzerland 62; Israel 26; Canada 25; India 24; Bermuda 19; Australia 15; Norway 12; Brazil 9 and further 14 countries.
The 10 most numerous sectors	Technology Hardware & Equipment 299; Pharmaceuticals & Biotechnology 227; Software & Computer Services 218; Electronic & Electrical Equipment 193; Industrial Engineering 140; Chemicals 112; Automobiles & Parts 109; Health Care Equipment & Services 74; General Industrials 71; Construction & Materials 53. The top 5 sectors account for 57.7% of the 1867 non-EU companies.
Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.	

Table I.2 Distribution of companies in the 2014 *Scoreboard* by size classes.

Number of employees	*Number of companies*	*R&D per company (€m)*	*Net sales per company (€m)*	*R&D intensity (%)*
Less than 250 (SMEs)	118	46.1	602.8	7.7
251 - 1000	259	37.6	197.6	19.0
1001 - 5000	604	54.7	864.2	6.3
5001 - 10000	370	109.4	2768.5	4.0
More than 10000	823	480.4	15490.5	3.1
Total	**2174**	**222.7**	**6699.4**	**3.3**

Note: Only 2174 companies out of the 2500 reported number of employees.
Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.

Figure I.1 Distribution of the 2500 companies in the 2014 *Scoreboard* by country.



Source: The 2014 EU Industrial R&D Investment Scoreboard; European Commission, JRC/DG RTD.

Box I.1 Methodological caveats

Users of *Scoreboard* data should take into account the methodological limitations summarised here, especially when performing comparative analyses (full description of methodology is found in Annex 2):

A typical problem arises when comparing data from different currency areas. The *Scoreboard* data are nominal and expressed in Euros with all foreign currencies converted at the exchange rate of the year-end closing date (31.12.2013). The variation in the exchange rates from the previous year directly affects the ranking of companies, favouring those based in countries whose currency has appreciated with respect to the other currencies. In this reporting period, the exchange rate of the Euro against main currencies changed as follows: the Japanese Yen significantly depreciated by 27%, the US dollar depreciated by 6.6% and the pound sterling remained practically unchanged.

The growth rate of the different indicators for companies operating in markets with different currencies is affected in a different manner. In fact, companies' consolidated accounts have to include the benefits and/or losses due to the appreciation and/or depreciation of their investments abroad. The result is an 'apparent' rate of growth of the given indicator that understates or overstates the actual rate of change. For example, this year the R&D growth rate of companies based in the Euro area with R&D investments in Japan is partly understated because the 'losses' of their overseas investments due to the important appreciation of the Euro against the Japanese yen (from ¥114.2 to ¥145.1). Conversely, the R&D growth rate of Japanese companies is partly overstated due to the 'benefits' of their investments in the Euro area. Similar effects of understating or overstating figures would happen for other indicators, e.g. for net sales.

When analysing data aggregated by country or sector, be aware that in many cases, the aggregate indicator depends on the figures of a few firms. This is due, either to the country's or sector's small number of firms in the *Scoreboard* or to the indicator dominated by a few large firms.

The different editions of the *Scoreboard* are not directly comparable because of the year-on-year change in the composition of the sample of companies, i.e. due to newcomers and leavers. Every *Scoreboard* comprises data of several financial years allowing analysis of trends for the same sample of companies.

In most cases, the companies' accounts do not include information on the place where R&D is actually performed; consequently the approach taken in the *Scoreboard* is to attribute each company's total R&D investment to the country in which the company has its registered office. This should be borne in mind when interpreting the *Scoreboard*'s country classification and analyses.

Growth in R&D can either be organic, the outcome of acquisitions or a combination of the two. Consequently, mergers and acquisitions may sometimes underlie sudden changes in specific companies' R&D growth rates and/or positions in the rankings. Demergers can result in substantial reductions of R&D with the emergence of new, demerged companies.

Other important factors to take into account include the difference in the various countries' (or sectors') business cycles which may have a significant impact on companies' investment decisions, and the initial adoption or stricter application of the International Financial Reporting Standards (IFRS)[4].

[4] Since 2005, the European Union requires all listed companies in the EU to prepare their consolidated financial statements according to IFRS (see: EC Regulation No 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002R1606:EN:HTML).

1. Worldwide trends in corporate R&D

This chapter provides an overview of main trends in R&D and economic indicators of the top 2500 R&D companies that each invested more than €15.5 million in R&D in 2013[5]. It includes the analysis of the long-term performance of companies aggregated by main world regions.

As in the previous year, the average growth rate of companies' R&D investments in 2013 was significantly higher than the growth rate of their sales revenues.

R&D investments and economic results in 2013 show important variations across world regions and industries. This reflects a continued weak and uneven recovery of the global economy and persistent market uncertainties. The potential growth rate is still uncertain since the beginning of the financial crisis in developed countries as well as in emerging economies.

Factors underlying the regional changes observed include the different policies aimed at stimulating further the recovery of the economy and the weakness of many banks following the financial crisis which has limited their lending to companies and therefore limited growth for some. Higher GDP growth is being seen in the US and the UK following the quantitative easing of their central banks. In Japan, the impact of radical fiscal and monetary policies, structural reforms and the devaluation of the yen are being perceived in companies' results. The Eurozone shows a lower GDP growth with the heavy burden of unemployment and remaining problems in the financial system. In China, a somewhat slower growth than in previous years is now being observed.

Key findings

- The top 2500 *Scoreboard* companies invested in R&D 4.9% more in 2013 than in 2012, following the increase of 6.7% in the year before. The net sales of the 2500 companies increased much less than R&D, at 2.7%, compared with the net sales increase of 4.1% in 2012.
- The 633 EU companies increased R&D investment by 2.6% while decreasing net sales by 1.9%. The 804 US companies reported a significant increase in R&D (5.0 %) but a lower increase in net sales (2.0%). The 387 Japanese companies showed a good performance increasing R&D by 5.5% and net sales by 11.2%.
- Companies outside of the EU, the US and Japan (the OC group) continued to show the best performance in terms of R&D (8.1%) and increasing net sales by 5.4 %. The largest increases in R&D investment in this group were reported by companies based in South Korea (16.6 %), China (9.8 %), and Taiwan (7.5%).
- Trends over the past 8 years show that companies based in the EU significantly slowed-down in 2013 the recovery of the R&D growth that followed the crisis in 2009, in a context of negative sales and profits. R&D growth of their US counterparts appears more resilient. This resilience in US growth is associated with

[5] Due to data availability some companies may be missed, please see methodological limitations in Annex 2.

strong growth in high tech sectors such as software and biotech. Japanese companies, hit hard by the crisis and the earthquake, showed positive results in the last year in terms of R&D, and especially regarding the growth rate of net sales and profits.

1.1 Indicator changes over the last year

The main economic and financial indicators for the year 2013 for the set of 2500 companies are summarised in Table 1.1. The table includes the indicators of the top 100 R&D investing companies to show their high weight on the whole sample.

- The positive trends on R&D investment continued in 2013 for the fourth consecutive year. The 2500 *Scoreboard* companies invested €538.5 billion in R&D, 4.9% more than in 2012, following the increase of 6.7% in the year before. Seventy per cent of the companies showed positive R&D growth in 2013.
- For the second consecutive year net sales increased less than R&D. In 2013, the growth rate of net sales of the 2500 companies was 2.7%, lower than the 4.1% of 2012. Company results in terms of operating profits improved significantly compared with the previous year: 83% of companies made profits in a much larger proportion than the 17% of companies that presented losses.
- Company investment in fixed capital continued to grow but at a slower pace, at 2.5%, compared with the previous year's increase of 9.1%. Capital expenditure as a percentage of net sales (7.2%) remained practically the same than the previous year (7.1%).
- The number of employees of the 2500 companies in the *Scoreboard* slightly decreased by 0.1%.
- The top 100 R&D companies account for 53% of the total R&D of the 2500 sample but only 26.5% of the total sales. This is mainly due to the large oil companies (Shell, China Petroleum, Exxon, BP, Total, Chevron and Petroleo Brasileiro) that are not among the top 100 R&D investors, but account for 10% of the total sales of the 2500 companies.

Table 1.1 Overall performance of companies in the 2014 *Scoreboard.*		
Factor	***Top 100 R&D investors***	***Top 2500 R&D investors***
Total R&D investment in 2013, € bn	*285.8*	538.5
One-year change, %	*3.7*	4.9
CAGR[6] 3yr, %	*5.5*	6.4
Net Sales, € bn	*4391.7*	16568.3
One-year change, %	*2.8*	2.7
CAGR 3yr, %	*5.2*	5.5
R&D intensity, %	*6.5*	3.2
Operating profits, € bn	*520.6*	1543.7
One-year change , %	*18.2*	8.2
Profitability, %	*11.9*	9.3
Capex[7], € bn	*280.4*	1067.1
One-year change , %	*3.4*	2.5
Capex / net sales, %	*6.9*	7.2
Number of employees, million	*11.0*	48.0
One-year change, %	*-1.0*	-0.1

Note: Calculation of growth rates and ratios include only companies for which data are fully available.

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.

[6] Compound annual growth rate.
[7] Fixed capital investment

1.2 R&D trends by world region

This section analyses the overall R&D and economic performance of the *Scoreboard* companies according to the location of their registered offices in the main world regions.

The 2500 companies are grouped into four main sets: the top 633 companies from the EU, 804 companies from the US, 387 from Japan and 676 companies from other countries (OC). 'Other countries' includes companies from China (199), Taiwan (104), South Korea (80), Switzerland (62), Cayman Islands (62), Israel (26), Canada (25) and companies based in a further 19 countries.

Figure 1.1 and table 1.2 summarise the companies' indicators aggregated by main world region. Table 1.3 shows the main indicators for countries included in the OC group.

The R&D investment of the 633 EU companies continued to grow in 2013 but at lower pace, 2.6%, compared with 6.8% in 2012. On the contrary, the net sales of the EU companies decreased by 1.9% while in 2012 net sales had risen by 3.9%.

The overall R&D and net sales of the EU group are largely driven by the performance of German companies that account respectively for 36.7% and 26.0% of the EU's total R&D and net sales. The 138 German companies in the EU-633 group increased R&D by 5.9% but decreased net sales by 1.2%. These results reflect to a large extent the performance of the German companies in the Automobiles & Parts sector (growth rate of 9.7% in R&D and 2.3% in net sales). This sector accounts for more than 50% of R&D and 33% of net sales of the group of German companies (see Chapter 5). Regarding the other two largest Member States of the EU, companies based in the UK increased R&D by 5.2% and reduced sales by 0.5%. In contrast French companies saw a decrease of R&D and net sales by 3.4% and 4.0% respectively.

The group of US companies increased R&D investment at similar rate than the world's average, at 5.0 % but like in the past year, they had a much lower net sales growth rate, 2.0%.

Japanese companies overperformed EU and US firms in terms of R&D (5.5%) and especially in terms of net sales (11.2%). As in the case of German companies, the average performance of Japanese companies is strongly dependent on the results of the Automobiles & Parts sector, largest Japanese sector that showed an increase of 11.0% in R&D and 15.5% in net sales.

Companies based outside of the EU, US and Japan (the OC group) continued to increase substantially the R&D investment (8.1%) and also net sales (5.4%), at a more moderate pace but well above the world average's rate. The largest increase in R&D investment was reported by the 80 companies based in South Koreas (16.6 %). The South Korea group is dominated by companies from the Electronic & Electrical Equipment sector and particularly by the outstanding performance of the company Samsung Electronics that accounts for more than 50% the total R&D, up by 25.4% in 2013.

Other companies from main investing countries in the OC group, that showed large increases in R&D, were those based in China (9.8%) and Taiwan (7.5%). The companies based in Switzerland, the largest R&D investing country of the OC group (world R&D

share of 4.3%) increased R&D in 2013 by 3.6%. The increasing group of companies with headquarters in the Cayman Islands[8], 62 (49 in the 2013 *Scoreboard*), operating especially in ICT industries, increased their R&D by 21%.

Compared with last year's *Scoreboard*, the EU and US companies' share of total R&D investment rose by 0.8 percentage points (from 29.3 % to 30.1 % and 35.2% to 36.0% respectively). Following the trend of recent years, the share held by the Japanese companies continued to fall sharply, from 18.9% to 15.9%, and that of the companies based in other countries increased significantly, overpassing the Japanese share, from 16.6% to 18.0%.

The average R&D intensity of companies based in the EU, the US and other countries increased due to a higher growth rate of R&D investments compared with the growth rate of net sales. The opposite happens for companies based in Japan that showed a growth rate of sales twice than that of R&D.

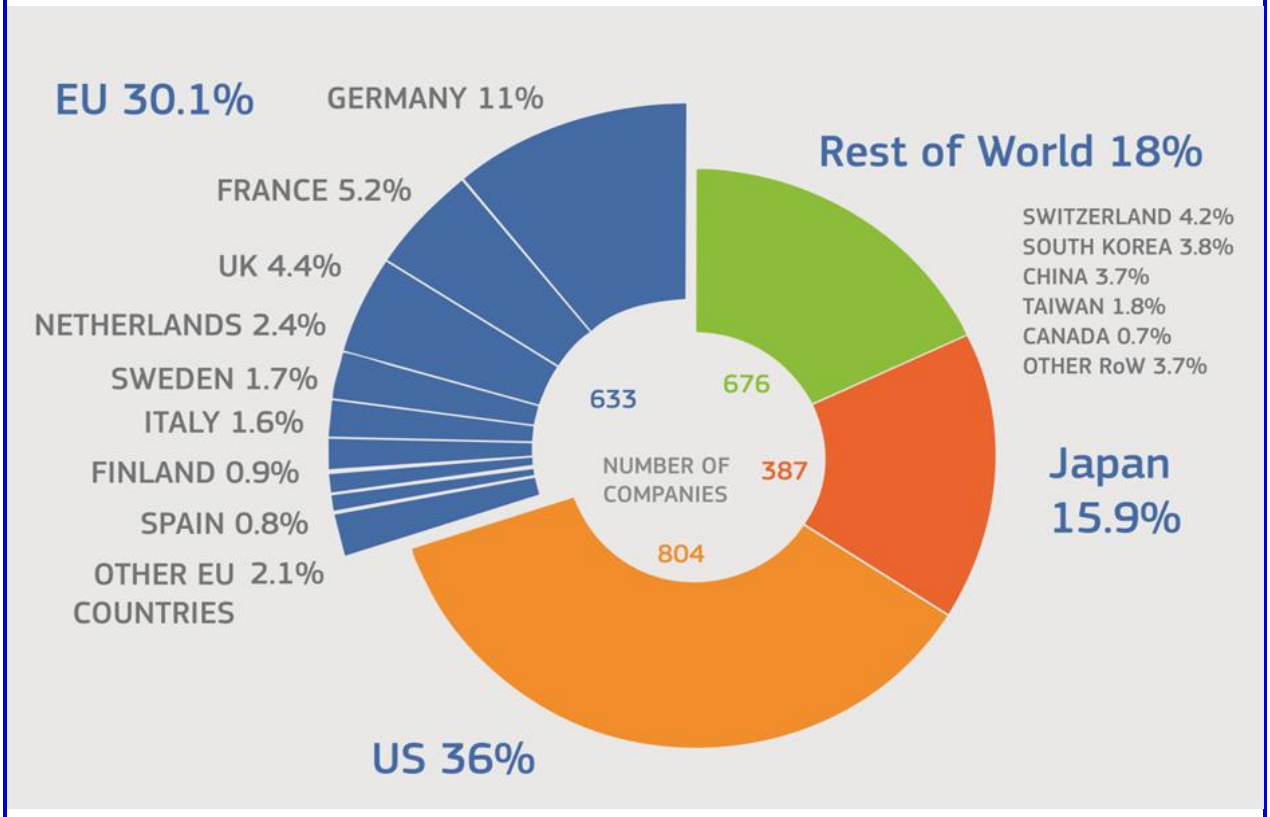
In 2013, average company capital expenditure decreased slightly for EU companies (-0.5%) following an important increase in the previous year. Companies in the other regions continued to increase capital expenditure but at lower pace compared with 2012. The highest increase was for the Japanese companies (5.0%), followed by the companies from the OC group (4.2%) and the US companies (3.0%).

Companies based in the EU showed a decrease in operating profits (-6.6%) however less pronounced than the tough decrease in 2012 (-24.3%). Companies based in the other three regions increased profits in 2013 with Japanese companies showing an impressive 63.7% increase mostly contributed by the Automobiles & Parts sector and particularly due to Toyota, the top R&D investor that increased profits by more than 400%. However, despite the big increase in profitability by the Japanese group, Japan has the lowest profitability at 5.5% compared to the EU at 6.9% and the US at 13.9%. The US companies and those from the OC group increased profits by 10.6% and 9.8% respectively. The profitability (operating profits as percentage of net sales) changed according to the difference between the growth rate of sales and profits. The average profitability of the EU companies decreased while that of Japanese companies recovered significantly and the profitability of the US and the OC group remained level.

As underlined in previous editions, most of the differences in R&D intensity and profitability between regions and countries are related to differences in sector mix. The US is by far the strongest region in the group of high R&D intensity sectors including pharmaceuticals, health, software, and technology hardware whereas the EU and Japan are stronger in medium R&D intensity sectors like the automotive sector (see chapter 4).

[8] There is evidence that most of these companies are headquartered in the Cayman Islands for fiscal reasons (as well as those based in Bermuda and other countries) while, according to their subsidiaries, their main activities are located in different countries. An increasing number of companies is taking advantage of low corporate taxes and may be responsible of unexpected results when analysing the Scoreboard data aggregated at country and region levels.

Figure 1.1 R&D investment by the top 2500 companies, by main world region (% of total €538.5bn)



Note: R&D shares of other EU countries (with number of companies in brackets): Ireland 0.7% (17), Denmark 0.7% (25), Belgium 0.4% (14), Austria 0.2% (17), Luxembourg 0.1% (6) and further 7 countries with less than 5 companies each (Portugal, Hungary, Slovenia, Greece, Czech Republic, Malta and Poland).

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Table 1.2 Overall performance of the 2500 companies in the 2014 *Scoreboard.*				
Factor	***EU***	***USA***	***Japan***	***Other countries***
No. of companies	633	804	387	676
R&D in 2013, € bn	162.4	193.7	85.6	96.8
World R&D share, %	30.1	36.0	15.9	18.0
One year change, %	2.6	5.0	5.5	8.1
CAGR 3yr, %	5.9	7.0	3.0	9.8
Net Sales, € bn	5888.9	3839.5	2508.8	4331.1
One year change, %	-1.9	2.0	11.2	5.4
CAGR 3yr, %	3.8	5.6	5.0	8.2
R&D intensity, %	2.8	5.0	3.4	2.2
Operating Profit, € bn	409.4	530.7	139.1	464.5
One year change, %	-6.6	10.6	63.7	9.8
Profitability[9]	6.9	13.9	5.5	10.8
Capex, € bn	354.8	232.5	130.8	348.9
One year change, %	-0.5	3.0	5.0	4.2
Capex intensity, %	7.1	6.2	6.0	8.9
Employees, million	17.9	11.3	7.8	11.0
One year change, %	-0.6	-3.1	2.8	1.7
Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.				

[9] Operating profits as percentage of sales.

Table 1.3 Performance of companies based in the largest countries of the OC (other countries) group.

Factor	Switzerland	South Korea	China	Taiwan	OC group
No. of companies	62	80	199	104	676
R&D in 2013, € bn	22.9	19.8	20.3	9.8	96.8
World R&D share	4.2	3.7	3.8	1.8	18
One year change, %	3.6	16.6	9.8	7.5	8.1
CAGR 3yr, %	2.3	9.5	17.0	8.0	9.8
R&D intensity	6.6	2.3	1.5	2.4	2.2
Profitability	15.8	6.7	6.2	5.2	10.8
Employees, thousand	1319.6	8.8	5178.0	416.7	10969.0
One year change, %	0.2	*	2.6	-2.7	1.7

** Many South Korean companies do not report number of employees.*

Source: The 2014 EU Industrial R&D Investment Scoreboard.
European Commission, JRC/DG RTD.

1.2.1 Long-term performance of companies by world region

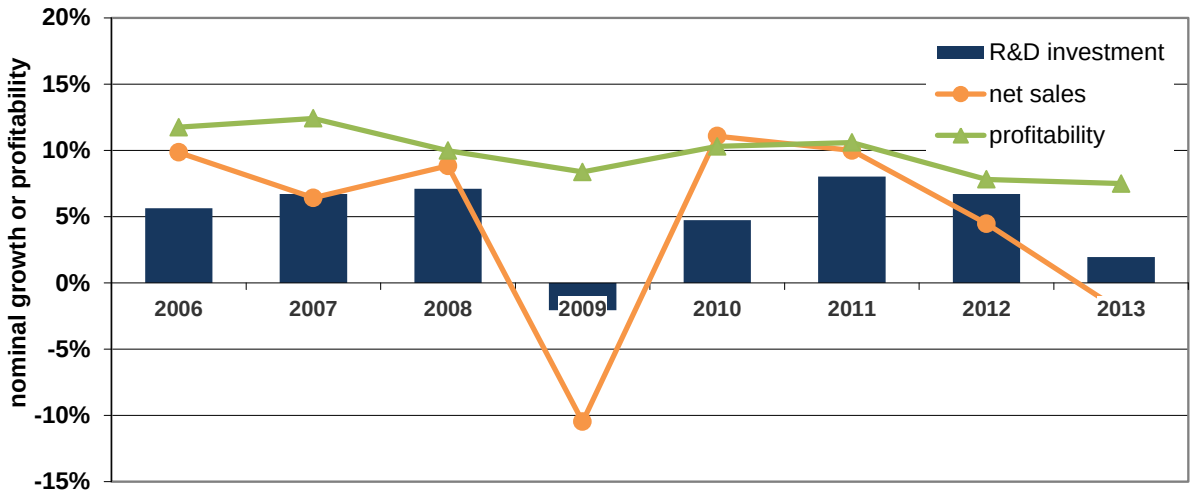
The annual growth rates of R&D investment and net sales and the profitability of companies based in the EU, the US and Japan is provided respectively in figures 1.2, 1.3 and 1.4 for the period 2005-2013. These figures are based on our history database comprising R&D and economic indicators over the whole 2005-2013 period (companies: EU 478, US 636 and Japan 366)[10].

The trends observed in these figures show the behaviour of these companies including the effects of the crisis that began in 2008. The following points are observed:

- Companies based in the EU broke in 2013 the R&D recovery trend observed since 2010. In terms of net sales and profitability the EU companies showed a short recovery period in 2010-2011 and then weakened again, especially regarding the growth rate of net sales over the last period.
- The US companies continued to show R&D investment growth similar to the level prior to the crisis but continued to show a very low rate of growth of net sales over the last two periods. In terms of profitability the US-based companies recovered more rapidly from the crisis and continued to show a high level of profitability in the last period. The profitability of the US companies is higher than their EU counterparts and especially higher than the Japanese ones.
- Japanese companies, hit hard by the crisis in 2008-2009 and by the earthquake in 2011, showed impressive figures in 2013 in terms of R&D and especially regarding the growth rate of net sales. The profitability of Japanese companies also recovered in 2013 but remained at low levels compared with that of EU and US companies.

[10] Long term trend data do suffer from survivorship bias since only companies that survive in the Scoreboard are analysed in the 2005-2013 period.

Figure 1.2. One-year R&D investment and net sales growth and profitability by the EU companies.



Note: For 478 out of the top EU 633 companies in the Scoreboard with data for the whole period. Profitability is the ratio of net sales to operating profit.

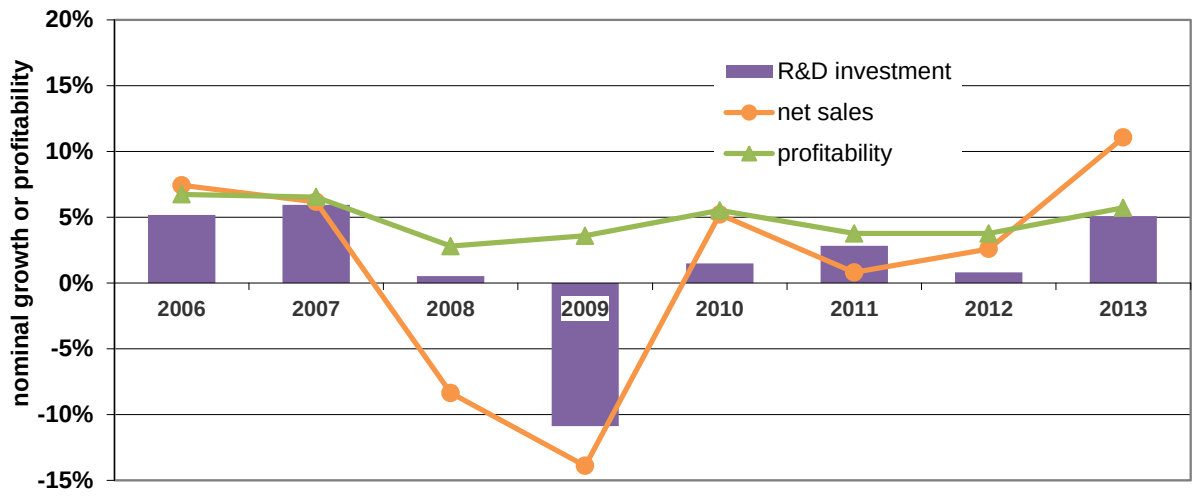
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Figure 1.3. One-year R&D investment and net sales growth and profitability by US companies.

Note: For 636 out of the top US 804 companies in the Scoreboard with data for the whole period. Profitability is the ratio of net sales to operating profit.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Figure 1.4. One-year R&D investment and net sales growth and profitability by Japanese companies.



Note: For 366 out of the top Japanese 387 companies in the Scoreboard with data for the whole period. Profitability is the ratio of net sales to operating profit.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

1.2.2 R&D trends by world regions and sector groups

Trends in R&D over the long-term are presented in figure 1.5 for the main world regions. The figures refer to a set of companies that reported R&D over the whole period 2005-2013 (1994 companies: EU 503, US 681, Japan 374 and rest of the world 436). The R&D data are broken down into groups of industrial sectors with characteristic R&D intensities (see definition in Box 1.1).

The following points can be observed regarding the overall R&D changes in the period 2005-2013 (figure 1.6):

- The world 1994 companies increased R&D by 52.7% (EU-503 46.6%; US-681 65.2%; Japan-374 11.8% and other countries-436 115.8%).
- For the 503 EU companies, the main R&D increases were in low R&D-intensive sectors (84.0%) and medium-low sectors (46.5%).
- For the 681 US companies, the main R&D increases were in medium-low R&D-intensive sectors (121.7%) and high sectors (78.2%).
- For the 374 Japanese companies, the main R&D increases were in medium-high R&D-intensive sectors (15.7%) and high sectors (8.3%).
- For the 436 companies based in the other countries (OC), the main R&D increases were in low R&D-intensive sectors (237.2%) and high sectors (117.2%).
- For the EU, the high R&D-intensity group was 40.9% of the EU total in 2005, decreasing to 39.2% in 2013 while for the US, the share increased from 68.3% in 2005 to 73.8% in 2013.

Box 1.1. Grouping of industrial sectors according to R&D intensity (R&D as % of net sales)*

High R&D intensity sectors include mainly Pharmaceuticals & biotechnology; Health care equipment & services; Technology hardware & equipment; Software & computer services, Aerospace & defence and Leisure Goods.

Medium-high R&D intensity sectors include mainly Electronics & electrical equipment; Automobiles & parts; Industrial engineering; Chemicals; Personal goods; Household goods; General industrials; Support services.

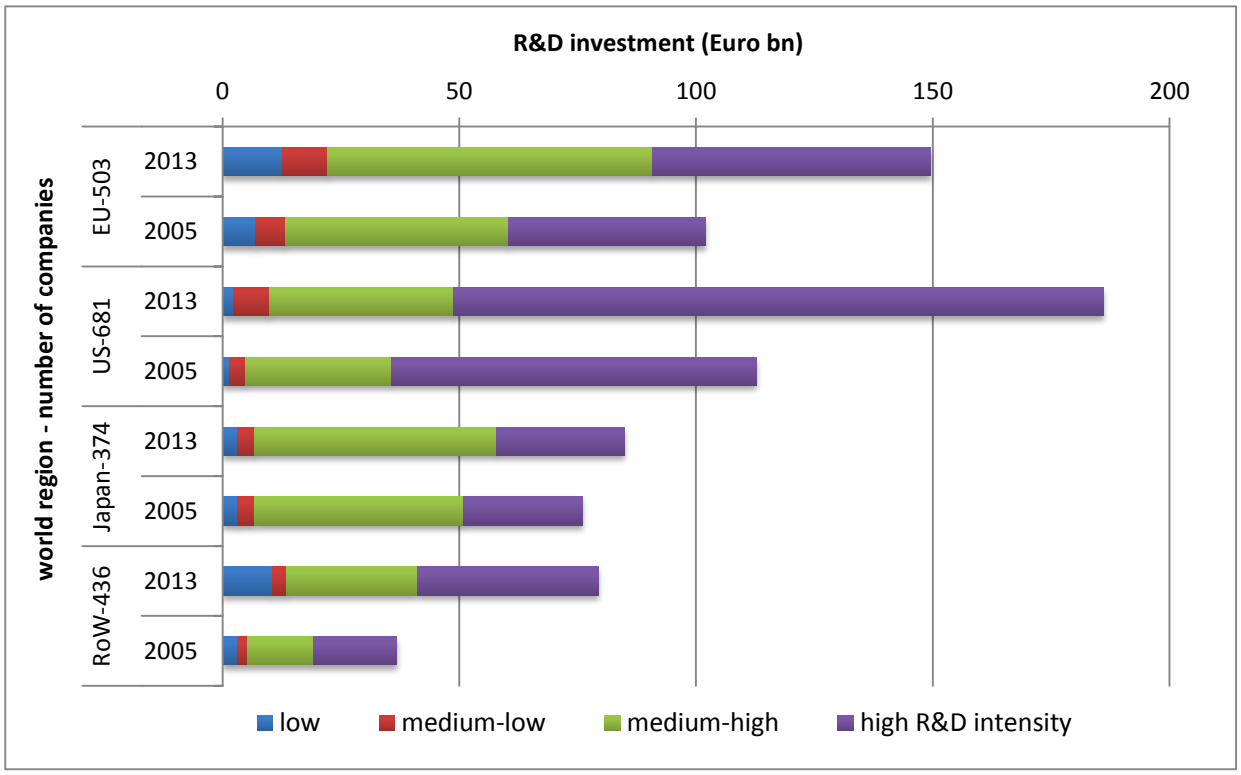
Medium-low R&D intensity sectors include mainly Food producers; Beverages; Travel & leisure; Media; Oil equipment; Electricity; Fixed line telecommunications.

Low R&D intensity sectors include mainly Oil & gas producers; Industrial metals; Construction & materials; Food & drug retailers; Transportation; Mining; Tobacco; Multi-utilities.

** This classification takes into account the R&D intensity of all companies aggregated by ICB 3-digits sectors: High above 5%; Medium-high between 2% and 5%; Medium-low between 1% and 2% and Low below 1%. Some sectors are adjusted to compensate the insufficient representativeness of the Scoreboard in those sectors using the OECD definition of technology intensity for manufacturing sectors[11].*

[11] ISIC REV 3. Technology intensity definition, OECD, 7 July, 2011.

Figure 1.5 R&D investment trends by the Scoreboard companies for main world regions



Note: For 1994 out of the 2500 Scoreboard companies with data for the whole period

Source: The 2013 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

1.2.3 Employment trends by regions and sector groups

In this year's *Scoreboard,* 2174 companies out of the 2500 top R&D investors reported number of employees. The 2174 companies employed 48.0 million people in 2013, slightly less than in 2012 (-0.1). The distribution of employees by region was 17.9 million in the 604 companies based in the EU, 11.3 million in the 765 US companies, 7.8 million in the 386 Japanese companies and 11.0 million in the 419 companies from other countries.

Trends on employment over the long-term are presented in figure 1.6 for the main world regions. The figures refer to a set of 1619 companies that reported number of employees over the whole period 2005-2013 and are broken down into groups of industrial sectors with characteristic R&D intensities (see definition in Box 1.1).

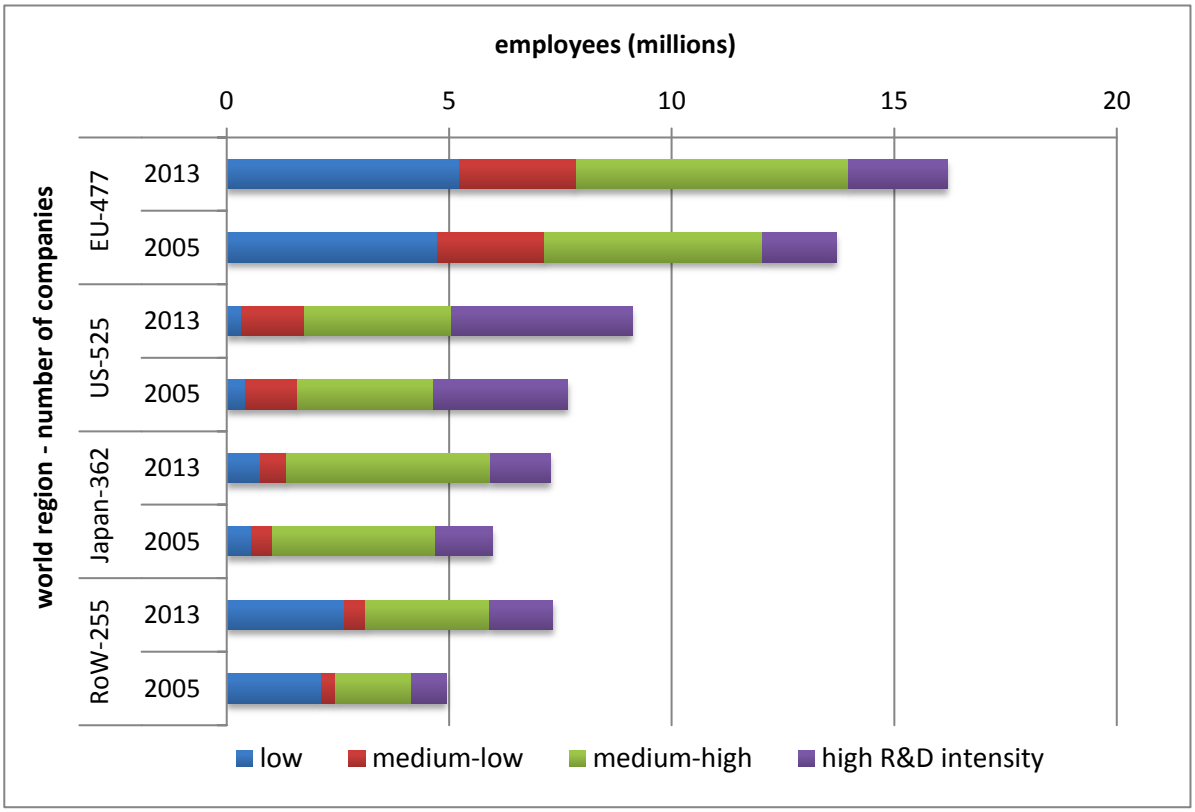
The following points can be observed regarding the changes in number of employees in the period 2005-2013 (figure 1.6):

- Overall worldwide employment by the 1619 companies increased by 23.7% from 2005 to 2013 led by increases in high R&D-intensive sectors (34.1%) and medium-high sectors (26.5%).
- For the 477 EU companies, the overall employment growth was 18.2%, increasing by 34.2% in high R&D-intensive sectors and by 25.1% in medium-high sectors.

- For the 525 US companies, the overall employment growth (19.1%) greatly varies by sector group: a strong increase for high R&D-intensive sectors (34.3%) and a sharp decrease in low-tech sectors (-19.9%).
- For the 362 Japanese companies, the overall employment increase of 21.7% corresponded to an increase of 33.6% in low R&D-intensive sectors and of 26.6% in medium-low sectors.
- The ratio of employment in high to medium-high R&D intensity sectors for companies based in Japan fell from 34.9% to 29.2%, rose slightly for EU companies, from 33.6% to 36.0%, and went up a lot for US companies from 99.4% to 122.4%. This illustrates the way high R&D-intensive sectors in the US have been growing rapidly while medium-high sectors such as the automotive sector are slowly going down the rankings.

It is important to remember that data reported by the *Scoreboard* companies do not inform about the actual geographic distribution of the number of employees. A detailed geographic analysis should take into account the location of subsidiaries of the parent *Scoreboard* companies as well as the location of other production activities involved in the value-chains. It is also important to remember that innovations by R&D companies in sectors such as software and semiconductors can enhance the products and services and hence the sales and employment of many companies that do not appear in the *Scoreboard* because they do not carry out significant amounts of R&D. Examples are the retailing and transport sectors.

Figure 1.6 Employment trends by the Scoreboard companies for main world regions



Note: For 1619 out of the 2500 Scoreboard companies with data for the whole period

Source: The 2013 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

2. Top R&D investing companies

This chapter describes the performance of individual companies, with a focus on the results of top R&D investors, highlighting those companies that show considerable changes in economic performance, in particular from an R&D viewpoint.

The world's top 100 R&D companies are analysed, highlighting those presenting important changes from the previous year and those showing the best performance in terms of R&D and economic growth over the last 10 years. This year's R&D ranking of the top 50 companies is presented in figure 2.1 and table 2.1 shows changes in such ranking since the first *Scoreboard* in 2004.

Key findings

- The four top R&D investors remain the same as in last year's *Scoreboard*: Volkswagen from Germany in the 1st place, Samsung Electronics from South Korea in the 2nd position, and Microsoft and Intel from the US in the 3rd and 4th places. The other companies in the top-ten are Novartis and Roche from Switzerland, Toyota from Japan, Johnson & Johnson and Google from the US and Daimler from Germany.
- The top 100 companies, accounting for 53.1 % of the total R&D investment by the 2500 companies, showed a significant increase in R&D investment in 2013, but at lower pace than that of 2012. Of these 100 companies, 62 increased R&D investment (vs. 72 in 2012), including 23 companies with double-digit R&D growth; of the 38 that decreased R&D, 7 decreased by a double digit percentage. Regarding net sales, 68 companies reported an increase (vs. 64 in 2012), including 20 companies with double-digit sales growth.
- In the top 100 group, 35.5% of EU companies increased R&D compared with about 70% of the US and Japanese firms and 92.3% of the other countries. Specifically:
  - 31 EU companies of which 11 have increased R&D (5 by more than 10%),
  - 39 US companies of which 27 increased R&D (9 by more than 10%),
  - 17 from Japan of which 12 increased R&D (3 by more than 10%) and
  - 13 companies from other countries of which 12 increased R&D (6 by more than 10%).
- In the top 100 group, the companies showing the largest increase in R&D are Celgene, US (39.0%); Apple, US (32.4%); Otsuka, Japan (29.4%); Qualcomm, US (26.9%); Samsung Electronics, South Korea (25.4%). Those showing the largest decrease in R&D are Abbot Laboratories, US (-66.4% due to demerger); Peugeot (PSA), France (-20.8%); STMicroelectronics, The Netherlands (-19.2%); Texas Instruments, US (-18.9%), Nokia, Finland (-17.1%). Some of the big increases or decreases in R&D may be due to acquisitions or demergers (see section 2.2).

- The rapid development of biotechnology is illustrated by the performance of the top 4 biotechnology companies, all of them based in the US (Celgene, Amgen, Gilead and Biogen): they increased R&D by 22.3%, whereas traditional pharmaceutical companies decreased it by 1.8%. Gilead Sciences, for example, is #68 in this Scoreboard but was #318 in 2005 whereas Pfizer was #15 in 2014 but #2 in 2005.
- Among the top 100 group, 31 companies have at least doubled their R&D investment since 2005 (8 companies based in the EU and 15 from the US). This group of companies is mainly from high R&D-intensive sectors, 23 of them have increased net sales by more than 100% and 16 companies increased employment by more than 100%. A number of the large increases are for companies that have made substantial acquisitions.

2.1 General trends

In the 2014 *Scoreboard* 104 companies have an R&D investment of more than € 1.0bn (32 from the EU and 40 from the US) while 53 have R&D exceeding € 2.0bn (17 from the EU and 21 from the US).

The top 10 companies each invested more than € 5bn in R&D and account for 14.0 % of the total R&D investment by the 2500 *Scoreboard* companies.

The four top R&D investors are the same as in last year's *Scoreboard*: In the 1st place the German company Volkswagen (23.4% R&D increase, up to €11.7bn), from South Korea in the 2nd position Samsung Electronics (25.4% R&D increase, up to €10.2bn) and from the US in the 3rd and 4th places Microsoft (€8.3bn) and Intel (€7.7bn). The other companies in the top-ten are from Switzerland Novartis (€7.2bn) and Roche (€7.1bn), from Japan Toyota Motor (€6.3bn), from the US Johnson & Johnson (€5.9bn) and Google (€5.7bn) and from Germany Daimler (€5.4bn).

The top 100 companies invested € 285.8 billion, accounting for 53.1 % of the total R&D investment and 26.5% of the total net sales by all the 2500 *Scoreboard* companies. The EU has 31 companies among the top 100 R&D investors, three companies more than it had in the 2013 *Scoreboard*. The US has 39 companies, two more than it had last year and Japan has 17, five companies less than in last year's *Scoreboard*.

The EU companies in the top 100 are mainly from the Automobiles & Parts (8), Pharmaceuticals & Biotechnology (7) and ICT[12] sectors (5). The US companies are mainly from the ICT (13), Pharmaceuticals & Biotechnology (11), and Chemicals (3) sectors. The Japanese companies operate mainly in the Automobiles & Parts (4) and Pharmaceuticals & Biotechnology (4) sectors.

Sixty-two companies in the top 100 have shown positive R&D investment growth. Among them, 23 companies had double-digit R&D growth, and of these, 12 companies also showed double-digit growth in net sales.

[12] ICT industries comprise Technology Hardware & Equipment and Software & Computer Services sectors.

Most of the top 100 companies showing double-digit R&D increases are in the Pharmaceuticals & Biotechnology (6), Automobiles & Parts (6) and ICT (4) sectors. The companies showing the largest increase in R&D are Celgene, US (39.0%); Apple, US (32.4%); Otsuka, Japan (29.4%); Qualcomm, US (26.9%); Samsung Electronics, South Korea (25.4%). With the exception of Apple, these companies showed also double-digit growth rate of sales.

Other companies among the top 100 group have shown double-digit growth in both R&D and net sales, e.g. Gilead Sciences and EBay from the US; Honda and Toyota from Japan, Taiwan Semiconductor (Taiwan) and Bombardier from Canada.

It is interesting to note the different trend of the biotechnology versus the standard pharmaceutical companies. The average R&D increase of the top 4 biotechnology companies (Celgene, Amgen, Gilead and Biogen) was 22.3% whereas that of the pharmaceutical companies decreased by 1.8%.

Thirty-seven companies in the top 100 have experienced a decrease in R&D investing. Among these, seven companies decreased R&D investments and three decreased net sales by more than 10 %. The companies with the largest decrease in R&D are Abbot Laboratories, US (-66.4% because of its demerger); Peugeot (PSA), France (-20.8%); STMicroelectronics, The Netherlands (-19.2%); Texas Instruments, US (-18.9%), Nokia, Finland (-17.1%).

The R&D intensity of companies in the top 100 (6.5%) has increased slightly due to a higher rate of increase for R&D (3.7 %) than for net sales (2.8 %). The EU companies in the top 100 have a higher average R&D intensity (6.7 %) than that of non-EU companies (6.4 %).

2.2 R&D changes driven by mergers and acquisitions and foreign direct investments.

Most of the increases or decreases in company R&D are the results of organic growth or of the need to trim costs in difficult times. But in some cases big changes in R&D are the results of mergers & acquisitions (M&As) or demergers when a company sharpens its focus by selling or spinning off one or more divisions. Pfizer provides a good example of growth by acquisition since it acquired Warner-Lambert in 2000 (giving it the super-blockbuster drug Lipitor), Pharmacia for $60bn in 2003 and Wyeth for $68bn in 2009. Pfizer then tried but failed to take over AstraZeneca earlier this year. The best example of a demerger in the Scoreboard is Abbott/AbbVie. Abbott Laboratories demerged its pharmaceutical division into a separate company now called AbbVie whose shares were listed in December 2012. AbbVie now has a market cap larger than that of Abbott, its former owner. The result of the demerger is that AbbVie is in the 52nd place in this year's *Scoreboard* whereas Abbott is at the 95th place (in last year's *Scoreboard* Abbott was at the 35th place). This illustrates the big effect that a demerger can have on R&D and company's position in the *Scoreboard*. A similar demerger but on a much smaller scale is Elan's demerger of its drug discovery activities as a separate

company Prothena. A number of other companies have announced that they are planning demergers – these include HP and eBay/PayPal.

Some facts and figures concerning M&As and foreign direct investments (FDIs) over the past 7 years for the top 50 R&D investors are provided in table 2.1. The table reports the total value of M&A deals per company, the number of M&As, the total value of investment and corresponding number of greenfield FDI projects and number of domestic and cross border M&As. Although not available for all world top 50 R&D investors, the values of M&As are on average larger than those of greenfield FDI.

Table 2.1. Foreign investment activities involving the top 50 *Scoreboard* companies over the past 7 years.

Company name	Tot value of M&A deals - €bn	N. of deals	Tot value of FDI (from2003)- €bn	N. of FDI projects	Domestic M&A	Cross border M&A
PFIZER	49.23	17	3.50	85	13	4
MERCK US	39.62	4	3.58	61	3	1
ORACLE	22.09	29	1.26	101	25	4
SANOFI-AVENTIS	18.10	11	3.03	73	1	10
GOOGLE	17.63	105	5.25	128	77	28
HEWLETT-PACKARD	17.09	22	7.90	272	16	6
GENERAL ELECTRIC	17.02	24	22.79	399	12	12
JOHNSON & JOHNSON	16.81	8	2.83	77	7	1
MICROSOFT	16.79	44	8.49	283	29	15
ASTRAZENECA	16.13	10	1.42	40	1	9
CISCO SYSTEMS	15.95	47	5.70	109	38	9
SIEMENS	13.22	26	16.09	415	5	21
BAYER	11.97	3	6.33	175	3	0
IBM	11.27	72	11.40	521	52	20
BRISTOL-MYERS SQUIBB	10.94	7	0.68	20	7	0
AMGEN	10.41	8	1.05	18	6	2
PANASONIC	10.12	11	5.31	158	8	3
VOLKSWAGEN	10.01	6	50.02	364	5	1
TAKEDA PHARMACEUTICAL	9.60	1	0.72	33	0	1
ELI LILLY	8.40	8	2.95	33	7	1
GLAXOSMITHKLINE	7.62	9	4.26	102	2	7
INTEL	7.16	28	16.20	159	13	15
NOKIA	6.97	17	3.48	144	3	14
SAP	5.47	21	1.74	114	4	17
ERICSSON	4.40	22	2.77	99	0	22
APPLE	4.04	30	0.29	19	22	8
HITACHI	3.76	18	10.44	210	13	5
QUALCOMM	2.79	17	2.16	35	8	9
GENERAL MOTORS	2.57	2	36.67	251	1	1
SONY	2.28	5	8.58	125	3	2
ROBERT BOSCH	1.77	19	8.83	252	10	9
EMC	1.75	23	1.71	78	17	6

TOSHIBA	1.28	13	4.70	126	3	10
TOYOTA MOTOR	1.25	5	34.32	462	3	2
DENSO	1.15	3	2.50	90	2	1
SAMSUNG ELECTRONICS	0.94	11	19.20	88	5	6
FIAT	0.56	6	27.89	193	3	3
HUAWEI	0.42	3	4.49	155	1	2
DAIMLER	0.28	11	17.65	133	8	3
LG ELECTRONICS	0.15	1	3.87	101	1	0
FORD MOTOR	0.15	4	30.49	182	3	1
NISSAN MOTOR	0.13	6	2.90	18	0	6
ALCATEL-LUCENT	0.01	2	1.67	37	1	1
AIRBUS	n.a.	6	9.71	205	1	5
HONDA MOTOR	n.a.	1	2.37	22	1	0
BMW			10.15	117		
BOEHRINGER INGELHEIM			1.51	37		
NOVARTIS			7.20	101		
ROCHE			3.59	66		
VOLVO			8.03	165		
Total	**399.49**	**748**	**2224**	**7255**	**443**	**305**

Source : Zephir database by Bureau van Dijk and fDi Markets database by the Financial Times

2.3 Long-term performance of top R&D companies

This section analyses the behaviour of the top companies over the last 10 years based on our history database containing company data for the period 2002-2013. Results of companies showing outstanding R&D and economic results are underlined.

Ranking of the top 50

Figure 2.1 shows the ranking of the top 50 global R&D companies with their 2010 rank shown in brackets. Table 2.2 then shows main R&D data and the evolution of the R&D rankings of the top 50 companies since the first *Scoreboard* in 2004 and the most important changes are highlighted. It is important to note, as stated in the previous section and in past reports, that the growth of companies is often accompanied by mergers and acquisitions while decreases may be the result of demergers.

There are 17 EU companies (18 in 2004) and 33 non-EU companies (32 in 2004).

In the EU group, four companies left the top 50 (Philips, Renault, BAE Systems and Peugeot) and three companies joined the top 50 (Boehringer Ingelheim, Volvo and SAP).

In the non-EU group, eight companies left the top 50 (Fujitsu, Matsushita Electric, NEC, Motorola, Nortel Networks, Wyeth, Delphi, Sun Microsystems) and nine companies

joined the top 50 (Amgen, Apple, Denso, Google, Huawei, Oracle, Panasonic, Qualcomm and Takeda Pharmaceuticals).

The distribution of the top 50 companies by main industrial sector and region changed from 2004 to 2013 as follows:

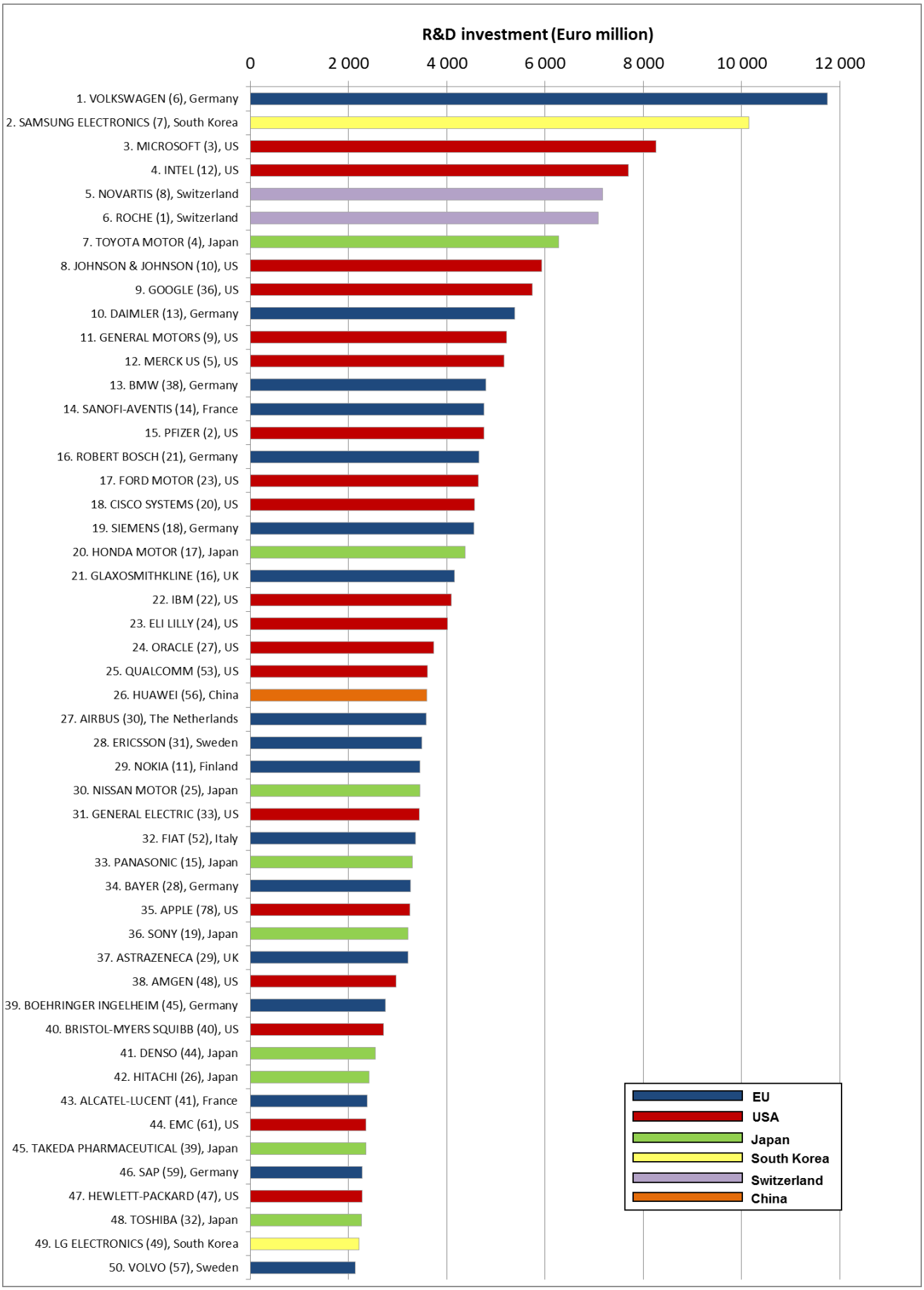
- Automobiles & Parts, from 13 (EU 7) to 11 (EU 5)
- ICT industries, from 15 (EU 3) to 15 (EU 4)
- Pharma & Biotech, from 11 (EU 3) to 14 (EU 5)

The EU companies that improved by at least 20 places are Boehringer Ingelheim (now ranked 39st), Sanofi (now 14th), SAP (now 46th) and Volvo (now 50th).

There are 9 non-EU companies that gained more than 20 places. They include Google, up 173 (now 9th), Qualcomm, up 112 (now 25th), Huawei, up more than 200 (now 26st), Oracle, up 47 (now 24th).

Three companies dropped twenty or more places but remained within the top 50: Sony (now 36th) and Hewlett Packard (now 47th).

Figure 2.1. The world's top 50 companies by their total R&D investment (€m) in the 2014 Scoreboard.



Note: The number in brackets after the name of the company indicates the ranking in 2010.

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.

Table 2.2. The top 50 companies in the 2014 Scoreboard: R&D data and rank change 2004-2014.					
Rank in 2014	Company	Country	R&D in 2013 (€m)	R&D intensity (%)	Rank change 2004-2014
1	VOLKSWAGEN	Germany	11743.0	6.0	up 7
2	SAMSUNG ELECTRONICS	South Korea	10154.9	6.5	up 31
3	MICROSOFT	US	8252.5	13.1	up 10
4	INTEL	US	7694.1	20.1	up 10
5	NOVARTIS	Switzerland	7173.5	17.1	up 15
6	ROCHE	Switzerland	7076.2	18.6	up 12
7	TOYOTA MOTOR	Japan	6269.9	8.2	down 2
8	JOHNSON & JOHNSON	US	5933.6	11.5	up 4
9	GOOGLE	US	5735.6	13.2	up 173
10	DAIMLER	Germany	5379.0	4.6	down 7
11	GENERAL MOTORS	US	5220.8	4.6	down 5
12	MERCK US	US	5165.0	16.2	up 17
13	BMW	Germany	4792.0	6.3	up 15
14	SANOFI-AVENTIS	France	4757.0	14.4	up 8
15	PFIZER	US	4750.2	12.7	down 13
16	ROBERT BOSCH	Germany	4653.0	10.1	up 10
17	FORD MOTOR	US	4640.7	4.4	down 16
18	CISCO SYSTEMS	US	4563.8	13.4	up 13
19	SIEMENS	Germany	4556.0	6.0	down 15
20	HONDA MOTOR	Japan	4366.7	5.4	down 4
21	GLAXOSMITHKLINE	UK	4154.3	13.1	down 10
22	IBM	US	4088.9	5.7	down 13
23	ELI LILLY	US	4010.8	23.9	up 18
24	ORACLE	US	3735.0	13.5	up 47
25	QUALCOMM	US	3601.6	20.0	up 112
26	HUAWEI	China	3589.3	25.6	up > 200
27	AIRBUS	The Netherlands	3581.0	6.0	up 8
28	ERICSSON	Sweden	3484.8	13.6	down 11
29	NOKIA	Finland	3456.0	14.7	down 19
30	NISSAN MOTOR	Japan	3447.2	4.8	up 4
31	GENERAL ELECTRIC	US	3444.3	3.3	up 6
32	FIAT	Italy	3362.0	3.9	up 12
33	PANASONIC	Japan	3297.2	6.2	down 26
34	BAYER	Germany	3259.0	8.1	down 2
35	APPLE	US	3244.9	2.6	up 120
36	SONY	Japan	3209.1	21.3	down 21
37	ASTRAZENECA	UK	3202.8	17.2	down 12
38	AMGEN	US	2960.6	21.9	up 18
39	BOEHRINGER INGELHEIM	Germany	2743.0	19.5	up 23
40	BRISTOL-MYERS SQUIBB	US	2705.4	22.8	up 2
41	DENSO	Japan	2538.9	9.0	up 12
42	HITACHI	Japan	2420.0	3.7	down 18
43	ALCATEL-LUCENT	France	2374.0	16.4	up 4
44	EMC	US	2355.2	14.0	up 48
45	TAKEDA PHARMACEUTICAL	Japan	2352.0	20.2	up 28
46	SAP	Germany	2282.0	13.6	up 23
47	HEWLETT-PACKARD	US	2273.2	2.8	down 24
48	TOSHIBA	Japan	2269.1	10.0	down 18
49	LG ELECTRONICS	South Korea	2208.5	5.5	up 61
50	VOLVO	Sweden	2130.5	6.9	up 27
Note : Companies in "blue" went up more than 20 ranks and in "red" lost more than 20 ranks.					
Source: The EU Industrial R&D Investment Scoreboards 2014 and 2004.					
European Commission, JRC/DG RTD.					

Best performers among the top 100

Among the top 100 group, 31 companies have at least doubled their R&D investment since 2005 (8 companies based in the EU and 15 from the US). This group of companies is mainly from high R&D-intensive sectors, 23 of them have increased net sales by more than 100% and 13 companies increased employment by more than 100%. A number of the large increases are for companies that have made substantial acquisitions.

The table 2.3 presents the list of 12 companies that increased simultaneously R&D, net sales and employment by more than 100% over the 2005-2013 period. Ten out of these companies are based in the US and operate in ICT and biotech industries. This illustrates the specialisation of US companies in high R&D-intensity sectors and their growing dominance observed over the past ten years (see chapter 4).

Table 2.3. Companies among the top 100 R&D investors that achieved the best performance from 2005 to 2013* (ranked by R&D in 2013).

World rank	*Company*	*Country*	*Sector*	*R&D in 2013 (€ m)*
9	GOOGLE	US	Software & Computer Services	5735.6
24	ORACLE	US	Software & Computer Services	3735.0
25	QUALCOMM	US	Technology Hardware & Equipment	3601.6
35	APPLE	US	Technology Hardware & Equipment	3244.9
44	EMC	US	Technology Hardware & Equipment	2355.2
55	CONTINENTAL	Germany	Automobiles & Parts	1918.6
59	BROADCOM	US	Technology Hardware & Equipment	1802.6
65	CELGENE	US	Pharmaceuticals & Biotechnology	1603.4
68	GILEAD SCIENCES	US	Pharmaceuticals & Biotechnology	1537.1
71	EBAY	US	General Retailers	1498.8
82	WESTERN DIGITAL	US	Technology Hardware & Equipment	1204.4
100	TEVA PHARMACEUTICAL INDUSTRIES	Israel	Pharmaceuticals & Biotechnology	1031.1

** These companies increased simultaneously R&D investment, net sales and employment by more than 100 % from 2005 to 2013 and had positive operating profits in 2013.*

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.

3. Technological specialisation of companies

This chapter presents an analysis of the technological profiles of the *Scoreboard* companies based on the examination of their patent portfolios. The focus is on the technological development of the top 100 R&D investors, addressing the following questions: In which technological fields do they specialise? What is their degree of specialisation or diversification? What is their involvement in developing key technologies expected to produce major societal changes? How do they compare with respect to their sector counterparts?

In some cases the field of specialisation and the sector are less easy to define since a company may have substantial businesses in two or more sectors or subsectors.

Key findings

- In 2010-2012, the 2000 *Scoreboard* companies have filed about one third of the total patents at the EPO and USPTO offices. The top 100 R&D investors have filed 53.2% of the overall *Scoreboard* patents.
- The patent propensity of companies (patents to R&D ratio) is very much sector-specific. The Electronic and Electrical Equipment sector shows the highest patent propensity, about ten times larger than that of the Pharmaceuticals & Biotechnology sector. The average patent propensity of the top 100 R&D investors is similar to that of the 2000 sample.
- The three most patented technologies by company give an indication of its degree of specialisation or diversification. The results show a great variety across sectors and companies. The largest specialisation is shown by the Technology Hardware & Equipment and the Pharmaceutical & Biotechnology sectors.
- Patent activity related with key enabling technologies differs also greatly across industries. In general, Chemicals, Electronic & Electrical Equipment, General Industrial and Pharmaceutical & Biotechnology sectors appear to be the most KETs intensive, but large differences between companies are also observed.

3.1 Overview

Matching company and patent data allows the identification of the technological fields in which the *Scoreboard* companies are involved. Patent data have been built up, in collaboration with the OECD,[13] using the information on the ownership structure of the 2000 companies in the 2013 *Scoreboard*, and considering those patents filed at the EPO and

[13] The JRC-IPTS of the European Commission and the Directorate for Science, Technology and Innovation of the OECD are currently collaborating to analyse the patent and trademark portfolios of the EU R&D Scoreboard companies. The results will be presented in a joint report to be published in the first half of 2015.

USPTO patent offices over the period 2010-2012. In order to control for the multiple filing of the same invention, different patent applications have been matched through INPADOC families[14] to avoid double counting.

The technological classification proposed by Schmoch[15] is applied in order to simplify the interpretation of the patent data. This classification groups the patents (IPC classes) into 35 technological fields belonging to five technological areas, namely: Electrical Engineering, Mechanical Engineering, Instruments, Chemistry, and Other Fields. In a second step, patents related to key enabling technologies (KETs)[16] have been identified to have a look to the activity of the *Scoreboard* companies in those technologies. KETs are identified according to the following partition: industrial biotechnology, nanotechnology, micro- and nano-electronics, photonics, advanced materials, and advanced manufacturing technologies.

Over the period considered, the top 2000 *Scoreboard* companies have filed about 30% and 33% of the total patents, at EPO and USPTO offices respectively.

3.2 Patents vs R&D investment by sector

This section presents the ratio of number of patents to R&D investment, defined as the propensity to patent[17], for the top 2000 R&D investors included in the 2013 *Scoreboard*. This indicator describes the relationship between patents and innovative efforts, and allows sector comparisons.

Figure 3.1 reports the patent propensity of the top 2000 investors of the 2013 *Scoreboard*, calculated as the sector's average number of patents per million euro of R&D investment over the period 2010-2012.

The figure shows that the patent propensity varies greatly across sectors ranging from about 0.01 for Banking to the 0.67 of the Electronic and Electrical equipment sector.

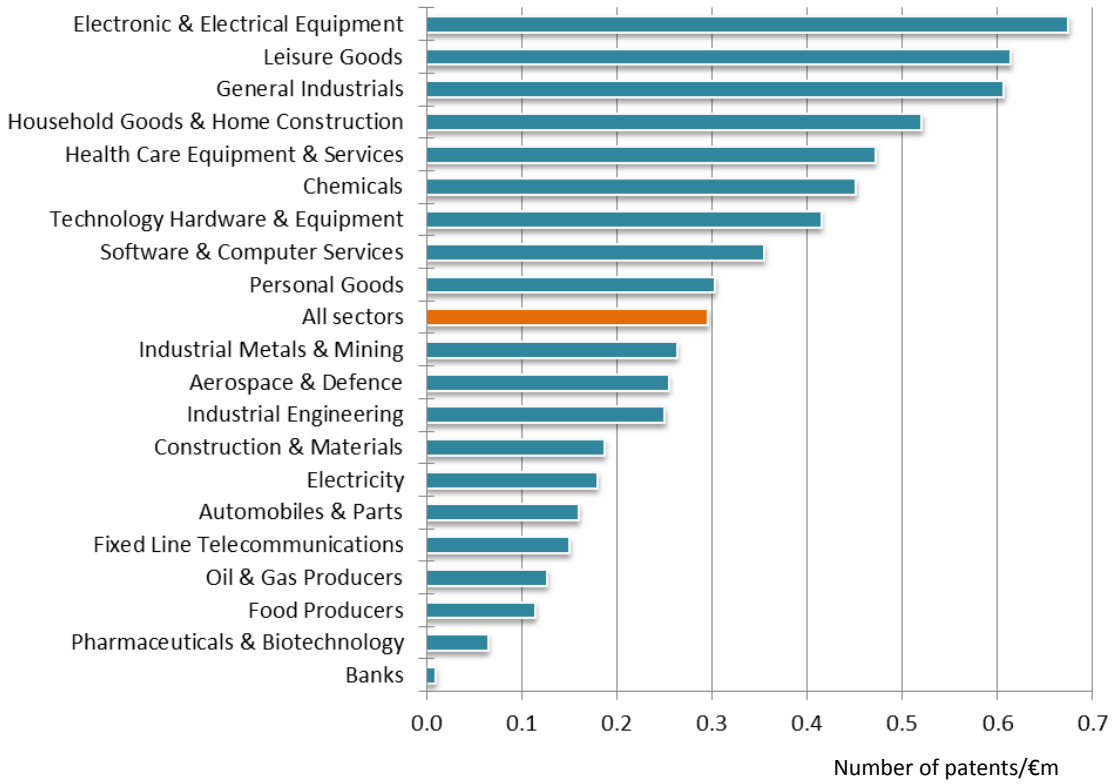
The highest patent propensities are shown by the Electrical Equipment, Leisure Goods, and General Industrial sectors, all with values above 0.6 (meaning an average R&D investment of €1.7 million per patent family).

Household Goods & Home Construction, Health Care Equipment & Services, Chemicals, Technology Hardware & Equipment represent a second grouping of sectors that display values ranging from 0.41 and 0.52.

Apart from the Software and Computer Services sector (0.36) all the other sectors present values for patent propensity below 0.3. The Pharmaceuticals & Biotechnology sector presents the second lowest value for the patent/R&D ratio. This is due, at least in part, by the substantial investments required to guarantee that a compound is effective, safe and admissible by the regulatory agencies.

[14] See definition at: http://www.epo.org/searching/essentials/patent-families/inpadoc.html
[15] See the concept note at: http://www.wipo.int/export/sites/www/ipstats/en/statistics/patents/pdf/wipo_ipc_technology.pdf. For an up-to-date concordance table, see: http://www.wipo.int/ipstats/en/statistics/technology_concordance.html.
[16] The classification could be find in: "Feasibility study for an EU Monitoring Mechanism on Key Enabling Technologies" (2012)
[17] Scherer, F.M. "The propensity to patent." International Journal of Industrial Organization 1.1 (1983): 107-128.

Figure 3.1. Patent Propensity of the 2013 *Scoreboard* companies by main industry



Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Note: Sectors with at least 20 companies are reported. Calculations based on the Worldwide Patent Statistical Database, EPO, Spring 2014 and the 2013 EU Industrial R&D Investment Scoreboard.

It should be noted that a higher patent propensity does not imply a better performance. In fact, the number of patents *per se* does not necessarily indicate the technological and economic value of the patent portfolio. This is an issue that deserves further investigation, including a deeper analysis of the technologies involved and their impact on the value chain of the company.

3.3 Patent activity of the top 100 R&D investors

The top 100 R&D investors have filed 53.2% of the overall Scoreboard patents, with a patent propensity very close to that recorded for the whole sample.

The Table 3.1 summarises the most important patent data on the top 100 R&D investors of the 2013 *Scoreboard*. Specifically, the table reports for each company the total number of patents from 2010 to 2012, the shares of the three most patented technological fields, the

share of these three fields (as a measure of technological specialisation vs diversification), and finally, the share of patents with at least one technology related to KETs. Companies are grouped according to the ICB sector in which they operate and ranked by R&D.

The technological specialisation (concentration) of the Pharmaceutical & Biotechnology, Technology Hardware & Equipment and Software and Computer service sectors appears to be, in general, higher than that of the other sectors reported in the table (blue bars).

The sector classification is also useful to identify the most important technologies for Pharmaceuticals & Biotechnology and Automobiles & Part companies, most of them share the same technology as the core of their innovation activity. However, marked differences arise across companies operating in the same sector.

In the Pharmaceutical & Biotechnology sector, some companies appear to be more specialized in medical technologies (Johnson & Johnson, Sanofi-Avensis and Abbott Laboratories), Bayer is particularly active in basic material chemistry and Merck DE in organic chemistry. Merck DE appears to be the most diversified company of this group, it presents similar shares for the top three technologies, and their sum is below 50% of the total patents. Biotechnology does not still represent the first technology of any of the companies considered, but Novo Nordisk (31%), Amgen (30%) and Roche (20%) have an important share of their patents related to biotechnologies.

Among the three most represented sectors in the top 100 group, the Technology Hardware and Equipment sector presents the highest variety of top technologies developed. Digital communication and computer technologies are in general the two most important technologies of this group of companies, but semiconductors, audio-visual technologies and optics represent an important share of the technology base for some companies, e.g. Texas Instrument, Western Digital, STMicroelectronics and Canon.

Companies operating in the Automobiles & Parts sector present medium-low values of technological concentration (Nissan scoring the highest one, 72%). Transport is the core technology of this sector group, with only Robert Bosch and Denso (both are parts companies) having Electrical Machinery and apparatus as the most relevant technology.

Similar to those in the Automobiles & Parts sector, companies grouped under the Electronic and Electrical Equipment sector present a medium-low degree of concentration, but very different technological profiles. In terms of top technologies, Samsung present a remarkable high number of patents and a low concentration of technological base.

The involvement of companies in KETs related inventions (3rd column of Table 3.1) varies greatly across industries. Overall, Chemicals, Electronic and Electrical Equipment, General Industrial and the Pharmaceutical & Biotechnology sectors appears to be the most KETs intensive, but with large differences across companies. On the other hand companies operating the Automobiles & Parts and Technological Hardware and Equipment sectors present a low degree of KETs related technologies. However, some companies stand out with respect to their counterparts: STMicroelectronics (34%) and Texas Instrument (33%) in the former and Fiat (22%) in the latter.

Table 3.1. The technological profiles of the top 100 *Scoreboard* companies.

World Rank	Company name	Country	First most patented technology		Second most patented technology		Third most patented technology		Tech. Speec.	Patent families (2010-12)	Share of KETs patents
			Technological Field	%	Technological Field	%	Technological Field	%			
Pharmaceuticals & Biotechnology											
6	ROCHE	CH	Pharmaceuticals	24	Biotechnology	20	Organic chemistry	13	57	1553	36
7	NOVARTIS	CH	Pharmaceuticals	44	Medical technology	17	Organic chemistry	13	74	1012	19
8	MERCK US	US	Pharmaceuticals	49	Organic chemistry	25	Biotechnology	13	87	640	16
9	JOHNSON & JOHNSON	US	Medical technology	60	Pharmaceuticals	11	Organic chemistry	9	80	1800	8
10	PFIZER	US	Pharmaceuticals	53	Organic chemistry	20	Biotechnology	18	91	352	22
15	SANOFI-AVENTIS	FR	Medical technology	40	Pharmaceuticals	32	Organic chemistry	14	86	1152	7
20	GLAXOSMITHKLINE	GB	Pharmaceuticals	54	Organic chemistry	20	Biotechnology	17	91	375	19
26	ELI LILLY	US	Pharmaceuticals	56	Organic chemistry	21	Biotechnology	13	90	126	20
33	ASTRAZENECA	GB	Pharmaceuticals	54	Organic chemistry	21	Biotechnology	16	91	308	18
35	ABBOTT LABORATORIES	US	Medical technology	34	Pharmaceuticals	17	Biotechnology	9	61	1196	22
36	BAYER	DE	Basic mat. chemistry	20	Organic chemistry	19	Macrom. chem, polymers	14	52	1525	22
40	BRISTOL-MYERS SQUIBB	US	Pharmaceuticals	55	Organic chemistry	28	Biotechnology	14	96	279	15
41	TAKEDA PHARMACEUTICAL	JP	Pharmaceuticals	47	Organic chemistry	26	Biotechnology	7	80	273	15
42	BOEHRINGER INGELHEIM	DE	Pharmaceuticals	47	Organic chemistry	26	Biotechnology	9	82	478	14
47	AMGEN	US	Pharmaceuticals	43	Biotechnology	30	Organic chemistry	19	93	212	44
67	OTSUKA	JP	Pharmaceuticals	41	Medical technology	21	Organic chemistry	18	80	36	15
68	DAIICHI SANKYO	JP	Pharmaceuticals	51	Organic chemistry	40	Biotechnology	6	97	192	9
69	ASTELLAS PHARMA	JP	Pharmaceuticals	58	Organic chemistry	23	Biotechnology	10	90	123	18
72	MERCK DE	DE	Organic chemistry	18	Basic mat. chemistry	17	Pharmaceuticals	14	49	628	34
78	NOVO NORDISK	DK	Pharmaceuticals	37	Biotechnology	31	Medical technology	23	91	170	24
81	GILEAD SCIENCES	US	Pharmaceuticals	64	Organic chemistry	30	Biotechnology	3	97	136	7
87	CELGENE	US	Pharmaceuticals	68	Organic chemistry	15	Biotechnology	8	91	117	12
Technology Hardware & Equipment											
4	INTEL	US	Computer technology	40	Digital communication	21	Telecommunications	11	72	1915	15
18	CISCO SYSTEMS	US	Digital communication	39	Computer technology	34	Telecommunications	11	84	1582	2
22	NOKIA	FI	Digital communication	36	Computer technology	34	Telecommunications	10	79	2388	3
28	ERICSSON	SE	Digital communication	61	Telecommunications	16	Computer technology	12	89	2963	1
31	HUAWEI	CN	Digital communication	51	Computer technology	18	Telecommunications	17	86	3510	2
38	QUALCOMM	US	Digital communication	42	Computer technology	18	Telecommunications	12	72	5436	7
44	CANON	JP	Computer technology	25	Optics	21	Audio-visual technology	15	60	10722	13
45	HEWLETT-PACKARD	US	Computer technology	40	Textile & paper mach.	12	Digital communication	11	63	1404	14
46	APPLE	US	Computer technology	43	Audio-visual technology	17	Digital communication	11	70	3164	7
49	ALCATEL-LUCENT	FR	Digital communication	48	Telecommunications	20	Computer technology	15	83	2457	6
52	EMC	US	Computer technology	90	Digital communication	7	Audio-visual technology	1	98	620	0
64	STMICROELECTRONICS	NL	Semiconductors	25	Computer technology	20	Basic communication	12	57	1701	34
65	BROADCOM	US	Digital communication	30	Telecommunications	24	Computer technology	18	72	1778	7
75	TEXAS INSTRUMENTS	US	Semiconductors	23	Computer technology	18	Basic communication	15	56	1154	33
90	WESTERN DIGITAL	US	Audio-visual technology	61	Computer technology	19	Surface technology	3	83	608	5
94	ZTE	CN	Digital communication	64	Telecommunications	14	Computer technology	13	91	1804	1
97	RESEARCH IN MOTION	CA	Computer technology	32	Digital communication	31	Telecommunications	16	78	3918	2
Automobiles & Parts											
1	VOLKSWAGEN	DE	Transport	45	Engines, pumps, turbines	14	Mechanical elements	10	68	1522	3
5	TOYOTA MOTOR	JP	Transport	20	Electrical mach, energy	16	Engines, pumps, turbines	15	51	3404	9
11	DAIMLER	DE	Transport	31	Engines, pumps, turbines	22	Electrical mach, energy	17	70	291	5
12	GENERAL MOTORS	US	Transport	19	Mechanical elements	15	Electrical mach, energy	13	46	4188	6
14	ROBERT BOSCH	DE	Electrical mach, energy	17	Engines, pumps, turbines	16	Transport	14	47	4220	7
16	HONDA MOTOR	JP	Transport	36	Electrical mach, energy	12	Engines, pumps, turbines	10	57	2842	5
23	FORD MOTOR	US	Transport	39	Electrical mach, energy	16	Computer technology	9	63	106	5
25	NISSAN MOTOR	JP	Transport	30	Electrical mach, energy	23	Mechanical elements	19	72	712	4
27	BMW	DE	Transport	33	Mechanical elements	11	Engines, pumps, turbines	10	53	461	6
34	FIAT	IT	Transport	26	Electrical mach, energy	23	Engines, pumps, turbines	15	65	406	22
39	DENSO	JP	Electrical mach, energy	21	Measurement	12	Engines, pumps, turbines	12	45	2611	8
48	PEUGEOT (PSA)	FR	Transport	48	Environmental tech.	9	Mechanical elements	8	65	777	4
58	RENAULT	FR	Transport	46	Engines, pumps, turbines	13	Electrical mach, energy	10	69	286	2
60	CONTINENTAL	DE	Transport	21	Engines, pumps, turbines	17	Measurement	11	49	923	8
73	TATA MOTORS	IN	Transport	47	Mechanical elements	11	Engines, pumps, turbines	8	66	32	0
91	AISIN SEIKI	JP	Transport	27	Mechanical elements	21	Electrical mach, energy	11	59	1141	6

World Rank	Company name	Country	First most patented technology		Second most patented technology		Third most patented technology		Tech. Spec.	Patent families (2010-12)	Share of KETs patents
			Technological Field	%	Technological Field	%	Technological Field	%			
Electronic & Electrical Equipment											
2	SAMSUNG ELECTRONICS	KR	Computer technology	26	Audio-visual technology	14	Semiconductors	13	53	13853	20
17	SIEMENS	DE	Electrical mach, energy	16	Computer technology	14	Engines, pumps, turbines	13	43	5781	7
37	HITACHI	JP	Computer technology	22	Electrical mach, energy	14	Audio-visual technology	9	45	5732	20
74	FUJIFILM	JP	Optics	25	Computer technology	16	Medical technology	9	50	4957	22
79	MITSUBISHI ELECTRIC	JP	Electrical mach, energy	18	Semiconductors	11	Computer technology	9	39	2324	19
86	SHARP	JP	Optics	20	Audio-visual technology	20	Computer technology	14	54	3375	32
88	RENESAS	JP	Semiconductors	39	Computer technology	20	Basic communication	13	72	2093	47
89	HON HAI PRECISION IND.	TW	Audio-visual technology	20	Electrical mach, energy	19	Computer technology	17	56	9370	16
Software & Computer Services											
3	MICROSOFT	US	Computer technology	74	Digital communication	7	Audio-visual technology	7	88	7703	1
13	GOOGLE	US	Computer technology	58	Digital communication	13	Audio-visual technology	8	79	3198	1
21	IBM	US	Computer technology	62	Semiconductors	14	IT management methods	4	80	14075	18
29	ORACLE	US	Computer technology	69	IT management methods	10	Digital communication	7	86	1264	5
53	SAP	DE	Computer technology	79	IT management methods	15	Digital communication	3	97	1197	0
55	FUJITSU	JP	Computer technology	33	Digital communication	14	Telecommunications	10	56	7530	15
82	NEC	JP	Computer technology	31	Digital communication	23	Telecommunications	13	67	2927	10
Aerospace & Defence											
30	EADS	NL	Transport	37	Measurement	9	Computer technology	7	53	2200	7
54	BOEING	US	Transport	15	Measurement	14	Computer technology	13	41	1507	16
61	FINMECCANICA	IT	Oth. special machines	19	Engines, pumps, turbines	12	Measurement	11	43	275	10
62	UNITED TECHNOLOGIES	US	Engines, pumps, turbines	32	Electrical mach, energy	10	Transport	8	50	2691	10
83	BOMBARDIER	CA	Transport	71	Electrical mach, energy	8	Civil engineering	5	84	145	1
100	SAFRAN	FR	Engines, pumps, turbines	38	Transport	13	Measurement	9	60	962	6
General Industrials											
32	GENERAL ELECTRIC	US	Engines, pumps, turbines	26	Electrical mach, energy	12	Measurement	8	46	7630	12
43	TOSHIBA	JP	Computer technology	24	Semiconductors	20	Audio-visual technology	13	56	8286	30
57	PHILIPS	NL	Medical technology	23	Electrical mach, energy	18	Computer technology	13	54	2727	22
77	HONEYWELL	US	Computer technology	16	Measurement	14	Organic chemistry	8	38	3079	14
85	3M	US	Optics	11	Electrical mach, energy	10	Medical technology	9	27	1328	36
Chemicals											
63	BASF	DE	Macrom. chem, polymers	20	Organic chemistry	19	Basic mat. chemistry	16	55	3048	34
70	DUPONT	US	Food chemistry	22	Biotechnology	19	Macrom. chem, polymers	10	50	2654	42
84	DOW CHEMICAL	US	Transport	14	Engines, pumps, turbines	14	Macrom. chem, polymers	11	40	3469	21
93	MITSUBISHI CHEMICAL	JP	Macrom. chem, polymers	15	Electrical mach, energy	14	Surface technology	12	41	621	55
96	MONSANTO	US	Food chemistry	51	Biotechnology	30	Basic mat. chemistry	7	88	904	34
Other Sectors											
19	PANASONIC	JP	Audio-visual technology	21	Electrical mach, energy	19	Semiconductors	12	52	8443	24
24	SONY	JP	Audio-visual technology	29	Computer technology	26	Semiconductors	8	62	8579	17
51	VOLVO	SE	Transport	24	Mechanical elements	18	Engines, pumps, turbines	12	54	247	3
56	LG ELECTRONICS	KR	Digital communication	31	Telecommunications	15	Computer technology	12	59	3465	6
59	CATERPILLAR	US	Engines, pumps, turbines	18	Mechanical elements	17	Civil engineering	14	50	951	2
95	ABB	CH	Electrical mach, energy	53	Measurement	8	Computer technology	7	67	1702	8
50	NTT	JP	Digital communication	55	Telecommunications	16	Computer technology	10	82	1086	4
99	TELEFONICA	ES	Digital communication	47	Computer technology	32	Telecommunications	9	88	121	1
66	PETROCHINA	CN	Basic mat. chemistry	23	Chemical engineering	18	Organic chemistry	15	56	24	19
71	PROCTER & GAMBLE	US	Medical technology	18	Basic mat. chemistry	15	Organic chemistry	13	47	1280	8
76	EBAY	US	IT management methods	54	Computer technology	38	Digital communication	4	97	586	0
80	NESTLE	CH	Food chemistry	33	Furniture & games	17	Handling	14	64	615	6
92	MEDTRONIC	US	Medical technology	80	Pharmaceuticals	5	Electrical mach, energy	4	89	1906	3
98	VALE	BR	Materials, metallurgy	48	Chemical engineering	11	Environmental tech.	8	67	19	13

Note: 'Share of KETs patents' is calculated as the number of patents with at least one IPC code classified as KET over the total patent portfolio of a company. 'Tech. Spec.' is the share of the top three technologies of a company.

Source: Calculations based on the Worldwide Patent Statistical Database, EPO, Spring 2014 and the 2013 EU Industrial R&D Investment Scoreboard.

3.4 Focus on patent propensity of most relevant sectors

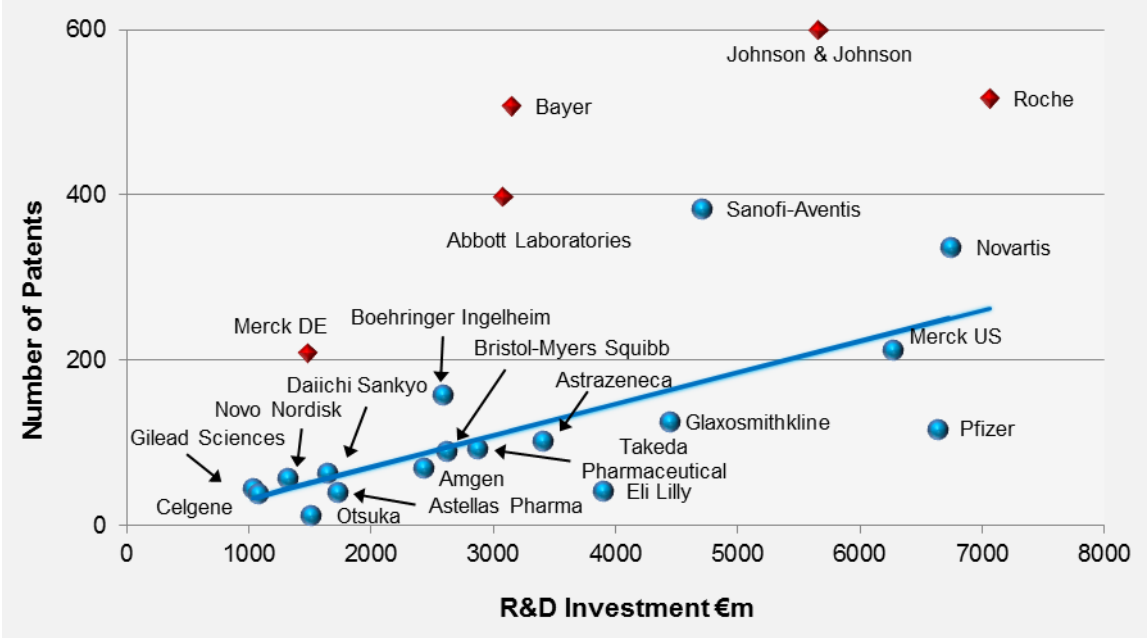
This section presents the patent propensity of the companies operating in the three most represented industries of the top 100 R&D investors: Pharmaceuticals & Biotech (22), Technological Hardware (17), Automobile & Parts (16 companies).

As mentioned above, patent propensity varies greatly across industries; however, there are also considerable firm differences within the sectors. Figure 3.2 reports the average number of patents filed yearly during the period 2010-2012 versus the average R&D investment for the same period. A regression line is reported together with R&D and patent figures.

Some companies lie notably far from the best fit line, those above having higher number of patents than sector's average and the contrary for those below.

Figure 3.2 reports these figures for the Pharmaceuticals & Biotechnology sector. In this sector Abbot Laboratories, Bayer, Johnson & Johnson, Merck De, Roche and Sanofi-Aventis, show the highest patent to R&D ratio. However, most of these companies have significant operation in different subsectors. In particular Abbot Laboratories is now focused on health care after demerging its pharmaceutical division to form a new company, AbbVie; Bayer is particular active in chemicals, Johnson & Johnson in health care, Merck De in chemicals and life-science tools, and Roche is the top world company in diagnostics. Therefore, the reported best fit line in figure 3.1 excludes these companies which are shown in red.

Figure 3.2 Pharmaceutical & Biotechnology, patent propensity of top R&D investors

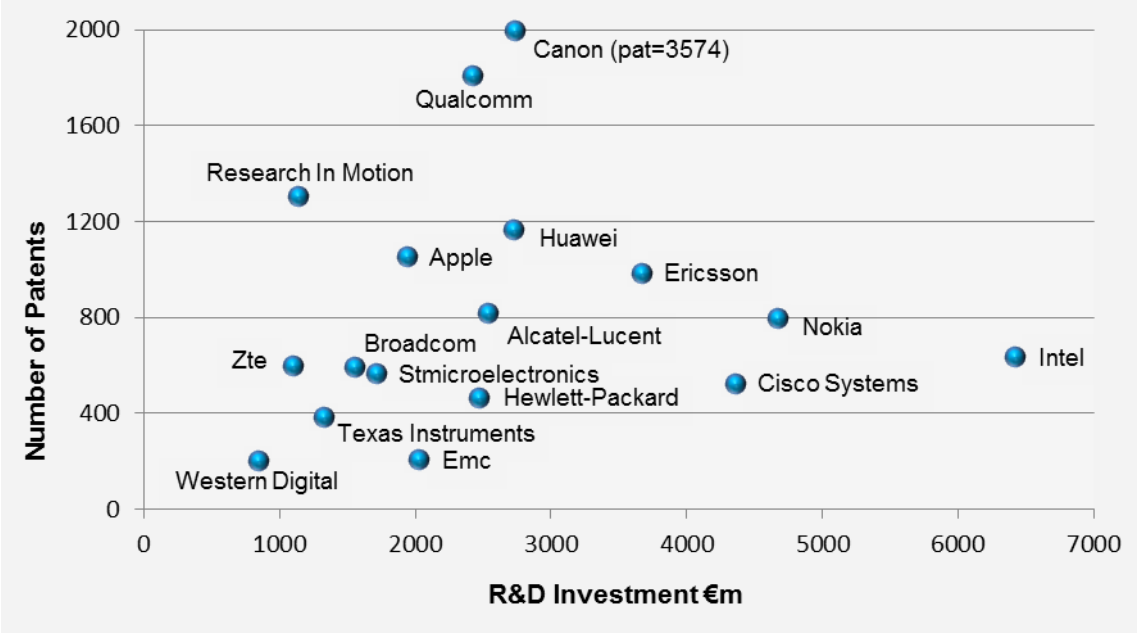


Source: Calculations based on the Worldwide Patent Statistical Database, EPO, Spring 2014 and the EU Industrial R&D Investment Scoreboard.
Note: Companies with red markers have not been included for the calculation of the best fit line.

In the Technological Hardware and Equipment sector, companies' differences in patent propensity are even more significant. Apart from Canon, Qualcomm and Research in Motion, companies file a similar number of patents with very different R&D investments. This is due to the great variety of the technological profiles in this sector as presented in table 3.1.

ICT technologies have experienced sustained growth rates in the past decades and are subject to a rapid evolution. Companies operating in this sector show a high variety of technological profiles and do not constitute a homogeneous group. More refined analyses on their technological profiles could help in building homogeneous typologies of firms able to better describe ICTs.

Figure 3.3 Technology Hardware & Equipment, patent propensity of top R&D investors



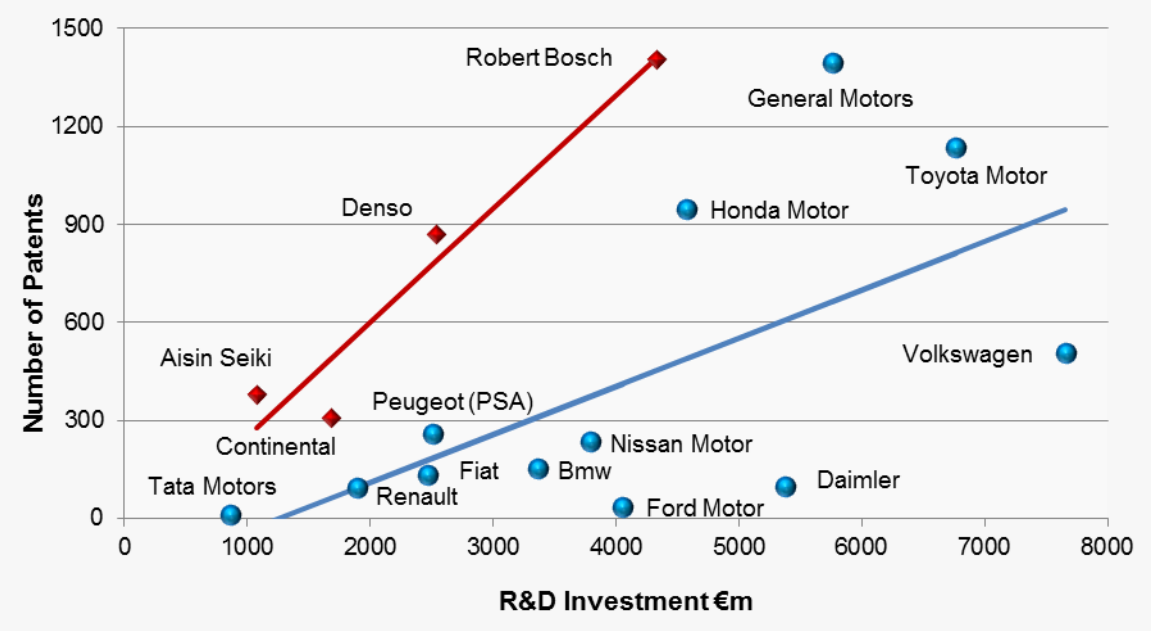
Source: Calculations based on the Worldwide Patent Statistical Database, EPO, Spring 2014 and the EU Industrial R&D Investment Scoreboard.
Note: Given the high variety of technological specialization, the best fit line is not included.

Finally, in the Automobiles and Parts sector Robert Bosch, Denso and General Motors have the highest patent to R&D ratio. However, this sector is made of two substantially different sub-sectors: vehicles and components. In Figure 3.4 the two types of companies are distinguished, the component companies in red and those mainly producing vehicles in blue.

The best fit line for the component companies is steeper than that of vehicles producers, companies operating in this sub-sector show a higher patent propensity. As noted before, Robert Bosch and Denso are the only two companies having the development of electrical

machinery apparatus rather than transport technologies as the most prominent technological field.

Figure 3.4 Automobiles & Parts, patent propensity of top R&D investors



Source: Calculations based on the Worldwide Patent Statistical Database, EPO, Spring 2014 and the EU Industrial R&D Investment Scoreboard.

4. R&D distribution by industrial sector

This chapter presents the main R&D trends among the 2014 *Scoreboard* companies aggregated by industrial sectors[18]. It comprises the ranking of sectors by their level of R&D investment, R&D intensities, rates of R&D growth and the comparison of such trends across world regions.

Key findings

- Companies from the top two R&D investing sectors achieved a modest increase of R&D, Pharmaceuticals & Biotechnology (2.4%) and Technology Hardware & Equipment (3.3%). The following three top sectors increased R&D well above the world average of 4.9%: Software & Computer Services (11.4%), Electronic & Electrical Equipment (9.0%) and Automobiles & Parts (7.1%). The highest R&D growth was showed by the Construction & Materials sector (13.6%) which is, however, a small sector in R&D terms.
- In the Pharmaceuticals & Biotechnology sector, companies operating in biotechnology increased R&D by 20.4% whereas the traditional pharmaceutical companies decreased it by 0.2%. As observed in chapter 2, this is mostly due to the rapid development of biotechnology, illustrated by an outstanding performance of the top biotechnology companies based in the US (Celgene, Amgen, Gilead, Biogen and Regeneron).
- Among the top 5 sectors, companies based in the EU had the highest R&D growth in Software & Computer Services (8.4%) and Automobile & Parts (6.2%). The highest R&D growth in the EU was showed by the Fixed Line Telecommunications sector (8.6%).
- Trends observed in the *Scoreboard* over the last 10 years show a characteristic industrial specialisation of the EU and US companies that persists after the crisis and appears to have been reinforced over the past few years: Concentration of the EU companies in medium-high R&D intensity sectors, in particular in Automobiles & Parts with total domestic and sector world R&D shares of 25.7% and 49.7% respectively; and US companies dominating in high R&D-intensity sectors, particularly in ICT industries with total domestic and sector world R&D share of 44.5% and 62.7% respectively.

4.1 General R&D trends

Figure 4.1 shows the R&D rankings of companies from the main industrial sectors including the relative R&D share by main world region. The specialisation of the main

[18] According to the Industry Classification Benchmark (ICB) applied in the *Scoreboard*.

world regions, represented by the share of sectors within the regions' total R&D investment, is given in figure 4.2.

- R&D investment in the *Scoreboard* remains highly concentrated by sectors: Out of 40 industrial sectors, the top three –Pharmaceuticals & Biotechnology, Technology Hardware & Equipment and Automobiles & Parts– account for 49.6% of the total R&D investment by the *Scoreboard* companies; the top 6 and top 15 sectors constitute, respectively, 71.1% and 92.1% of the total R&D in the *Scoreboard*. A similar concentration of R&D in a relatively small number of industrial sectors has been observed over the last 10 years.
- The ranking of the top 15 sectors has changed as follows: The Banks sector took over the 13th position from the Fixed Line Telecom (now 14th) and the Construction & Materials sector took the 15th position from Food Producers (now 16th).
- The Pharmaceuticals & Biotechnology sector keeps the first position in the R&D ranking, keeping a similar share of the total R&D investment (18.0%). It is followed by the Technology Hardware & Equipment sector with a share of R&D 16.1% (slightly lower to last year's 16.4%) and the Automobile & Parts sector with 15.5%, slightly similar than the 15.7% of last year.
- The R&D specialisation (share of R&D investment) of the main regions in the top 3 sectors are:

  In the EU, Automobiles & Parts (25.7%), Pharmaceuticals & Biotechnology (17.3%), and Technology Hardware & Equipment (9.2%);

  In the US, Technology Hardware & Equipment (24.8%), Pharmaceuticals & Biotechnology (21.4%) and Software & Computer Services (19.7%);

  In Japan, Automobiles & Parts (27.6%), Electronic & Electrical Equipment (13.0%) and Pharmaceuticals & Biotechnology (11.1%).

  The contribution to the total *Scoreboard* R&D by EU companies is 51.1% to Aerospace & Defence, 49.7% to Automobiles & Parts and 40.3% to the Industrial Engineering sectors; the US contributes 74.6% to Software and Computer Services, 64.1% to Health Care Equipment & Services and 55.6% to Technology Hardware & Equipment and; Japan contributes 30.4% to General Industrials, 29.5% to Chemicals, 26.8% to the Electronic & Electric Equipment sector and 28.2% to Automobiles & Parts.

4.2 R&D growth by industrial sector

The actual contribution of an industrial sector to the overall R&D growth of a region depends on its rate of R&D change and the sector's share of total R&D of the region. Figures 4.1 and 4.2 show the shares of the main industrial sectors and table 4.1 shows their ranking by R&D annual growth rate worldwide for the *Scoreboard* companies based in the main world regions (EU-633, US-804, and Japan-387).

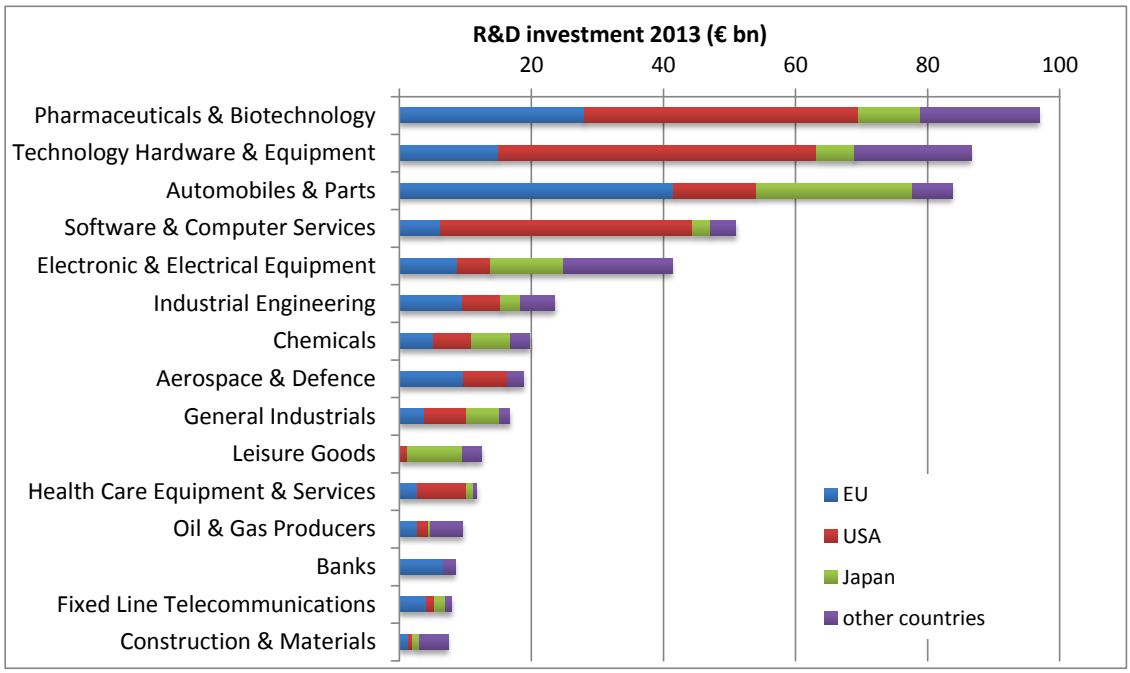
The following points are observed for the top 15 sectors accounting for 92.1% of the total R&D investment of the *Scoreboard* companies:

- Worldwide, the Construction & Materials sector shows the highest one-year growth rate (13.6%) followed by Software & Computer Services (11.4%), Electronic & Electric Equipment (9.0%), and Automobiles & Parts (7.1%) sectors. The significant R&D growth rate of the Electronic & Electric Equipment sector is due to a large extent by the R&D growth of Samsung Electronics (25.4%) that accounts for one quarter of the total R&D of the sector worldwide.
- Among the companies based in the EU, the Fixed Line Telecom sector shows the highest one-year growth rate (8.6%), followed by the Software & Computer Services (8.4%). The sectors showing the lowest one-year R&D growth are Technology Hardware & Equipment (-5.4%) and Industrial Engineering (0.9%). The low R&D growth rate of the Industrial Engineering sector is mostly due to the R&D decrease of Volvo (-6.5%), company that accounts for 22.4% of the total sector R&D of the EU-633 sample.
- Among the companies based in the US, the Fixed Line Telecom sector shows the highest one-year growth rate (17.5%) followed by Software & Computer Services (12.0%) and Oil & gas Producers (7.6%). Sectors showing the lowest one-year R&D growth are Industrial Engineering (-6.4%) and Pharmaceuticals & Biotechnology (0.4%).
- For Japanese companies, the highest one-year growth rate is shown by Automobiles & Parts (11.0%) and Pharmaceuticals & Biotechnology (9.3%). The poorest performance was shown by Fixed Line Telecom (-7.4%) and Oil & Gas Producers (-6.7%).

Apart from the top 15 industries, there were important R&D changes in some other sectors:

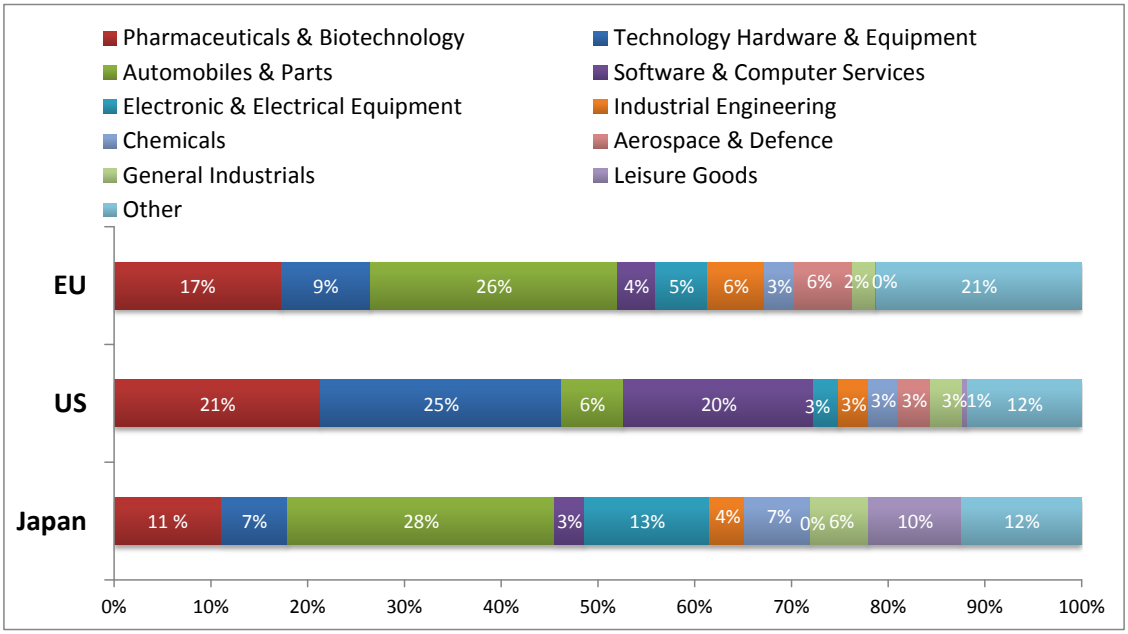
- Most services sectors (financing, insurance, leisure, travelling) showed double-digit R&D growth.
- The alternative energy sub-sector that has shown a substantial increase of R&D investment before the crisis, continued to decrease R&D investment in 2013 (-1.9%) following the sharp R&D reduction in 2012 (-22.9%).
- The Industrial Transportation sector reduced considerably its R&D investment (-14.2%).

Figure 4.1. R&D ranking of industrial sectors and share of main world regions for the world's top 2500 companies.



Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Figure 4.2. R&D shares of sectors of the main world regions



Source: The 2013 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Table 4.1. Ranking of top 15 industrial sectors by overall one-year R&D growth for the EU, US and Japanese companies in the 2014 *Scoreboard*.

Rank	Sector	Overall one-year R&D growth (%)	EU-633 R&D change (%)		US-804 R&D change (%)		Japan-387 R&D change (%)	
			1 year	3 years	1 year	3 years	1 year	3 years
1	Construction & Materials	13.6	1.3	5.2	5.3	4.7	7.0	3.2
2	Software & Computer Services	11.4	8.4	12.6	12.0	11.6	-4.0	-3.6
3	Electronic & Electrical Equipment	9.0	5.4	5.4	1.8	6.5	1.7	-0.5
4	Automobiles & Parts	7.1	6.2	11.6	5.6	5.2	11.0	8.6
5	Banks	4.9	5.6	8.4				
6	Health Care Equipment & Services	4.8	5.2	9.4	3.5	5.9	8.2	3.6
7	Fixed Line Telecommunications	4.8	8.6	-0.1	17.5	6.0	-7.4	-2.4
8	General Industrials	4.6	2.7	5.8	3.6	5.1	7.6	3.1
9	Oil & Gas Producers	4.6	6.7	6.0	7.6	4.5	-6.7	-2.8
10	Aerospace & Defence	4.2	3.8	6.1	1.6	0.5	9.3	11.3
11	Chemicals	4.2	3.1	7.2	2.8	5.7	3.7	2.1
12	Technology Hardware & Equipment	3.3	-5.4	-1.8	6.5	9.9	0.5	-0.1
13	Leisure Goods	3.0	6.7	4.1	3.1	1.3	-0.8	0.7
14	Pharmaceuticals & Biotechnology	2.4	0.9	2.8	0.4	2.5	9.3	3.0
15	Industrial Engineering	0.1	0.9	7.9	-6.4	6.7	7.3	4.8
	Total 40 industries	**4.9**	**2.6**	**5.9**	**5.0**	**7.0**	**5.5**	**3.0**

Source: The 2014 EU Industrial R&D Investment Scoreboard.

European Commission, JRC/DG RTD

4.3 R&D intensity by sector

Table 4.2 provides the list of industrial sectors ranked by worldwide R&D intensity of the main industrial sectors for the 2500 *Scoreboard* companies grouped by main world region.

The following points are observed:

- Some industrial sectors increased their R&D intensity as R&D investment increased more than net sales in 2013, in particular the Software & Computer Services (11.4% vs. 7.2%) and Technology Hardware & Equipment (3.3% vs. 2.2%). The opposite happened for Health Care Equipment & Services (4.7% vs 7.0%) and Industrial Engineering (0.1% vs 1.4%).
- Four sectors have an R&D intensity of more than 5.0%: Pharmaceuticals & Biotechnology, IT sectors (Software & Computer Services and Technology Hardware & Equipment) and Leisure Goods (mainly electronic leisure). The sector with the lowest R&D intensity is Oil & Gas Producers (0.3%).
- Among the top 15 sectors, the R&D intensity of EU companies is larger than that of the US and Japan in 6 sectors (Electronic & Electrical Equipment, Technology Hardware & Equipment, Industrial Engineering, General Industrials, Automobiles & Parts and Aerospace & Defence). Japanese companies show higher R&D intensity than the EU and the US in sectors such as Leisure Goods and Chemicals. The R&D intensity of US companies is higher than that of the EU and Japan in Pharmaceuticals & Biotechnology and Software & Computer Services.
- As observed in previous *Scoreboards*, the overall lower average of R&D intensity of the EU companies is due to their large share of low R&D-intensive sectors with very large sales such as Oil & Gas, Mining, Banks, as compared to a similar group of non-EU companies. Conversely, the high average R&D intensity of the US companies is due to their considerable weight in high R&D-intensive sectors (see Figures 4.1 and 4.2)

Table 4.2. Ranking of the top 15 industrial sectors by overall R&D intensity for the EU, US and Japanese companies in the 2014 *Scoreboard.*

Rank	Sector	Overall sector R&D intensity, %	EU-633 sector R&D intensity, %	US-804 sector R&D intensity, %	Japan-387 sector R&D intensity, %
1	Pharmaceuticals & Biotechnology	14.4	13.3	16.3	14.6
2	Software & Computer Services	10.4	10.6	12.3	4.4
3	Technology Hardware & Equipment	8.0	14.3	9.1	5.4
4	Leisure Goods	7.3	3.4	5.5	8.7
5	Aerospace & Defence	4.6	5.8	3.3	1.3
6	Automobiles & Parts	4.5	5.4	3.7	4.9
7	Electronic & Electrical Equipment	4.3	5.1	3.7	4.6
8	Health Care Equipment & Services	4.2	4.4	3.8	7.0
9	Industrial Engineering	2.8	3.7	2.8	1.9
10	Chemicals	2.6	2.1	3.4	3.6
11	General Industrials	2.3	4.5	2.9	2.0
12	Banks	2.0	2.0		
13	Fixed Line Telecommunications	1.8	1.8	1.2	2.3
14	Construction & Materials	1.0	0.6	2.5	1.2
15	Oil & Gas Producers	0.3	0.3	0.3	0.2
	Total 40 industries	**3.2**	**2.7**	**5.0**	**3.4**

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD

4.4 Growth of net sales and profitability by industrial sector

Table 4.3 shows the ranking of the top 15 industrial sectors by overall one-year growth of net sales for the companies based in the EU, the US and Japan. It also includes the sector profitability for these regions.

The following points are observed:

- Worldwide, the Construction & Materials sector shows the highest one-year growth rate of net sales (7.9%), followed by Software & Computer Services (7.2%), Health Care Equipment & Services (7.0%) and Automobiles & Parts (7.0%).
- Among the companies based in the EU, the highest growth rates of net sales are in Leisure Goods (6.2%) and Software & Computer Services (4.3%). The sector showing the lowest one-year sales growth is Fixed Line Telecom (-6.6%) followed by Technology Hardware & Equipment (-6.2%). Among the largest sectors in the EU, the highest profitability is shown in Software & Computer Services (17.3%) and Pharmaceuticals & Biotechnology (16.7%). The EU companies' lowest profitability is in the Technology Hardware & Equipment sector (4.9%).
- Among the companies based in the US, the Health Care Equipment & Services sector shows the highest one-year growth rate for sales (8.7%) followed by Construction & Materials (7.2%). Sectors showing the lowest one-year R&D growth are Oil & Gas Producers (-6.1%) and Industrial Engineering (-2.3%). The US-based companies have the highest profitability in Software & Computer Services (22.0%) and Pharmaceuticals & Biotechnology (21.9%). The US companies' lowest profitability is in the Automobiles & Parts sector (4.8%) and in Health Care Equipment & Services (9.4%). All the other large sectors in the US show double-digit profitability.
- For Japanese companies, the highest one-year growth rate for sales is shown by Automobiles & Parts (15.5%) and Aerospace &Defence (15.3%). The poorest performance is shown by the Fixed Line Telecom (2.1%). The profitability of companies based in Japan is generally lower than their counterparts in the EU and the US, for example 9.9% for Pharmaceuticals & Biotechnology, the highest profitability sector versus 16.7% and 21.9% for the EU and US counterparts.
- Excluding banks (for which data are only available for EU companies), six sectors in the EU show decreases in sales compared to two in the US and none in Japan.

Table 4.3. Ranking of top 15 industrial sectors by overall one-year sales growth and related data for the EU, US and Japanese companies in the 2014 *Scoreboard.*

Rank	Sector	World-wide	EU-633		US-804		Japan-387	
		Sales growth 1y (%)	Sales growth 1y (%)	Profit.*	Sales growth 1y (%)	Profit.*	Sales growth 1y (%)	Profit.*
1	Construction & Materials	7.9	-0.1	6.6	7.2	10.4	9.3	4.1
2	Software & Computer Services	7.2	4.3	17.3	6.7	22.0	5.0	3.8
3	Automobiles & Parts	7.0	1.8	6.2	4.9	4.8	15.5	7.4
4	Health Care Equipment & Services	7.0	1.3	14.6	8.7	9.4	9.7	9.8
5	Electronic & Electrical Equipment	6.5	1.0	8.5	2.2	11.9	12.1	5.9
6	General Industrials	4.5	1.7	7.0	2.6	12.7	9.7	1.6
7	Aerospace & Defence	4.3	4.3	7.1	3.4	11.0	15.3	6.2
8	Leisure Goods	4.0	6.2	21.5	3.2	12.9	3.7	3.1
9	Chemicals	3.9	-0.7	9.9	3.9	12.8	12.0	5.4
10	Pharmaceuticals & Biotechnology	2.8	0.2	16.7	1.6	21.9	8.4	9.9
11	Technology Hardware & Equipment	2.2	-6.2	4.9	1.5	16.3	13.7	8.9
12	Industrial Engineering	1.4	-0.5	7.2	-2.3	11.5	12.6	5.8
13	Oil & Gas Producers	0.0	-3.4	7.8	-6.1	11.6	11.9	1.4
14	Fixed Line Telecommunications	-2.6	-6.6	13.7	1.1	23.5	2.1	11.1
15	Banks	-3.2	-5.7	3.2				
	Total 40 industries	**2.7**	**-1.9**	**6.9**	**2.0**	**13.9**	**11.2**	**5.5**

** Profitability: operating profits as percentage of net sales.*

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD

4.5 Changes in indicators by region and sector groups

It is interesting to see the distribution of R&D investment of the *Scoreboard* companies across regions and sectors using an aggregation of the 40 industrial sectors into four groups of high-, medium-high-, medium-low- and low- R&D intensity (see Box 1.1 in chapter 1).

The worldwide and domestic distribution of the R&D investment by the 2500 *Scoreboard* companies shows clear differences by world region, illustrating respectively the weight of the region in the world and its specialisation (See Table 4.4):

- Companies based in the EU specialise in medium-high R&D-intensive sectors (45.7% of total R&D of the EU companies) and contribute 37.1% of the total world R&D of that sector group. Industrial sectors accounting for a large share of total world R&D of these sectors are Automobiles & Parts (49.7%), Aerospace & Defence (51.1%) and Industrial Engineering (40.3%).
- Those based in the US specialise in high R&D intensive sectors (73.8% of total R&D of the US companies) and contribute 51.5 % of the world R&D of that sector group. Industrial sectors accounting for a large share of total world R&D of these sectors are Software & Computer Services (74.9%), Technology Hardware & Equipment (55.6%) and Pharmaceuticals & Biotechnology (42.8%).
- Japanese companies specialise in medium-high R&D intensive sectors (60.0% of total domestic R&D) while contributing 25.7% of the world R&D of that sector group. The industrial sectors with highest weight in the total world R&D are Chemicals (29.5%) and Automobiles & Parts (28.2%).

Table 4.4. World and domestic R&D distribution of the 2500 *Scoreboard* companies by sector groups for the main regions.

Sector / Region	High Share, %		Medium-high Share, %		Medium-low Share, %		Low Share, %		Total
	world	domestic	world	domestic	world	domestic	world	domestic	domestic
EU	**22.3**	**38.1**	**37.1**	**45.7**	**38.8**	**5.9**	**45.5**	**10.3**	100
US	**51.5**	**73.8**	**20.2**	**20.8**	**31.3**	**4.0**	**7.6**	**1.4**	100
Japan	**9.8**	**31.9**	**25.7**	**60.0**	**15.3**	**4.4**	**8.7**	**3.7**	100
Other countries	**16.4**	**46.9**	**17.0**	**35.0**	**14.5**	**3.7**	**38.2**	**14.4**	100
Total world	100		100		100		100		

Note : Sector groups as defined in Box 4.1.

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD

4.6 Focus on high R&D-intensive industries: the EU/US R&D gap

This section describes the main characteristics of the samples of companies based in the EU and the US for high R&D-intensive industries that are important from R&D and economic perspectives. R&D plays an important role for the competitiveness of these industries and they have a role as enablers for the whole value-chain of key sectors ranging from ICT-related industries, transport and health.

Moreover, EU based companies compared with their main counterparts present a weak structural position both in terms of number and weight of companies in most of these industries. As observed in previous *Scoreboard* editions, the EU gap in these industries is particularly sizeable and widening against the US companies. In fact trends observed over the past 10 years show a growing dominance of US companies in sectors such as Software/Internet and Biotechnology where a number of key companies are rapidly moving up the R&D rankings (see chapter 2).

Table 4.5 describes the main characteristics of the companies based in the EU and the US in three sub-sectors, namely those related with health and ICT.

The salient points from the table are the following:

- In this sample, the Pharmaceuticals sub-sector is the only one where the EU and the US have similar number of companies, R&D investment and R&D intensity.
- In the Biotechnology sub-sector, the US dominates the EU in number of companies (5 times more numerous), R&D investment (10 times larger) and larger average R&D intensity per company.
- In the ICT industries the EU/US largest gap is observed in number of companies and level of R&D investment, especially in Semiconductors and Computer Hardware, but also in Software and Internet.

Table 4.5. Sample of EU and US companies in health and ICT related sectors

Industry	# companies		R&D in 2013 (€m)		R&D intensity (%)	
	EU	US	EU	US	EU	US
Health						
Pharmaceuticals	47	46	26781.9	29150.0	13.2	14.0
Biotechnology	20	98	1238.4	12287.3	17.4	27.2
Health Care Equip. & Services	23	54	2708.2	7483.5	4.4	3.8
IT hardware						
Semiconductors	16	77	3895.6	22150.3	17.9	18.5
Computer Hardware	6	27	1081.8	12069.5	8.1	4.1
Telecommunications Equipment	12	35	9941.2	13373.8	14.6	14.2
Electronic Office Equip.	1	3	57.6	505.3	5.3	2.6
Software & services						
Software	33	86	4797.2	22413.9	14.8	15.0
Computer Services	15	46	1401.9	6904.8	5.5	6.9
Internet	2	20	97.6	8811.5	6.3	14.3
Total	**175**	**492**	**52001.3**	**135149.8**		

Source : The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD

5. The top 1000 R&D investors in the EU

This chapter discusses the R&D and economic trends of companies based in Members States of the EU. This specific analysis is based on an extended sample of companies representing the top 1000 R&D investors in the EU, i.e. the 633 EU companies included in the world top 2500 sample and 367 additional companies based in the EU. The main questions addressed are firstly about the one-year changes in R&D and economic indicators of companies based in the top 10 Member States by level of R&D investment. The second question regards the long-term trends of company results, namely the rate of growth of R&D and net sales and profitability for companies based in the top three Member States of the EU.

Finally, the performance of EU companies is analysed in terms of Value Added (company's sales less the cost of its bought-in goods and services)[19], comparing the main ratios and efficiency measures of top R&D investing sectors and companies.

Key findings

- Companies based in Germany, the top R&D investor, continued to increase R&D in 2013, at 5.8%, above the world (4.9%) and EU (2.5%) averages. Companies based in the UK showed also a significant increase of R&D (4.8%) and French companies, on the contrary, reduced R&D investment by 3.4%.
- Apart from the three top Member States, among the group of largest EU countries, those whose companies increased R&D above the EU average were Ireland (13.5%), Italy (6.0%) and Spain (4.4%). Companies based in three countries decreased R&D in 2013: Finland (-10.8%), Sweden (-0.9 %) and The Netherlands (-0.2%).
- The analysis of 10-year trends of R&D and economic results for companies based in Germany, the UK and France show the effects of the crisis in 2008-2009 and a recovery over 2010-2012, especially for the German companies. However over the past year the recovery seems stalling with companies from the three countries showing a fall in net sales. The latter is mostly due to the decrease of net sales of large companies in terms of sales but with relatively small R&D, e.g. oil companies (Total, Shell, ENI) and banks (HSBC).
- The analysis of the performance of EU companies in terms of Value Added shows significant differences both between and within sectors. The ratio of Value Added to Net Sales of the Software & Computer Services sector is more than twice that of Automobiles & Parts sector. The largest wealth creation efficiency (ratio of value-added to costs of employees and depreciation) is found in Pharmaceuticals &

[19] Definitions and assumptions taken from the UK 2009 Value Added Scoreboard (available on line at http://webarchive.nationalarchives.gov.uk/20100908131539/http://innovation.gov.uk/value_added/downloads/2009_ValueAdded_Analysis.pdf , last access 14/10/2014). To compute the value added we follow the computation formula suggested in the data document (available on line at http://webarchive.nationalarchives.gov.uk/20100908131539/http://innovation.gov.uk/value_added/downloads/2009_ValueAdded_Data.pdf , last access 14/10/2014), where is reported: "Value Added has been calculated as the aggregate of operating profit, employment costs, depreciation, amortisation & impairment. It is also equivalent to EBITDA plus employment costs"(pg 242). We relied on the "EBITDA plus employment costs" computation formula, using data download from the Orbis database. For 2013, it was possible to compute the value added for 738 out of the top 1000 R&D investors in the EU.

Biotechnology, three times more 'efficient' than the Electronic & Electrical Equipment sector. Within each sector analysed great differences are observed at company level for all value added indicators. For example, among the top 10 R&D investors in the Chemicals sector, Solvay shows the highest ratios of VA to net sales and cost of resources (50.0% and 227.5% respectively) whereas Lanxess shows the lowest ones (23.6% and 98.8% respectively).

5.1 Overview of the EU 1000 companies

The composition of the sample of the EU 1000 companies across industrial sectors and countries is found in Annex 3. This sample, as well as the global 2500, shows a high concentration of companies by sector and country. The 6 largest sectors in terms of R&D account for 50% of the companies. These sectors and the countries accounting for at least 15% of the companies each are shown in Table 5.1:

Table 5.1 Distribution of the EU 1000 companies across main sectors and countries.

Industrial sector*	Number of companies	Man countries*
Software & Computer Services	**111**	**UK 45; Germany 20; France 19**
Industrial Engineering	**110**	**Germany 40; UK 14; SE 13**
Pharmaceuticals & Biotechnology	**105**	**UK 30; France 17; DE 11**
Electronic & Electrical Equipment	**76**	**UK 20; Germany 16; FR 10**
Technology Hardware & Equipment	**49**	**UK 13; Sweden 8; Germany 7**
Automobiles & Parts	**45**	**Germany 17; UK 9; FR/IT 6**
Total	***496***	

** Six largest sectors in terms of R&D worldwide and countries whose companies account for more than 15% of the sector within the EU 1000 sample.*

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.

5.2 Trends of companies in the top 10 Member States of the EU

There are 904 companies based in the top 10 Member States accounting for 97.4 % of the total R&D of the 1000 EU sample (see table 5.2).

The overall performance of the EU group is largely driven by the performance of companies based in Germany, France and the UK, accounting for 68.4 % of the total R&D and 68.5 % of total net sales (see Tables 5.2 and 5.3).

The 221 German companies in the EU 1000 sample, accounting respectively for 36.3% and 26.7% of the total R&D and net sales, increased R&D by 5.8% but decreased net sales by 1.0%. These results reflect to a large extent the performance of the German companies in the Automobiles & Parts sector (+9.7% in R&D and +2.4% in net sales). This sector accounts for more than 50% of R&D and 33% of net sales of the group of German companies.

The 120 companies based in France, accounting respectively for 17.2% and 18.1% of the total R&D and net sales of the EU 1000 sample, reduced R&D investment by 3.3% and net sales by 4.0%. The largest R&D investing sectors of the French sample reduced both R&D and net sales, Automobiles & Parts (-8.9% and -2.0%) and Pharmaceuticals & Biotechnology (-1.4% and -3.8%).

The 258 companies from the UK, accounting for 14.9% and 23.7% of the total R&D and net sales of the EU 1000 sample, increased R&D investment by 4.9% and reduced net sales by 0.4%. The largest R&D investing sectors of the UK sample presented contrasting figures, Pharmaceuticals & Biotechnology (-0.4% in R&D and -2.0% in net sales) while Automobiles & Parts significantly increased both R&D and net sales (9.4% and 6.9%).

Apart from the group of the three top countries, among the group of largest EU countries, those whose companies increased R&D above the EU average were Ireland (13.5%), Italy (6.4%) and Spain (4.4%). Companies based in three countries decreased R&D in 2013: Finland (-10.8%), Sweden (-0.5 %) and The Netherlands (-0.1%). In term of net sales, most countries showed negative results, with the exception of companies based in Ireland (9.9%) and Denmark (2.0%). The poorest figures in net sales were for companies based in Italy (-5.2%) and Spain (-4.8%).

It is important to remember that in many countries, the aggregate country indicators depend to a large extent on the figures of a very few firms. This is due, either to the country's small number of companies in the *Scoreboard* or to the concentration of R&D in a few large firms. For example:

- The R&D growth of Fiat (2.0%), accounting for more than 38 % of the R&D of companies based in Italy, contributed a significant part of the R&D growth of that country.
- Two companies from the Automobiles & Parts sector, accounting for 27.5% of the R&D of companies based in Germany, contributed a large part of the that country's R&D growth: Volkswagen (23.4%) and BMW (21.3%).

Table 5.2 R&D trends of companies based in the top 10 EU Member States

Country	No. of companies	R&D Share within EU	R&D one year growth, %	Net sales One year growth, %
Germany	221	36.3	5.8	-1.0
France	120	17.2	-3.3	-4.0
UK	258	14.9	4.9	-0.4
The Netherlands	49	7.7	-0.1	0.3
Sweden	90	5.8	-0.5	-0.8
Italy	47	5.3	6.4	-5.2
Finland	45	3.0	-10.8	-4.2
Spain	21	2.6	4.4	-4.8
Denmark	32	2.3	2.3	2.0
Ireland	21	2.3	13.5	9.9
Total E-10	904	97.4	2.5	-1.8

For the sample of 1000 EU companies.

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.

Table 5.3. Ranking of top 15 industrial sectors by one-year R&D growth for the EU 1000 companies and related data for German, French and UK companies.								
Rank	Sector	EU 1000 one-year R&D growth (%)	Germany-221 R&D change (%)		France-120 R&D change (%)		UK-258 R&D change (%)	
			1 year	3 years	1 year	3 years	1 year	3 years
1	Fixed Line Telecommunications	8.7	45.2	-7.3	-3.9	-2.6	1.8	-5.7
2	Software & Computer Services	8.2	1.5	8.6	11.4	22.5	8.8	9.5
3	Leisure Goods	7.1	15.0	-4.4			15.5	18.9
4	Oil & Gas Producers	6.7			17.9	9.9	3.0	4.9
5	Automobiles & Parts	6.2	9.7	13.6	-8.9	-0.4	9.4	10.3
6	Electronic & Electrical Equipment	5.3	1.6	3.5	7.7	5.5	11.7	10.3
7	Banks	4.9	9.8	11.8	-2.6	3.0	21.5	12.1
8	Health Care Equipment & Services	4.1	-6.2	17.1	-11.2	13.1	9.2	12.4
9	Aerospace & Defence	3.7	0.7	0.6	13.1	20.9	12.7	4.1
10	Chemicals	3.2	2.2	6.8	-4.0	3.0	6.7	8.4
11	General Industrials	2.2	11.2	13.9	-5.3	-0.3	18.4	7.7
12	Construction & Materials	2.2	4.0	6.3	-2.4	16.2	3.7	1.3
13	Industrial Engineering	1.1	5.1	8.3	4.2	2.0	16.3	14.2
14	Pharmaceuticals & Biotechnology	0.8	0.6	2.3	-1.4	3.9	-0.4	0.4
15	Technology Hardware & Equipment	-5.4	3.1	5.0	-3.0	-3.0	7.8	18.3
	Total	**2.5**	**5.8**	**9.1**	**-3.3**	**3.0**	**4.9**	**5.0**

Source: The 2014 EU Industrial R&D Investment Scoreboard.

European Commission, JRC/DG RTD

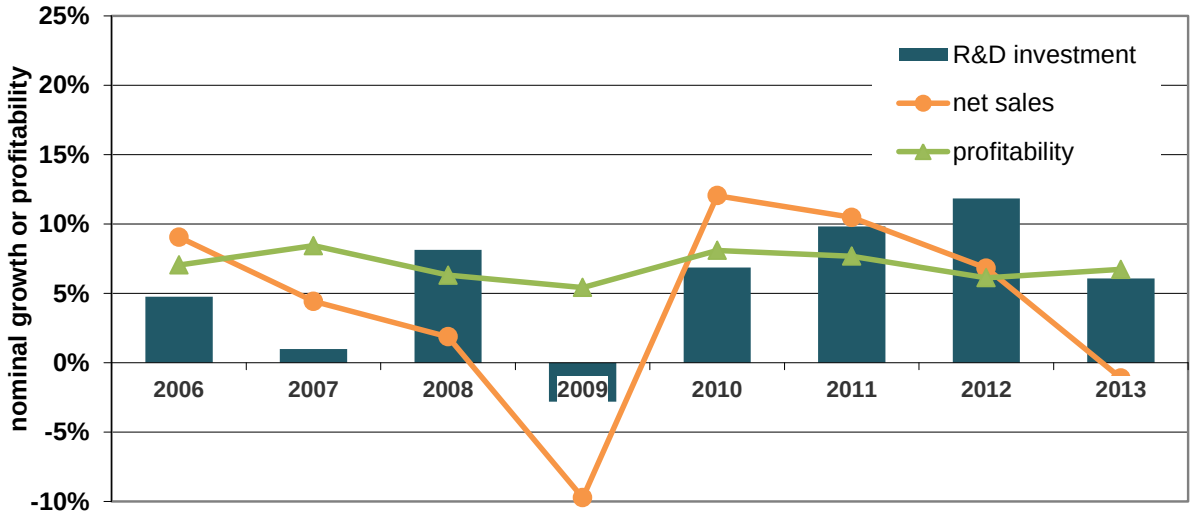
5.3 Long-term performance of companies based in the 3 top EU Member States

The annual growth rates of R&D investment and net sales and profitability of companies based in Germany, France and the UK is provided respectively in figures 5.1, 5.2 and 5.3 for the period 2005-2013. These figures are based on our history database comprising R&D and economic indicators over the whole 2005-2013 period from the EU 1000 dataset, including 150 from Germany, 87 from France and 159 from the UK.

The trends observed in these figures show the behaviour of these companies including the effects of the crisis that began in 2008. The following points are observed:

- Companies based in Germany showed a good performance over the period 2010-2012, recovering the levels of growth prior to the crisis, especially in terms of R&D. In the last period, they continued to increase R&D a slower pace while maintaining a stable level of profitability but showing a decline in net sales.
- Companies based in France showed a recovery in R&D and net sales in 2010-2011, however, over the last period they presented an important decline in both net sales and R&D growth. The average profitability of the French companies shows a decreasing trend since 2011.
- Companies based in the UK showed a strong recovery of R&D and net sales in 2010-2011 that was broken up in 2012. Over the last period their R&D investment resumed to grow at significant pace but with a level of net sales practically unchanged. The average profitability of the UK companies, like their French counterparts, shows a decreasing trend since 2011.

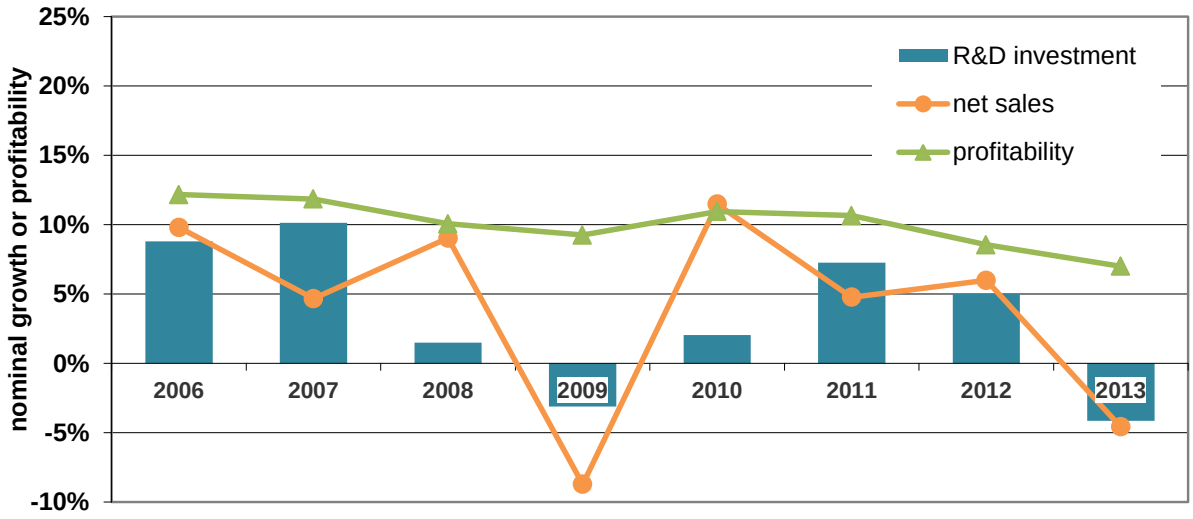
Figure 5.1. One-year R&D investment and net sales growth and profitability by the German companies.



Note: For 150 out of the 221 German companies in the EU1000 with data for the whole period. Profitability is the ratio of operating profit to net sales.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

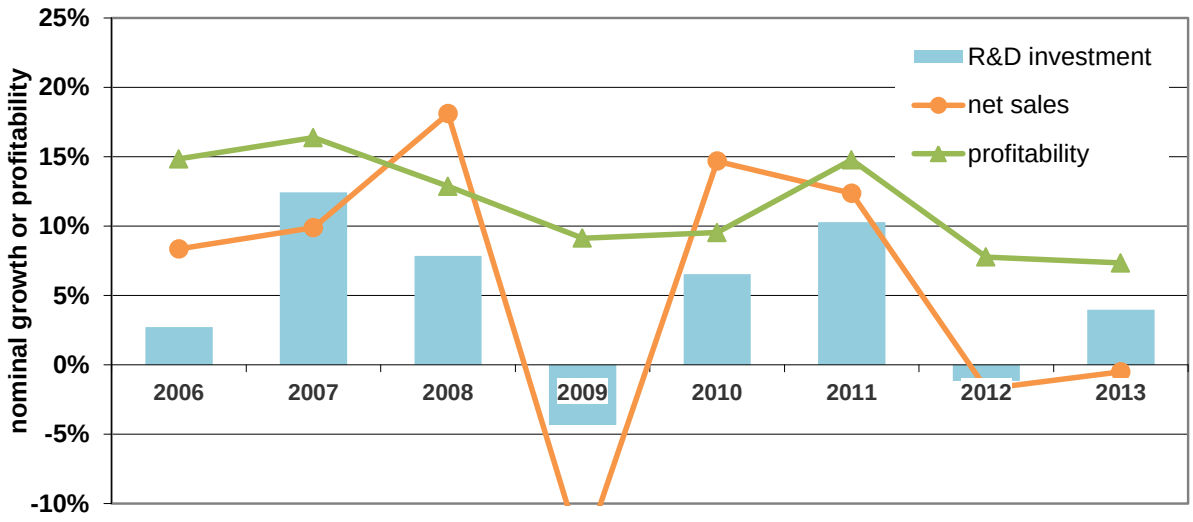
Figure 5.2. One-year R&D investment and net sales growth and profitability by the French companies.



Note: For 87 out of the 120 French companies in the EU1000 with data for the whole period. Profitability is the ratio of operating profit to net sales

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Figure 5.3. One-year R&D investment and net sales growth and profitability by the UK companies.



Note: For 159 out of the 258 UK companies in the EU1000 with data for the whole period. Profitability is the ratio of operating profit to net sales.

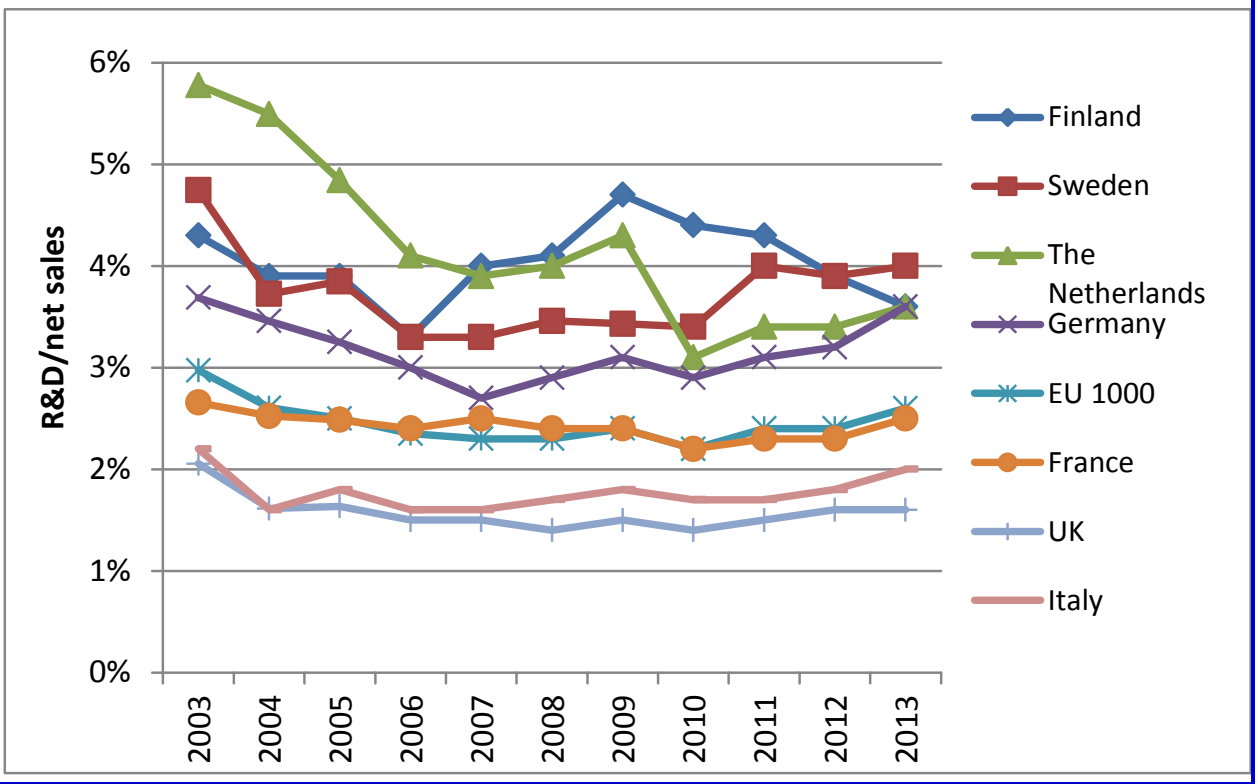
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

5.4 R&D intensity trends by companies based in selected Member States

In 2013, for the third consecutive year, the average R&D intensity of the EU-1000 companies increased because of the higher increase of R&D investments compared to that of net sales, 6.1% vs. 4.3% (see Figure 5.4).

It is important to remember that a few large but low R&D intensity companies have a big effect on some country average R&D intensities. One example is Shell and BP for the UK. In the 2013, these companies contributed 40.4% of the UK's *Scoreboard* company sales, so if these two companies had been left out, the average R&D intensity of UK companies would had increased by 55% (from 1.66% to 2.58%). Large banks such as HSBC and mining companies have a similar but smaller effect in the UK.

Figure 5.4. Trends in R&D intensities for EU *Scoreboard* companies in selected Member States.



For the EU1000 companies in each of the eleven Scoreboards 2004-2014

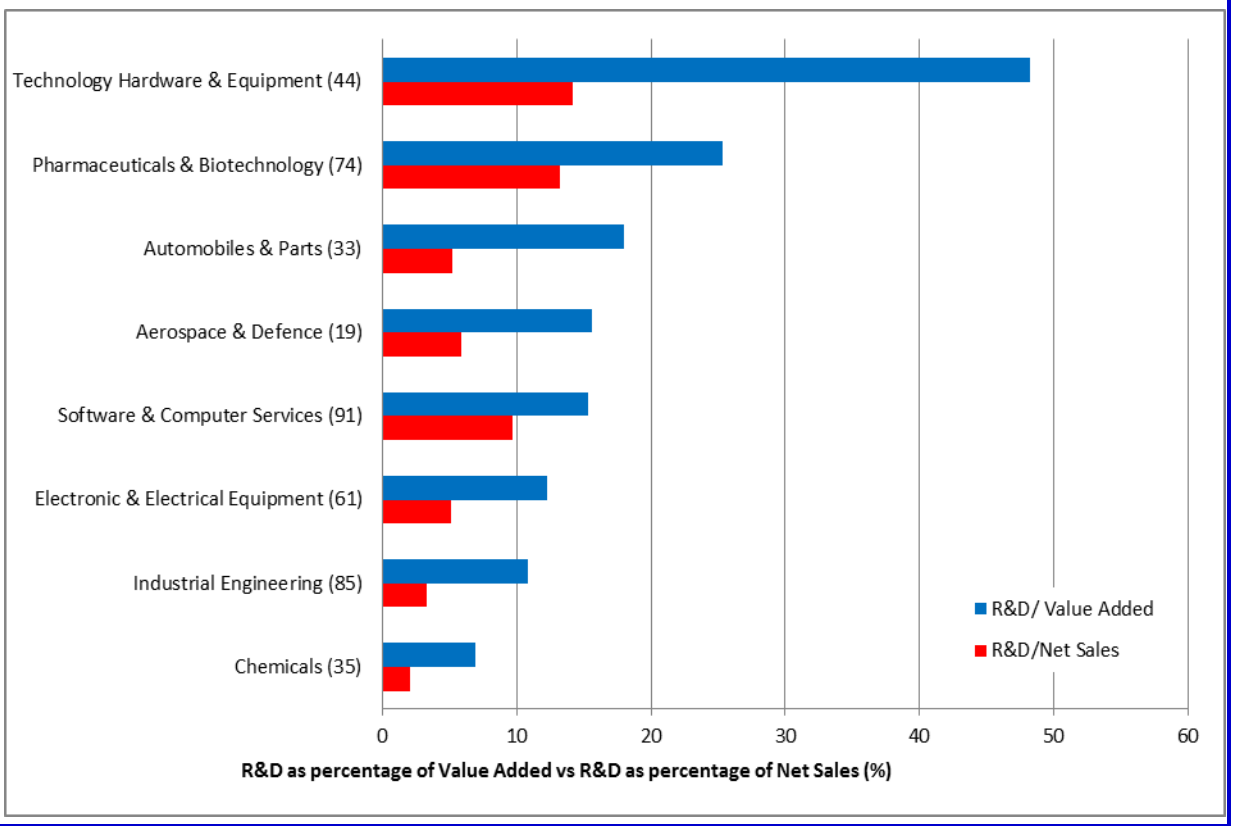
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

5.5 Performance of companies in terms of Value Added.

In this section, the performance of the top 1000 R&D investors in the EU is analysed in terms of their 2013 Value Added for the largest R&D investors and sectors.

The R&D intensities, expressed as a percentage of Value Added and net sales are reported for eight selected sectors in Figure 5.5. This figure shows that the differences between the two R&D intensities vary significantly from the Automobiles & Parts sector, showing the largest difference, to the Software & Computer Services sector showing the lowest. This reflects sector-specific differences of the ratio Value Added to net sales discussed in the following paragraphs.

Figure 5.5 R&D intensities in terms of Value Added and Net Sales by sector

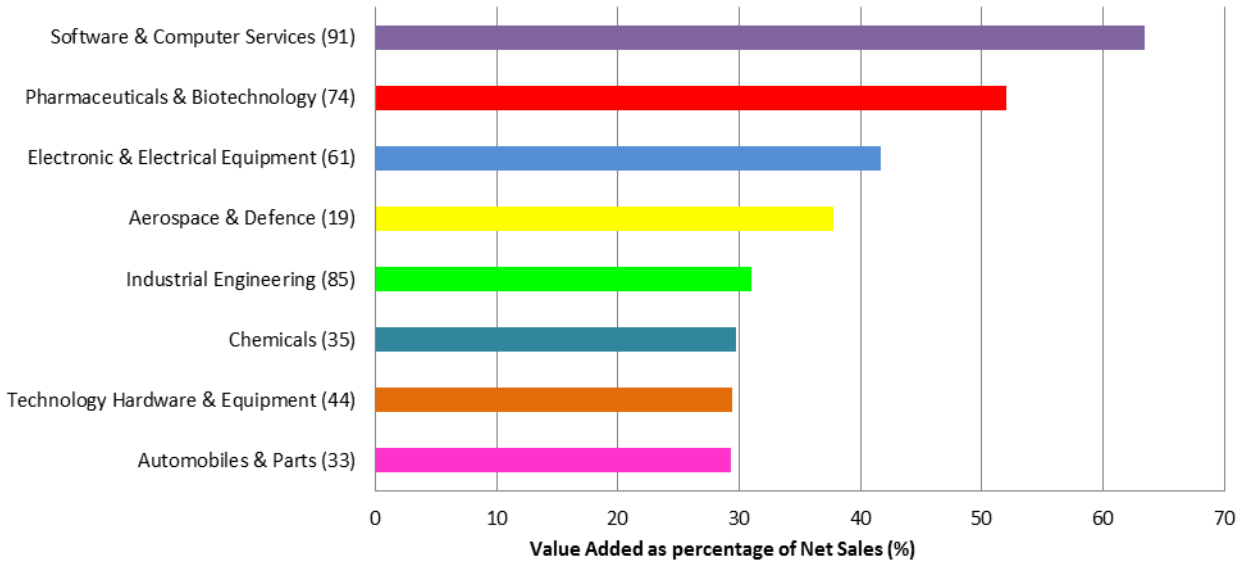


Note: Only the top 8 sectors in terms of R&D investment are included. Between brackets the number of companies per sector for which it was possible to compute the ratio. Overall 442 companies out of 564.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Value Added expressed as a percentage of net sales is reported for the eight selected sectors in Figure 5.6. This gives a first idea of the differences among sectors in terms of Value Added. The sector "Software & Computer Services" is the one with the highest value (63.5 %), while "Automobiles & Parts" is the one with the lowest (29.3%).

Figure 5.6. Value Added as percentage of Net Sales by sector

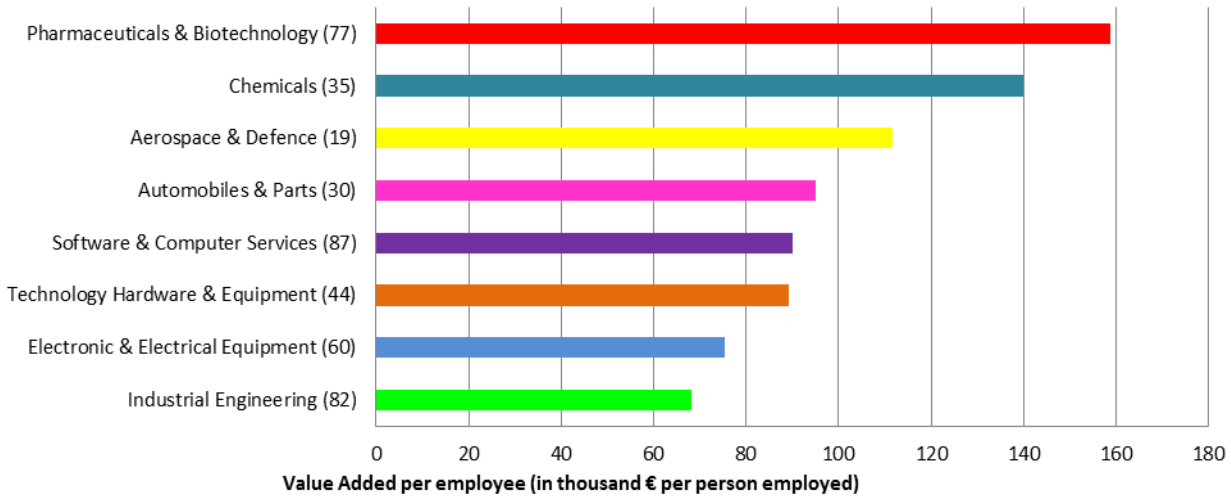


Note: Only the top 8 sectors in terms of R&D investment are included. Between brackets the number of companies per sector for which it was possible to compute the ratio. Overall 442 companies out of 564.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

Value Added can be used to compute two interesting measures of performance. The first one it the Value Added per employee, which is a measure of labour productivity (reported in Figure 5.7). In this case the sector showing the highest value is Pharmaceuticals & Biotechnology (€158.7k per employee), while Industrial Engineering and Electronic & Electrical Equipment show the lowest (€80k per employee). Differences among sectors can be inflated in cases where one or more companies in a sector have a high number of part time and/or low paid employees.

Figure 5.7. Value Added per employee (in € per person employed) by sector

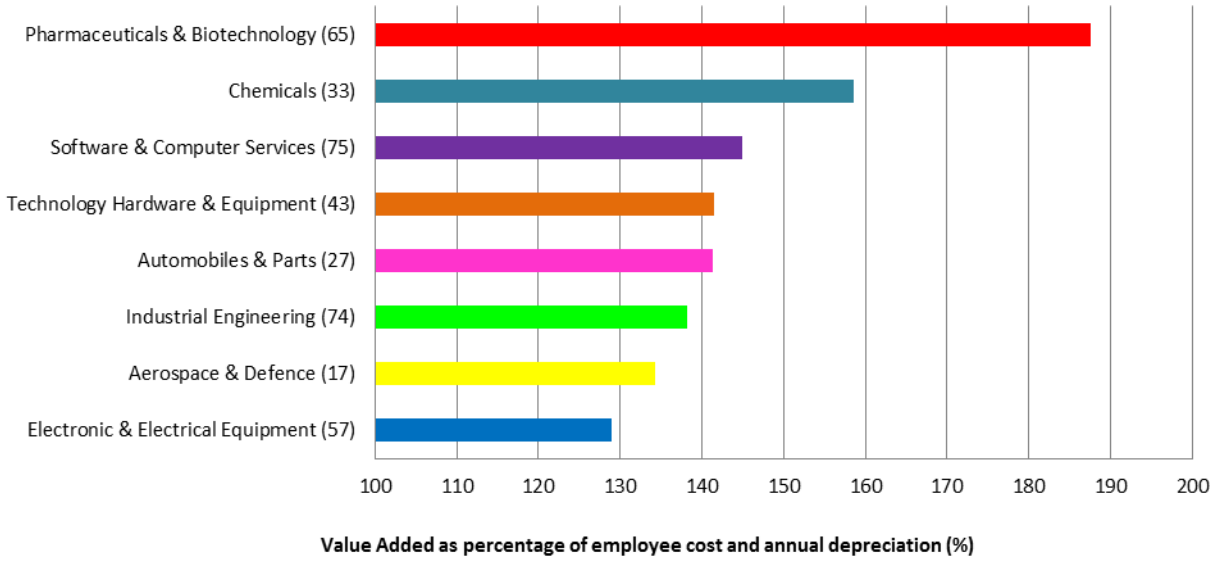


Note: Only the top 8 sectors in terms of R&D investment are included. Between brackets the number of companies per sector for which it was possible to compute the ratio. Overall 434 companies out of 564.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

The second one is the Value Added as a percentage of employee costs plus capital depreciation, which is a measure of wealth creation efficiency (reported in Figure 5.8). As for labour productivity, Pharmaceuticals & Biotechnology (188%) and Chemicals (158%) are the sectors with the highest values, while in this case the lowest values are shown by Electronic & Electrical Equipment (128%) followed by Aerospace & Defence (134%). Unlike Value Added per employee, the measure of Value Added as a percentage of employee costs plus capital depreciation is not affected by the problem of exaggerated sectorial differences due to the presence of part time or low paid workers, given it's based on total costs and not on headcount. If for a sector or a company the Value Added as a percentage of employee costs plus capital depreciation is 100%, then the sector or the company is creating as much Value Added as the resources used to produce it. So to be sustainable in the long run, a sector or a company needs a value significantly over 100% (let's say 120% or more). This is because need to build up reserves to survive temporary dips in sales and profits due to recessions or business/product cycles.

Figure 5.8. Value Added as percentage of employee costs and capital depreciation by sector



Note: Only the top 8 sectors in terms of R&D investment are included. Between brackets the number of companies per sector for which it was possible to compute the ratio. Overall 391 companies out of 564.

Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

The figures briefly discussed at sector level actually hide a great variation within each sector at company level. Table 5.4 reports the values of the three ratios computed for the top 10 R&D investing companies in each of the top eight sectors as well as the R&D intensities calculated in terms of Value Added and net sales.

A great variation can be observed in each of them for all the three indicators.

For example, looking at the three top sectors of Figure 5.8 ("Pharmaceuticals & Biotechnology", "Chemicals" and "Software & Computer Services") and comparing the companies within each sector according to their efficiency (measured as Value Added as a percentage of employee costs plus capital depreciation), gives an idea of how big these differences are.

The rank of the 10 companies in the table according to their efficiency, in the "Pharmaceuticals & Biotechnology" sector, shows that the first one (Shire), is 6.5 times more efficient than the last one (Boehringer Ingelheim). Excluding the first and the last, the difference between the second (Actavis) and the ninth (Bayer) in terms of efficiency is still significant (3.1 times).

Replicating the same example for the "Software & Computer Services" sector provides a similar picture. The difference in efficiency between the first (AVG technologies) and the tenth (Sopra) of the rank is 7.5 times, while the difference between the second (Amdocs) and the ninth (Indra Sistemas) is 4.0 times.

In the "Chemicals" sector, the differences are less extreme, but they are still significant. There is a 2.3 times efficiency difference between the first (Solvay) and the tenth (Laxness) company of the rank and a 1.6 times difference between the second (Johnson Matthey) and the ninth (Wacker Chemie).

Table 5.4 R&D intensities in terms of Value Added and Net Sales and ratios of Value Added to Net Sales, employees and costs of resources.

Company	Country	R&D/Net Sales (%)	R&D/VA (%)	VA/Net Sales (%)	VA/EMP (€ per person employed)	VA/(Employee Costs + Depreciation) (%)
Aerospace & Defence						
AIRBUS	Netherlands	6.0	20.2	29.9	122.9	120.3
FINMECCANICA	Italy	10.9	30.8	35.4	88.8	115.8
SAFRAN	France	8.0	16.8	47.5	103.9	143.9
ROLLS-ROYCE	UK	4.3	11.0	38.7	130.0	148.5
DASSAULT AVIATION	France	10.2	17.2	59.6	236.2	267.1
ZODIAC AEROSPACE	France	6.7	14.4	46.6	72.0	150.9
BAE SYSTEMS	UK	1.1	2.5	43.1	111.3	135.3
SAAB	Sweden	5.6	10.8	51.9	98.4	117.6
MTU AERO ENGINES	Germany	3.7	12.8	28.7	123.3	156.1
MEGGITT	UK	6.7	10.8	62.7	111.0	171.5
Automobiles & Parts						
VOLKSWAGEN	Germany	6.0	20.3	29.4	101.2	135.5
DAIMLER	Germany	4.6	15.7	29.1	125.0	157.9
BMW	Germany	6.3	22.9	27.5	189.6	182.3
CONTINENTAL	Germany	5.8	15.7	36.7	68.8	145.4
RENAULT	France	4.4	20.0	22.0	73.8	117.2
VALEO	France	6.4	20.0	32.1	52.0	130.7
MICHELIN	France	3.2	7.7	41.1	74.8	132.9
GKN	UK	2.7	7.4	37.3	74.0	127.8
RHEINMETALL	Germany	4.9	13.8	35.6	77.9	112.2
PIRELLI	Italy	3.2	8.7	37.3	60.4	154.0
Chemicals						
BASF	Germany	2.5	9.6	26.0	171.3	162.9

DSM	Netherlands	5.5	18.4	30.0	118.4	140.0
EVONIK INDUSTRIES	Germany	3.0	8.1	37.1	141.8	132.7
AKZO NOBEL	Netherlands	2.2	6.9	31.3	93.8	135.9
SOLVAY	Belgium	2.2	4.3	50.0	218.8	227.5
L'AIR LIQUIDE	France	1.3	3.0	42.3	128.2	165.4
LANXESS	Germany	2.2	9.5	23.6	112.8	98.8
WACKER CHEMIE	Germany	3.9	9.7	40.2	112.4	106.6
JOHNSON MATTHEY	UK	1.3	12.0	10.4	120.4	171.9
ARKEMA	France	2.4	8.1	29.3	132.3	147.3
Electronic & Electrical Equipment						
SIEMENS	Germany	6.0	13.2	45.6	94.4	122.4
SCHNEIDER	France	3.5	8.1	42.6	61.5	153.8
TOMTOM	Netherlands	19.2	40.1	47.9	125.6	178.3
AGFA-GEVAERT	Belgium	5.1	12.2	41.6	108.0	120.6
SMITHS	UK	3.6	7.7	47.2	75.3	160.7
INGENICO	France	8.1	18.9	43.0	126.3	171.2
BARCO	Belgium	9.3	27.0	34.4	100.2	130.0
SPECTRIS	UK	7.4	13.6	54.2	106.0	150.9
LEONI	Germany	2.7	10.0	26.8	17.1	121.2
NEXANS	France	0.0	0.1	18.5	48.0	91.3
Industrial Engineering						
VOLVO	Sweden	6.9	26.3	26.3	85.4	117.7
ALSTOM	France	5.0	13.5	36.9	86.8	121.0
SANDVIK	Sweden	3.8	8.6	44.1	90.5	131.6
HEXAGON	Sweden	11.3	18.3	61.6	107.5	166.2
ATLAS COPCO	Sweden	2.9	6.3	45.6	107.6	189.7
WARTSILA	Finland	4.7	12.6	37.0	92.4	147.5
SKF	Sweden	2.9	29.4	9.9	14.7	270.5
CLAAS	Germany	5.2	19.7	26.2	103.5	154.1
DANFOSS	Denmark	4.1	9.5	43.2	86.5	139.3
KRONES	Germany	5.8	15.3	37.9	87.0	123.9
Pharmaceuticals & Biotechnology						
SANOFI-AVENTIS	France	14.4	25.2	57.3	168.3	193.0
GLAXOSMITHKLINE	UK	13.1	20.6	63.8	202.4	200.9

BAYER	Germany	8.1	19.0	42.7	151.7	159.4
ASTRAZENECA	UK	17.2	32.6	52.7	190.6	215.5
BOEHRINGER INGELHEIM	Germany	19.5	39.9	48.8	144.7	145.8
NOVO NORDISK	Denmark	14.0	19.9	70.2	207.1	218.0
MERCK DE	Germany	13.6	22.3	60.8	176.8	190.0
UCB	Belgium	25.6	47.8	53.6	187.2	160.5
SHIRE	UK	18.0	45.2	39.9	285.3	959.8
ACTAVIS	Ireland	7.1	37.2	19.1	62.6	494.0
Software & Computer Services						
SAP	Germany	13.6	17.7	76.8	194.1	164.8
AMADEUS	Spain	16.3	24.8	65.7	194.2	177.0
DASSAULT SYSTEMES	France	18.2	41.5	43.8	84.9	301.2
INDRA SISTEMAS	Spain	9.8	16.4	60.0	45.3	115.7
AMDOCS	UK	7.2	35.4	20.3	23.7	458.7
SAGE	UK	10.5	13.9	75.5	93.7	161.6
SOFTWARE AG	Germany	11.1	13.7	81.0	150.4	145.6
WINCOR NIXDORF	Germany	4.0	12.0	33.5	93.5	120.1
SOPRA	France	5.7	7.4	77.2	64.0	113.6
AVG TECHNOLOGIES	Netherlands	15.0	42.2	35.5	142.6	849.0
Technology Hardware & Equipment						
ERICSSON	Sweden	13.6	102.0	13.3	191.2	549.7
NOKIA	Finland	14.7	70.6	20.9	88.7	108.5
ALCATEL-LUCENT	France	16.4	44.9	36.6	84.9	103.7
STMICROELECTRONICS	Netherlands	23.2	49.7	46.8	60.4	92.2
SEAGATE TECHNOLOGY	Ireland	8.4	28.2	29.9	57.4	480.4
ASML HOLDING	Netherlands	16.0	32.1	49.9	252.7	214.0
INFINEON TECHNOLOGIES	Germany	15.0	26.5	56.5	81.3	120.1
NXP SEMICONDUCTORS	Netherlands	13.3	22.5	58.9	80.0	159.3
CSR UK	UK	28.2	73.0	38.7	127.2	118.3
DIALOG SEMICONDUCTOR	UK	17.4	53.2	32.6	194.2	180.4

Note: Only 10 companies for each of the top 8 sectors in terms of R&D investment are included. Companies selected according to their position in the R&D investment ranking within each sector. Only companies for which was possible to compute the three indicators were included

Source: The 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.

6. Potential leading innovators in the EU

This chapter presents an analysis of the R&D and economic performance of the EU companies at the lower reaches of the R&D ranking. The objective is to identify potential leading innovators and to understand the factors underlying successful trajectories.

The analysis is based on a sample of 500 companies from the lower part of the 1000 EU R&D company ranking in the 2014 *Scoreboard.* This sample consists of middle-size companies that invested in R&D between 5 and 50 million Euros in 2013.

The first section characterises a filtered sample of companies relying on a set of corporate R&D performances between 2005 and 2013. The investigation goes further to identify top companies with the best R&D and economic performance.

The last section analyses the evolution of companies in the EU R&D ranking over the period 2006-2013. It focuses on the mergers and acquisitions (M&As) and foreign direct investments (FDIs) in the dynamics of the selected companies.

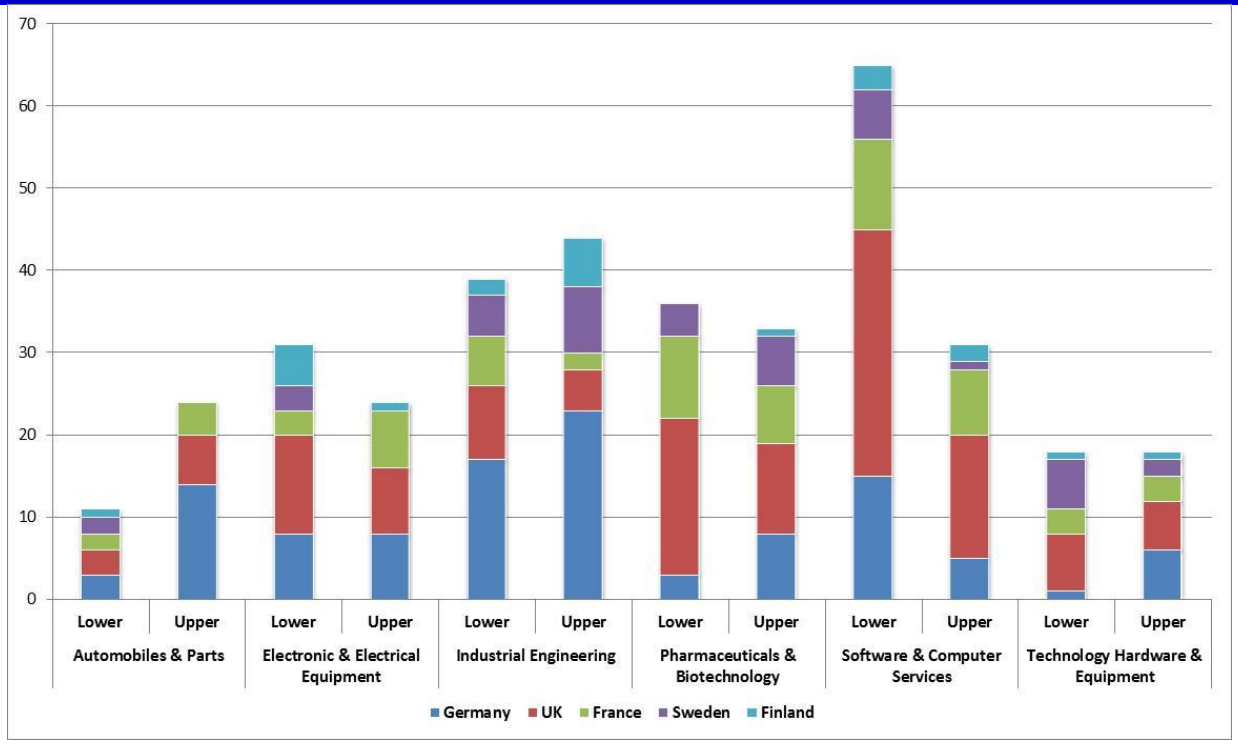
Key findings

- About a half of the examined sample of companies (248 high and medium-high technology companies out of the 500 at the bottom of the R&D ranking) showed R&D intensity higher than 1% and a significant R&D growth over 2005-2013. Two-thirds of these companies operate in ICT- and health-related sectors and concentrate in a few Member States, namely the United Kingdom, Germany, Sweden and France.
- The top 37 companies showing the best R&D and economic performance operate mainly in Software & Computer Services (8), Electronic & Electric Equipment (6) and Industrial Engineering (6). The top countries are similar to that of the first selected sample, but Sweden now comes second among the highest performers. Within the top companies, 18 were found to have engaged in FDIs projects, mainly in China, the US, Romania and Thailand.
- Out of the 482 companies at the bottom of the 2007 R&D *Scoreboard* (2006 data), 181 companies survived and continue to be in the 2014 *Scoreboard*. Of the remaining companies, 127 have been acquired or merged.

Overview of the EU 500 lower reaches

The distribution of the lower reaches of the *Scoreboard* shows a high concentration at the country and sector levels (see Figure 6.1). Five countries, Germany, the United Kingdom, France, Sweden and Finland account for about 80% of the total number of companies in the selected six sectors (about 70% of the upper reaches of the EU 1000). The United Kingdom, Germany, France and Sweden account respectively for about 30%, 20%, 14% and 10% of the companies.

Figure 6.1 Distribution of the upper and lower reaches of EU 1000 in top countries *(selected sectors)*



Note: 374 companies – Industrial classification: ICB 3 digit
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD

This group of EU companies, as well as the global 2500, shows a high concentration of companies by sector and country. The 9 largest sectors account for about two-thirds of the 500 companies. These sectors and the associated most representative countries are presented below:

Selected sectors	Total companies	Top countries (# companies) and sector concentration *(1)*	
Software & Computer Services	72	UK 30, Germany 15, France 10	76%
Industrial Engineering	54	UK 9, Germany 17	48%
Pharmaceuticals & Biotechnology	50	UK 19, Germany 17	72%
Electronic & Electrical Equipment	39	UK 12, Germany 8	51%
Support Services	27	UK 15, Germany 9	89%
Construction & Materials	24	Germany 5, Belgium 4	38%
General Industrials	22	UK 6, Sweden 6, Germany 5	77%
Technology Hardware & Equipment	22	UK 7, Sweden 6	59%
Chemicals	21	UK 7, Sweden 4, Germany 4	71%
Total	***331***	***215***	***65%***

(1) Sector shares of the top countries (number of companies)
Source: The 2014 EU Industrial R&D Investment Scoreboard.
European Commission, JRC/DG RTD.

6.1 High-performance R&D investors in the EU 500 lower reaches

This section introduces a first distinction of companies on the basis of several criteria detailed in the Box 6.1. An initial criterion, the R&D intensity, separates the companies according to the relative level of resources devoted to R&D. A second classification considers the growth patterns of corporate R&D investments. Here the analysis accounts for both the short and longer term changes in R&D investments. A third focus is made on companies that operate in high and medium-high technology companies. The application of such criterion intends to address the relative shortfall of EU R&D spending, particularly in high and medium-high technology industries.

Box 6.1 Selection of high-performance EU companies

The following criteria are considered :

(1) The R&D intensity: an initial distinction is made at a 1% threshold of corporate R&D intensity in 2013. Among the EU 500 lower reaches companies, 381 companies have a value of **R&D intensity superior to 1%**.

(2) The growth pattern of R&D investment: companies are further excluded on the basis of their pattern of R&D growth over and across periods. The **average of the annual growth rates (AAGr) and the compound annual growth rate (CAGr) of R&D investments** are computed for the period 2005-2013 for the first restricted sample. The following table presents the distribution of negative and positive corporate growth rates according to the computational method considered.

(1)	Number of positive corporate rates	Number of negative corporate rates	Number of overlapping positive and negative corporate rates
Average of Annual Growth rates (AAGr)	343	35	# Positive rates: 318 # Negative rates : 34
Compound Annual Growth rate (CAGr)	319	59	

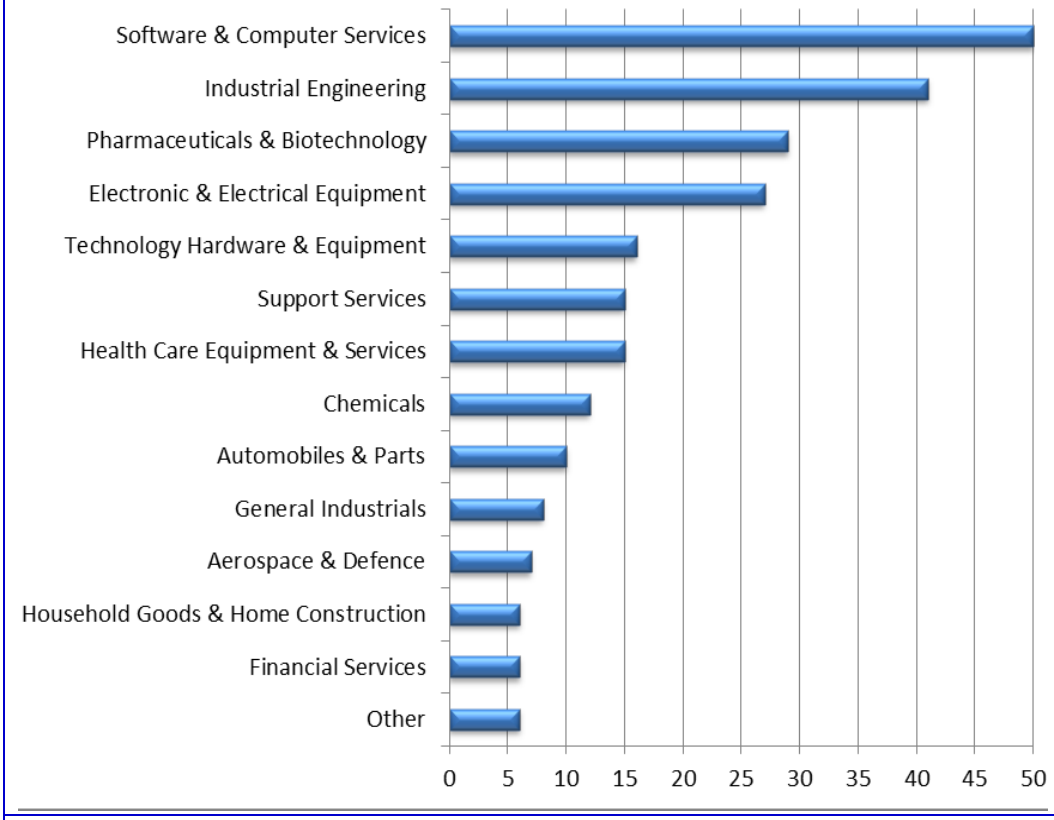
(1) Total : 378 companies - three firms in the 381-companies sample enter in 2013 in the ranking

In order to consider the performances of companies on the short and longer term, only companies with a positive average of the annual growth rates and a positive compound annual growth rate of R&D expenditures are maintained in the sample. The combination of these two indicators allows attenuating the potential impact of the high annual fluctuations observed. On the same basis, companies that enter in the ranking in the last year are not included, as well as companies with few available evidence with respect to the R&D and Net sales growth.

(3) High and medium-high technology sectors: only the companies that operate in **high and medium-high technology industries** are maintained in the sample.

The application of the above-mentioned filters leads to a sample of 248 high-performances EU companies, out of the 500 originally considered. This sub-group includes 119 companies that operate in high-technology sectors and 129 in the medium-high technology sectors. The Figure 6.2 shows the distribution of the companies by industrial sector.

Figure 6.2 Sector distribution of high R&D performers



Note: 248 companies – Industrial classification: ICB 3 digit
'Other' include two companies in each of the sectors of Leisure goods, Personal goods and Travel and leisure
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

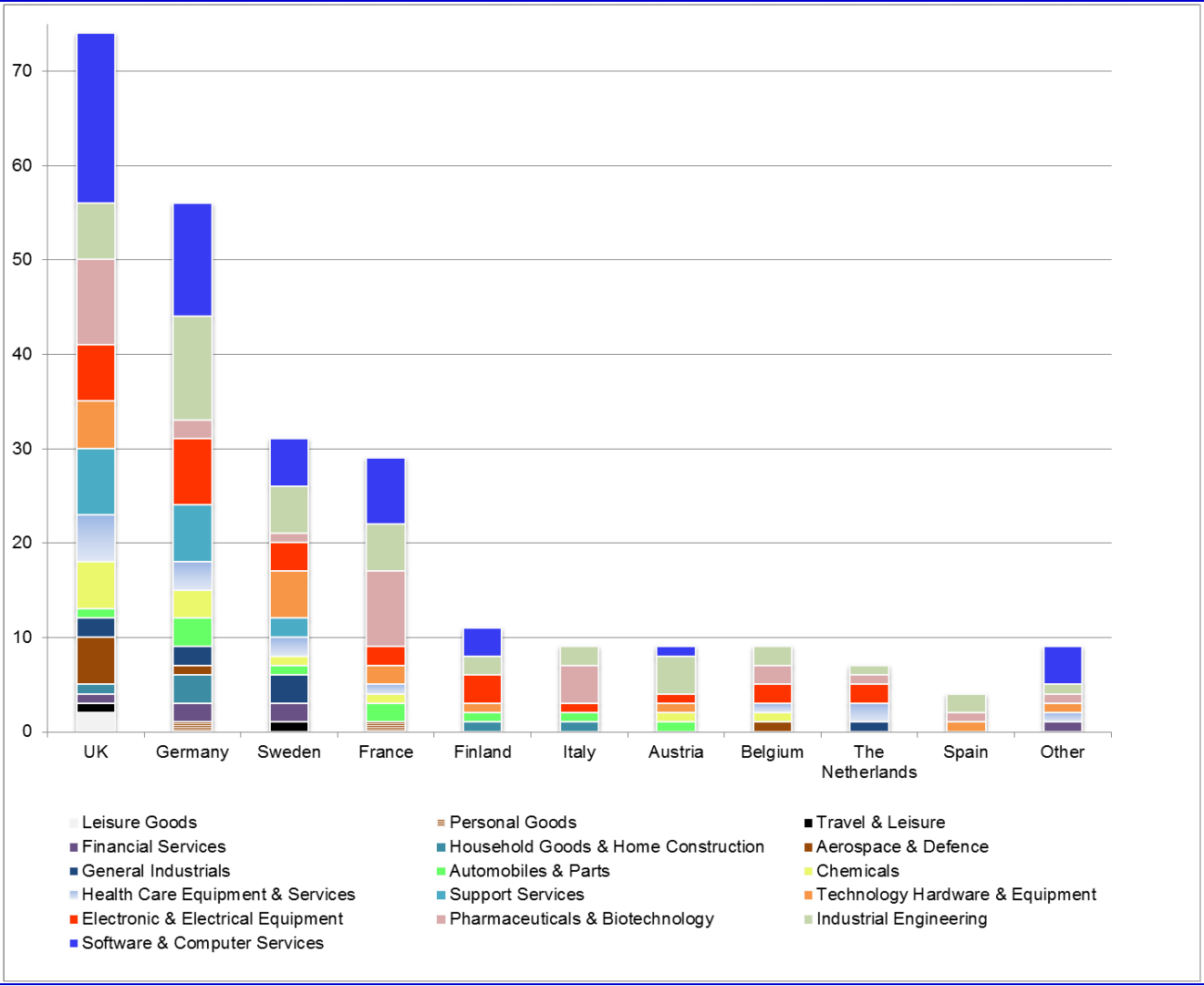
The sector distribution reveals that:

- As with the initial sample of companies, this sub-group shows a high concentration pattern. Indeed the top four sectors are identical for the two samples.
- About half of these companies operate in three sectors (48.4%) including Software and computer services, Industrial engineering and Pharmaceuticals and biotechnology, respectively. This proportion rises to two-thirds of the filtered sample when the Electronic and electrical equipment and Technology hardware and equipment sectors are additionally taken into account.
- Relatively less representative industries, for which the total number of companies is below 10, include notably the sectors of General Industrials, Aerospace & Defence, Household Goods and Home Construction and Financial Services.

The Figure 6.3 compares the sector distribution of companies by country of origin. The following points can be observed:

- The country distribution shows a very high concentration in two countries, namely the United Kingdom (29.8% of the 248 companies) and Germany (22.6%), which together account for more than half of the EU R&D investors selected. Besides these two, one fourth of these companies come from Sweden (12.5%) and France (11.5%).
- The countries exhibit different sector distributions of companies with a prevalence of two to four sectors, revealing an important concentration at the individual country level.
- In general countries with a high number of companies are also those which display the broadest coverage with respect to sector origin. Indeed the UK, German and Sweden groups of companies are present respectively in 15, 13 and 12 sectors out of the 16 considered here.

Figure 6.3. Distribution of the EU High-performance R&D investors by country and sector



Note: 248 companies – Industrial classification: ICB 3 digit
Source: The 2014 EU Industrial R&D Investment Scoreboard
European Commission, JRC/DG RTD.

6.2 The top EU potential leading innovators

This second section presents the finest sample which includes 37 EU R&D investors from the lower reach with the most outstanding performances in terms of R&D and economic indicators. The selection of the top companies is made on the basis of the following criteria:

- 100 out of 248 companies have a compound annual growth rate of R&D superior to 15%.
- Among these R&D investors, only the companies with relatively higher performances with respect to their net sales and operating profits are further maintained in the sample. In other words the focus is made on companies with a compound annual growth rate of net sales above 10% (2010-2013) and positive operating profits in the last year.

The Table 6.1 gives more details on the sector of origin, the R&D and economic performances (net sales, employment and operating profits) of the top 37 EU potential leading innovators meeting these conditions and having an R&D intensity superior to 2%. The top companies identified are ranked according to their level of R&D investments (or equivalent rank in the top 1000 EU companies). The following points can be observed:

- Companies are equally distributed across medium-high and high technology sectors (resp. 19 and 18 companies).
- The group of top companies shows the same country distribution as the 248-companies sample, with UK, Sweden and Germany accounting for more than two thirds (27 companies). Note however that Sweden accounts for 8 companies from 7 different sectors and Germany represents 7 of the top lower reaches companies from 6 different sectors. The companies based in the UK are present in 5 sectors; this indicates a higher sector concentration as compared to the first restricted sample of 248 companies.
- With respect to the sector distribution, the Software & Computer Services sector is still leading the sector picture, while companies from the group of Electronic & Electrical Equipment companies (6) come second as for the group of Industrial Engineering companies (6).
- Looking at the other indicators, the table also shows that the Swedish company, Systemair from Industrial Engineering sector records the highest number of employees of the sample (4250 employees). In terms of operating profits in 2013 (but not in profitability) the Belgian firm Picanol performs better than the other companies in the 37 selected.
- In terms of R&D intensity, 5 companies have a value above 20%, including two companies from the UK. The majority of companies have an intensity ranging between 3% and 20% (26 companies including 14 between 10% and 20%), and there are 8 companies from the Software and computer services sector with intensity between 7.5% and 23.8%.

Table 6.1 The top EU potential leading companies

EU rank	Short name	Country	ICB 3 digit name	Sector group	R&D intensity 2013	RD-2013 (2)	CAGr R&D (1)	AAGr R&D (1)	CAGr Net Sales, 2010-2013	Net Sales-2013 (2)	Operating Profits-2013 (2)	Employees 2013
510	PHARM RESEARCH ASSOCIATES	UK	Pharmaceuticals & Biotechnology	high	12.1%	24	26.3%	26.6%	74.7%	202	7	561
514	THROMBOGENICS	Belgium	Pharmaceuticals & Biotechnology	high	21.5%	24	16.1%	18.2%	163.3%	113	26	146
516	MANITOU BF	France	Industrial Engineering	medium-high	2.1%	24	23.9%	26.8%	12.0%	1176	21	3242
524	HOLLYSYS AUTOMATION TECHNOLOGIES	UK	Electronic & Electrical Equipment	medium-high	9.3%	24	77.3%	106.3%	26.1%	253	42	3813
534	MEGGER	UK	Electronic & Electrical Equipment	medium-high	10.8%	23	15.6%	17.4%	21.6%	210	26	1230
548	EMIS	UK	Software & Computer Services	high	16.3%	21	24.4%	28.0%	19.2%	126	30	1356
551	TRANSMODE	Sweden	Technology Hardware & Equipment	high	17.4%	20	17.1%	17.4%	13.7%	116	17	284
561	FAIRFORD EUROPE	Sweden	Support Services	medium-high	4.7%	20	32.9%	38.8%	16.6%	415	13	1880
562	MANZ AUTOMATION	Germany	Industrial Engineering	medium-high	7.3%	19	24.7%	34.4%	13.6%	266	3	1799
565	KENDRION	The Netherlands	Industrial Engineering	medium-high	5.5%	19	32.2%	53.3%	16.8%	354	21	2756
594	BLINKX	UK	Software & Computer Services	high	9.9%	18	40.3%	49.3%	53.2%	177	12	282
606	COSMO PHARMACEUTICALS	Italy	Pharmaceuticals & Biotechnology	high	29.6%	17	53.6%	30.6%	20.7%	56	13	163
620	LPKF LASER & ELECTRONICS	Germany	Electronic & Electrical Equipment	medium-high	12.4%	16	23.0%	23.7%	16.9%	130	24	752
671	SYSTEMAIR	Sweden	Industrial Engineering	medium-high	2.3%	14	15.0%	16.0%	15.2%	598	38	4250
680	PICANOL	Belgium	Industrial Engineering	medium-high	2.3%	13	36.6%	147.6%	12.3%	560	103	1997
687	ADVANCED BUSINESS SOFTWARE AND SOLUTIONS	UK	Software & Computer Services	high	13.5%	13	21.1%	23.8%	19.2%	95	13	653
692	MUNTERS	Sweden	General Industrials	medium-high	2.9%	13	99.4%	182.8%	75.7%	428	9	2658
721	HMS NETWORKS	Sweden	Technology Hardware & Equipment	high	20.7%	12	24.2%	26.0%	13.3%	57	10	359
761	BETSSON	Sweden	Travel & Leisure	medium-high	3.7%	10	41.8%	51.7%	15.6%	280	68	789
771	SERMA	France	Electronic & Electrical Equipment	medium-high	13.6%	10	47.8%	111.4%	10.6%	75	13	704
789	S&T	Austria	Technology Hardware & Equipment	high	2.9%	10	22.8%	26.5%	61.2%	338	14	1570
793	NET ENTERTAINMENT NE	Sweden	Software & Computer Services	high	13.6%	10	28.8%	37.6%	19.7%	71	20	328
795	FLEETMATICS GROUP PUBLIC LIMITED	Ireland	Software & Computer Services	high	7.5%	10	44.0%	44.9%	40.0%	129	21	659
810	USU SOFTWARE	Germany	Software & Computer Services	high	16.5%	9	18.2%	19.7%	13.6%	56	3	452
831	EXCEET GROUP	Luxembourg	Financial Services	medium-high	4.6%	9	15.6%	16.1%	16.9%	191	8	927
848	BRADY (GB)	UK	Software & Computer Services	high	23.8%	8	33.0%	38.1%	38.2%	35	1	228
861	CORNERSTONE GROUP LIMITE	UK	Industrial Engineering	medium-high	3.8%	8	23.4%	36.7%	15.0%	214	6	1370
864	FASHION CHEMICALS	Germany	Chemicals	medium-high	3.3%	8	104.8%	252.0%	10.3%	240	10	731
874	FIRST SENSOR	Germany	Electronic & Electrical Equipment	medium-high	7.2%	8	30.0%	41.9%	33.9%	109	3	698
899	ABCAM	UK	Pharmaceuticals & Biotechnology	high	5.0%	7	30.2%	32.1%	19.8%	146	52	690
909	RMD HOLDING	Germany	Support Services	medium-high	7.8%	7	16.3%	17.2%	15.2%	91	15	520
926	VITROLIFE	Sweden	Health Care Equipment & Services	high	13.0%	7	17.9%	19.0%	15.0%	51	9	240
963	GOOCH & HOUSEGO	UK	Leisure Goods	high	7.9%	6	24.4%	27.6%	12.3%	76	11	567
968	NANOGATE	Germany	General Industrials	medium-high	10.9%	6	32.9%	45.5%	36.3%	53	2	360
982	SMARTRAC	The Netherlands	Electronic & Electrical Equipment	medium-high	2.1%	5	42.9%	73.0%	26.0%	256	14	3635
986	CANTAB BIOPHARMACEUTICALS	UK	Pharmaceuticals & Biotechnology	high	79.2%	5	19.6%	57.8%	105.2%	7	0	22
1000	CRANEWARE	UK	Software & Computer Services	high	16.7%	5	21.5%	22.2%	13.4%	30	8	198

(1) Initial years may vary by company according to their entry date in the Scoreboard; companies with data at least for the last 4 years have been considered (2) in millions of euro.
CAGr denotes the compound annual growth rate and AAGr indicates the average annual growth rate
Source: The 2014 EU Industrial R&D Investment Scoreboard.
European Commission, JRC/DG RTD.

6.3 The dynamics of the lower reaches of the EU ranking: a look at M&As and FDIs

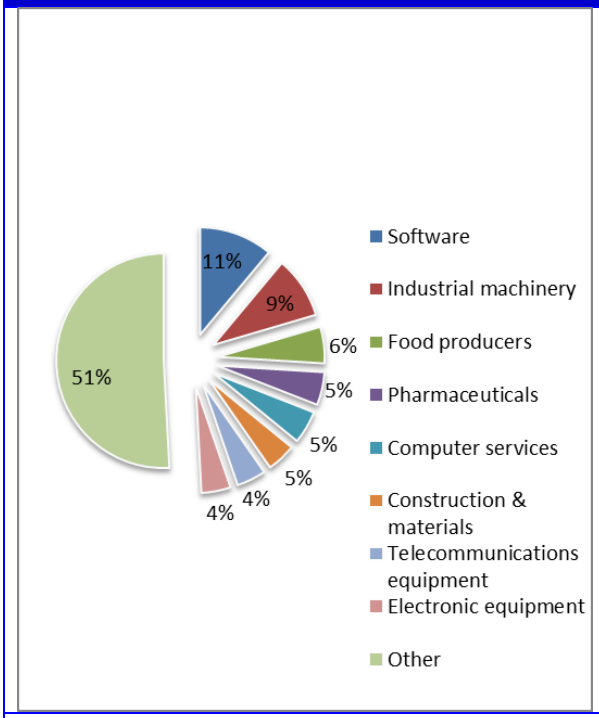
This last section examines the trajectory of the lower reaches. It presents their dynamics in terms of M&As and FDIs in the last decade.
The first sub-section provides some stylized facts on the R&D investors that are still in the EU Scoreboard 2014, have merged or been acquired on the period 2007-2013. In this respect, the initial sample includes 181 companies, out of the 482 lower reaches (see the 2007 *Scoreboard*), and 127 companies that have been either acquired or merged.

The surviving R&D investors between 2006 and 2013

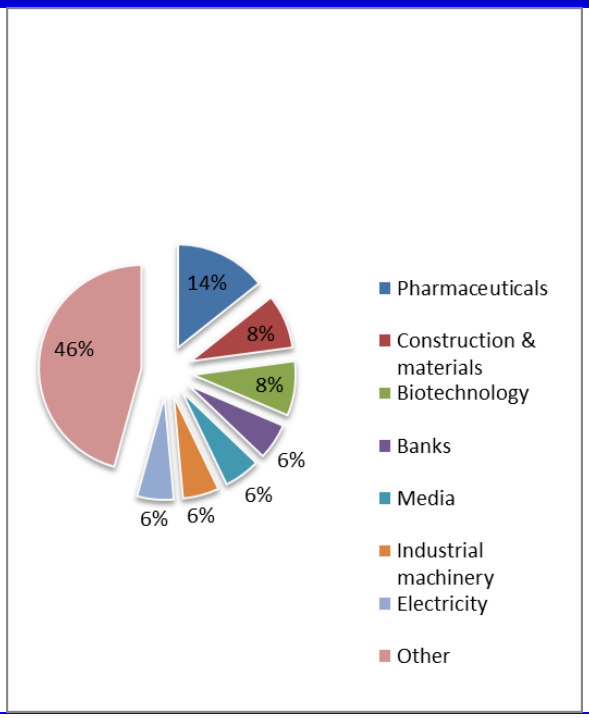
Among the year 2006, companies that are still recorded in the latest Scoreboard, only one fifth were able to position themselves among the EU top 500 (35 companies), including two now in the world top 500. Indeed a closer examination of the net sales growth rate reveals that these 35 R&D investors have recorded a higher average growth as compared to the greatest part of the 181 companies (respectively 43% and 30%).

Figure 6.4 provides the sector distribution of the companies that belong to both the 2007 and 2014 EU *Scoreboards*. It distinguishes in the right quadrant those R&D investors that have climbed up to the EU top 500. It mainly shows that Software and Industrial machinery are the main sectors of activities for the initial sample of companies while the 35 R&D investors, which are now part of the EU top 500, mainly come from the sectors of Pharmaceutical, Biotechnology and Construction and materials.

Figure 6.4 The sector distribution of surviving EU companies



Notes: 181 companies ranked in the EU top 1000 in 2007 and 2014



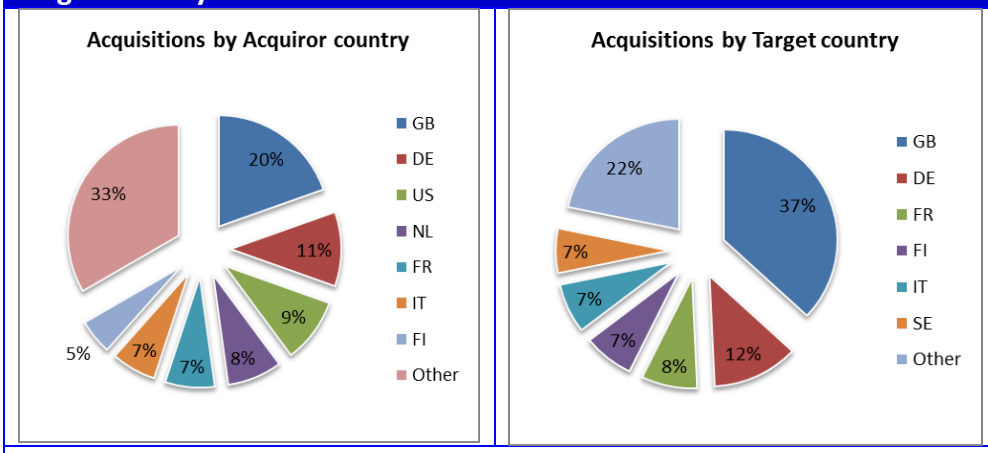
Notes: 35 companies that climbed up to the EU top 500

Source: The 2007 and 2014 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.

The M&As and FDIs in the EU lower reaches

During the period 2007-2013, 127 companies out of the 482 lower reaches have gone through M&As.
Figure 6.5 reports the distribution of this group by acquiror and target country. Companies located in the United Kingdom, Germany, the US and the Netherlands are responsible for about 48% of the acquisitions, while about half of the mergers and acquisition deals are achieved in the United Kingdom and Germany.

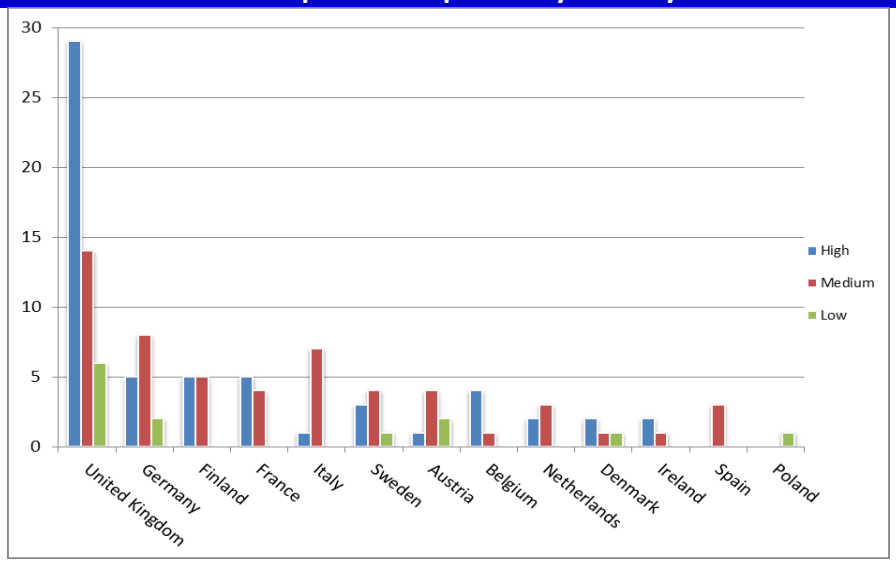
Figure 6.5 Distribution of 127 lower reach companies by acquirer and target country



Notes: 127 companies
Source: The 2007 and 2014 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD and Zephir database by Bureau van Dijk.

Figure 6.6 displays the distribution of the acquired companies by country and R&D intensity category. A total of 49 UK companies were acquired, especially in the high-tech sectors (29 out of the 49 acquired companies). France, Belgium and Denmark also present a quite high proportion of acquired companies from the high-technology sectors, whereas most companies acquired in Germany, Finland, Italy, Sweden, Austria, and the Netherlands, were operating in the medium-technology sectors.

Figure 6.6 Distribution of the acquired companies by country and R&D intensity group



Notes: 127 companies
Source: The 2007 and 2014 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD and Zephir database by Bureau van Dijk.

The international activities of the top 37 EU potential leading companies

Among the top 37 EU potential leading companies, 18 were found to have engaged in foreign investments. In particular, Table 6.2 reports the millions of Euro spent in the top 10 destination countries (representing 80% of total capital) by main business activity. It mainly reveals that:

- US, Thailand, China and Romania are together the recipient countries of almost 50% of capital expenditures with the US having 22.5%.
- The top 37 most promising companies did not record FDI investments in research.
- The 37 EU most promising companies had invested in the US, especially in development (design, development & testing) which is their fifth (out of eight) most important business activity.
- Investments in manufacturing and business services constitute more than 80% of the capital expenditure in the top 10 destination countries.

Table 6.3 lists the 18 companies by capital expenditures dedicated to the setting up of new facilities abroad (greenfield FDIs).

Table 6.2 FDI by destination country and business activity *(millions of euro)*

Top 10 Destination Countries	Manufacturing	Business Services	Maintenance & Servicing	Sales, Marketing & Support	Design, Development & Testing	Other business activities	Total
Thailand	83.8						83.8
United States	80.5			8.2	15.6	12.7	**117.0**
Brazil	34.5			1.8			36.3
Russia	28.2	9.9					38.1
China	26.8		19.6	8.3			54.6
Romania	17.2	32.0					49.3
Slovakia	4.7	32.0				3.9	40.6
Lithuania	4.3	32.0					36.4
Estonia		32.0					32.0
Slovenia		32.0					32.0
Total	**280.0**	**170.0**	**19.6**	**18.3**	**15.6**	**16.6**	**520.0**

Notes: 18 parent companies. Capex figures shown in the table are in EUR - Euro millions. Capex data includes estimated values from the Financial Times Ltd.
Source: The 2014 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD and © fDi Intelligence, from the Financial Times Ltd 2014.

Table 6.3 Greenfield FDI projects by the top 50 EU potentially leading companies

Parent company	Projects	Capex	Jobs Created	Companies
S&T	8	178.2	646	3
SMARTRAC	5	113.5	2000	1
SAF-HOLLAND	10	60.0	429	1
MANITOU BF	2	58.1	458	1
SYSTEMAIR	6	35.6	450	2
GOOCH & HOUSEGO	2	33.8	118	1
LPKF LASER & ELECTRONICS	6	26.7	245	2
MANZ AUTOMATION	2	25.2	307	1
TRANSMODE	4	18.6	136	1
PICANOL	2	17.2	372	2
MUNTERS	2	16.6	125	1
CRANEWARE	3	15.9	248	1
KENDRION	3	12.6	227	3
MEGGER	3	12.0	83	1
HMS NETWORKS	3	11.2	106	1
VITROLIFE	2	9.4	27	1
THROMBOGENICS	1	8.4	40	1
ABCAM	3	7.0	57	1
Total	**67**	**660.0**	**6074**	**25**

Notes: 18 parent companies. Capex figures shown in the table are in EUR - Euro millions. Capex and Jobs data includes estimated values from the Financial Times Ltd.
Source: The 2014 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD and © fDi Intelligence, from the Financial Times Ltd 2014.

Annex 1 - Background information

The *Scoreboard* is part of the European Commission's monitoring activities to improve the understanding of trends in R&D investment by the private sector and the factors affecting it. It was created in response to the Commission's Research Investment Action Plan[20], which aims to help close the gap between the EU's R&D investment and that of other developed economies.

The annual publication of the *Scoreboard* is intended to raise awareness of the importance of R&D for businesses and to encourage firms to disclose information about their R&D investments and other intangible assets.

The data for the *Scoreboard* are taken from companies' publicly available audited accounts. As in more than 99% of cases these accounts do not include information on the place where R&D is actually performed, the company's whole R&D investment in the *Scoreboard* is attributed to the country in which it has its registered office[21]. This should be borne in mind when interpreting the *Scoreboard*'s country classifications and analyses.

The *Scoreboard*'s approach is, therefore, fundamentally different[22] from that of statistical offices or the OECD when preparing Business Enterprise Expenditure on R&D (BERD) data, which are specific to a given territory. The *Scoreboard* data are primarily of interest to those concerned with benchmarking company commitments and performance (e.g. companies, investors and policymakers), while BERD data are primarily used by economists, governments and international organisations interested in the R&D performance of territorial units defined by political boundaries. The two approaches are therefore complementary. The methodological approach of the *Scoreboard*, its scope and limitations are further detailed in Annex 2 below.

Scope and target audience

The *Scoreboard* is a benchmarking tool which provides reliable up-to-date information on R&D investment and other economic and financial data, with a unique EU-focus. The 2000 companies listed in this year's *Scoreboard* account for more than 90%[23] of worldwide business enterprise expenditure on R&D (BERD). The data in the *Scoreboard* are published as a four-year time-series to allow further trend analyses to be carried out, for instance, to examine links between R&D and business performance.

The *Scoreboard* is aimed at three main audiences.

- **Companies** can use the *Scoreboard* to benchmark their R&D investments and so find where they and their competitors stand in the EU and in the global industrial R&D landscape. This information could be of value in shaping business or R&D strategy.

[20] "Investing in research: an action plan for Europe", COM(2003)266, http://europa.eu.int/eur-lex/en/com/cnc/2003/com2003_0226en02.pdf.

[21] The registered office is the company address notified to the official company registry. It is normally the place where a company's books are kept.

[22] The *Scoreboard* refers to all R&D financed by a company from its own funds, regardless of where the R&D is performed. BERD refers to all R&D activities performed by businesses within a particular sector and territory, regardless of the location of the business's headquarters, and regardless of the sources of finance. The sources of data also differ: the *Scoreboard* collects data from audited financial accounts and reports whereas BERD typically takes a stratified sample, covering all large companies and a representative sample of smaller companies. Additional differences concern the definition of R&D intensity (BERD uses the percentage of R&D in value added, while the *Scoreboard* considers the R&D/Sales ratio) and the sectoral classification (BERD uses NACE (the European statistical classification of economic sectors), while the *Scoreboard* uses the ICB (the International Classification Benchmark).

[23] According to latest Eurostat statistics. However BERD and *Scoreboard* figures are not directly comparable.

• **Investors and financial analysts** can use the *Scoreboard* to assess investment opportunities and risks.

• **Policy-makers, government and business organisations** can use R&D investment information as an input to policy formulation or other R&D-related actions and to assess the need for changes to the business environment to encourage the formation and growth of profitable R&D companies in sectors appropriate for specific countries.

Furthermore, the *Scoreboard* dataset has been made freely accessible so as to encourage further economic and financial analyses and research by any interested parties.

Annex 2 - Methodological notes

The data for the 2014 EU Industrial R&D Scoreboard (the *Scoreboard*) have been collected from companies' annual reports and accounts by Bureau van Dijk Electronic Publishing GmbH (BvD). The source documents, annual reports & accounts, are public domain documents and so the *Scoreboard* is capable of independent replication.

Main characteristics of the data

The data correspond to companies' latest published accounts, intended to be their 2013 fiscal year accounts, although due to different accounting practices throughout the world, they also include accounts ending on a range of dates between late 2012 and early 2014. Furthermore, the accounts of some companies are publicly available more promptly than others. Therefore, the current set represents a heterogeneous set of timed data.

In order to maximise completeness and avoid double counting, the consolidated group accounts of the ultimate parent company are used. Companies which are subsidiaries of any other company are not listed separately. Where consolidated group accounts of the ultimate parent company are not available, subsidiaries are included.

In case of a demerger, the full history of the continuing entity is included. The history of the demerged company can only go back as far as the date of the demerger to avoid double counting of figures.

In case of an acquisition or merger, pro forma figures for the year of acquisition are used along with pro-forma comparative figures if available.

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 when disclosed. Where part or all of R&D costs have been capitalised, the additions to the appropriate intangible assets are included to calculate the cash investment and any amortisation eliminated.

Companies are allocated to the country of their registered office. In some cases this is different from the operational or R&D headquarters. This means that the results are independent of the actual location of the R&D activity.

Companies are in industry sectors according to the NACE Rev. 2[24] and the ICB (Industry Classification Benchmark).

Limitations

The *Scoreboard* relies on disclosure of R&D investment in published annual reports and accounts. Therefore, companies which do not disclose figures for R&D investment or which disclose only figures which are not material enough are not included in the

[24] NACE is the acronyme for “Nomenclature statistique des activités économiques dans la Communauté européenne”.

Scoreboard. Due to different national accounting standards and disclosure practice, companies of some countries are less likely than others to disclose R&D investment consistently.

In some countries, R&D costs are very often integrated with other operational costs and can therefore not be identified separately. For example, companies from many Southern European countries or the new Member States are under-represented in the *Scoreboard*. On the other side, UK companies are over-represented in the *Scoreboard*.

For listed companies, country representation will improve with IFRS adoption.

The R&D investment disclosed in some companies' accounts follows the US practice of including engineering costs relating to product improvement. Where these engineering costs have been disclosed separately, they have been excluded from the *Scoreboard*. However, the incidence of non-disclosure is uncertain and the impact of this practice is a possible overstatement of some overseas R&D investment figures in comparison with the EU.

Where R&D income can be clearly identified as a result of customer contracts it is deducted from the R&D expense stated in the annual report, so that the R&D investment included in the *Scoreboard* excludes R&D undertaken under contract for customers such as governments or other companies. However, the disclosure practise differs and R&D income from customer contracts cannot always be clearly identified. This means a possible overstatement of some R&D investment figures in the *Scoreboard* for companies with directly R&D related income where this is not disclosed in the annual report.

In implementing the definition of R&D, companies exhibit variability arising from a number of sources: i) different interpretations of the R&D definition. Some companies view a process as an R&D process while other companies may view the same process as an engineering or other process; ii) different companies' information systems for measuring the costs associated with R&D processes; iii) different countries' fiscal treatment of costs.

Interpretation

There are some fundamental aspects of the *Scoreboard* which affect their interpretation.

The focus of the *Scoreboard* on R&D investment as reported in group accounts means that the results can be independent of the location of the R&D activity. The *Scoreboard* indicates the level of R&D funded by companies, not all of which is carried out in the country in which the company is registered. This enables inputs such as R&D and Capex investment to be related to outputs such as Sales, Profit, productivity ratios and market capitalisation.

The data used for the *Scoreboard* are different from data provided by statistical offices, e.g. BERD data. The *Scoreboard* refers to all R&D financed by a particular company from its own funds, regardless of where that R&D activity is performed. BERD refers to all R&D activities performed by businesses within a particular sector and territory, regardless of the location of the business's headquarters, and regardless of the sources of finance.

Further, the *Scoreboard* collects data from audited financial accounts and reports. BERD typically takes a stratified sample, covering all large companies and a representative sample of smaller companies. Additional differences concern the definition of R&D intensity (BERD uses the percentage of value added, while the *Scoreboard* measures it as

the R&D/Sales ratio) and the sectoral classification they use (BERD follows NACE, the European statistical classification of economic sectors, while the *Scoreboard* classifies companies' economic activities according to the ICB classification).

Sudden changes in R&D figures may arise because a change in company accounting standards. For example, the first time adoption of IFRS[25], may lead to information discontinuities due to the different treatment of R&D, i.e. R&D capitalisation criteria are stricter and, where the criteria are met, the amounts must be capitalised.

For many highly diversified companies, the R&D investment disclosed in their accounts relates only to part of their activities, whereas sales and profits are in respect of all their activities. Unless such groups disclose their R&D investment additional to 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 groups, e.g. R&D as a percentage of sales, are possibly underestimated and so comparisons with non-diversified groups are limited.

At the aggregate level, the growth statistics reflect the growth of the set of companies in the current year set. Companies which may have existed in the base year but which are not represented in the current year set are not part of the *Scoreboard* (a company may continue to be represented in the current year set if it has been acquired by or merged with another).

For companies outside the Euro area, all currency amounts have been translated at the Euro exchange rates ruling at 31 December 2013 as shown in Table A3.1. The exchange rate conversion also applies to the historical data. The result is that over time the *Scoreboard* reflects the domestic currency results of the companies rather than economic estimates of current purchasing parity results. The original domestic currency data can be derived simply by reversing the translations at the rates above. Users can then apply their own preferred current purchasing parity transformation models.

[25] Since 2005, the European Union requires all listed companies in the EU to prepare their consolidated financial statements according to IFRS (International Financial Reporting Standards, see: http://www.iasb.org/).

Table A3.1. Euro exchange rates applied to *Scoreboard* data of companies based in different currency areas (as of 31 Dec 2013).		
Country	**As of 31 Dec 2012**	**As of 31 Dec 2013**
Australia	**$ 1.27**	**$ 1.56**
Brazil	**2.69 Brazilian real**	**3.25 Brazilian real**
Canada	**$ 1.31**	**$ 1.47**
China	**8.30 Renminbi**	**8.42 Renminbi**
Czech Republic	**25.14 Koruna**	**27.43 Koruna**
Croatia	**7.55 Kuna**	**7.63 Kuna**
Denmark	**7.47 Danish Kronor**	**7.46 Danish Kronor**
Hungary	**291.54 Forint**	**297.62 Forint**
India	**72.25 Indian Rupee**	**85.40 Indian Rupee**
Israel	**4.92 Shekel**	**4.79 Shekel**
Japan	**114.15 Yen**	**145.14 Yen**
Mexico	**17.16 Mexican Peso**	**18.03 Mexican Peso**
Norway	**7.35 Norwegian Kronor**	**8.38 Norwegian Kronor**
Poland	**4.09 Zloty**	**4.15 Zloty**
Russia	**40.08 Rouble**	**45.15 Rouble**
South Korea	**1408.45 Won**	**1449.28 Won**
Sweden	**8.58 Swedish Kronor**	**8.86 Swedish Kronor**
Switzerland	**1.21 Swiss Franc**	**1.23 Swiss Franc**
Turkey	**2.35 Turkish lira**	**2.95 Turkish lira**
UK	**£ 0.84**	**£ 0.84**
USA	**$ 1.32**	**$ 1.38**
Taiwan	**$ 38.28**	**$ 41.42**

Glossary of definitions

1. **Research and Development (R&D) investment** in the *Scoreboard* is the cash investment 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. Being that disclosed in the annual report and accounts, it is subject to the accounting definitions of R&D. For example, a definition is set out in International Accounting Standard (IAS) 38 "Intangible assets" and is based on the OECD "Frascati" manual. **Research** is defined as original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding. Expenditure on research is recognised as an expense when it is incurred. **Development** is the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems or services before the start of commercial production or use. Development costs are capitalised when they meet certain criteria and when it can be demonstrated that the asset will generate probable future economic benefits. Where part or all of R&D costs have been capitalised, the additions to the appropriate intangible assets are included to calculate the cash investment and any amortisation eliminated.

2. **Net sales** follow the usual accounting definition of sales, excluding sales taxes and shares of sales of joint ventures & associates. For banks, sales are defined as the "Total (operating) income" plus any insurance income. For insurance companies, sales are defined as "Gross premiums written" plus any banking income.

3. **R&D intensity** is the ratio between R&D investment and net sales of a given company or group of companies. At the aggregate level, R&D intensity is calculated only by those companies for which data exist for both R&D and net sales in the specified year. The calculation of R&D intensity in the *Scoreboard* is different from than in official statistics, e.g. BERD, where R&D intensity is based on value added instead of net sales.

4. **Operating profit** is calculated as profit (or loss) before taxation, plus net interest cost (or minus net interest income) minus government grants, less gains (or plus losses) arising from the sale/disposal of businesses or fixed assets.

5. **One-year growth** is simple growth over the previous year, expressed as a percentage: 1 yr growth = 100*((C/B)-1); where C = current year amount, and B = previous year amount. 1yr growth is calculated only if data exist for both the current and previous year. At the aggregate level, 1yr growth is calculated only by aggregating those companies for which data exist for both the current and previous year.

6. **Three-year growth** is the compound annual growth over the previous three years, expressed as a percentage: 3 yr growth = 100*(((C/B)^(1/t))-1); where C = current year amount, B = base year amount (where base year = current year - 3), and t = number of time periods (= 3). 3yr growth is calculated only if data exist for the current and base years. At the aggregate level, 3yr growth is calculated only by aggregating those companies for which data exist for the current and base years.

7. **Capital expenditure (Capex)** is expenditure used by a company to acquire or upgrade physical assets such as equipment, property, industrial buildings. In accounts capital expenditure is added to an asset account (i.e. capitalised), thus increasing the asset's base. It is disclosed in accounts as additions to tangible fixed assets.

8. **Number of employees** is the total consolidated average employees or year-end employees if average not stated.

Annex 3 – Composition of the EU 1000 sample

The analysis of chapter 5 applies an extended sample of 1000 companies based in the EU. It consists of 633 companies included in the world R&D ranking of top 2500 companies and additional 367 companies also ranked by level of R&D investment. The composition by country and industry of the EU 1000 sample is presented in the table A3.1 below.

Table A3.1 Distribution of the sample of 1000 companies based in the EU by country and industry.

Industry	EU country codes																			
ICB 3-D	AT	BE	CZ	DE	DK	ES	FI	FR	GR	HU	IE	IT	LU	MT	NL	PL	PT	SE	SI	UK	Total
Aerospace & Defence		1		3		1	1	6				2			1			1		10	**26**
Alternative Energy				3	1								1								**5**
Automobiles & Parts	4			17			1	6				6						2		9	**45**
Banks		2		6	2	2		1			1	2	1		2	1	2	2		5	**29**
Beverages		1		1	1															1	**4**
Chemicals	2	3		13	1		3	3							3			4		10	**42**
Construction & Materials	3	4		6	1	3	2	6			2	2	1		2		1	2	1	2	**38**
Electricity	1	1	1	1		2	2	2				2					1	1		3	**17**
Electronic & Electrical Equip.	4	4		16	2		6	10			1	4			6			3		20	**76**
Equity Invest. Instrum.				1																	**1**
Financial Services				4				1					1		1			4		5	**16**
Fixed Line Telecom	1	1		1	1	1		1				1				1	1	1		1	**11**
Food & Drug Retailers		1													1					2	**4**
Food Producers				2	1		4	3			3		1		5					9	**28**
Forestry & Paper							3	1			1							3		1	**9**
Gas, Water & Multi-utilities	1			2	1			3				1								3	**11**
General Industrials	1	1		11	1	1	1	1			1	1	1		2			8		11	**41**
General Retailers				4				1												6	**11**
Health Care Equip. & Services		2		11	2			2			2	1			2			6		8	**36**

Industry	Country codes																			
ICB 3-D	**AT**	**BE**	**CZ**	**DE**	**DK**	**ES**	**FI**	**FR**	**GR**	**HU**	**IE**	**IT**	**LU**	**MT**	**NL**	**PL**	**PT**	**SE**	**SI**	**UK**	**Total**
Household Goods & Home Const.				6			1	2				3	1		1			2		3	**19**
Industrial Engineering	5	2		40	3	3	8	8			1	7	2		4			13		14	**110**
Industrial Metals & Mining	2	2		5			1	1					3		1			2		1	**18**
Industrial Transportation			1	1	1			3				3			1			1		1	**12**
Leisure Goods				1	2		1								1					2	**7**
Life Insurance				1				1												2	**4**
Media								5				1						1		5	**12**
Mining				1														2		4	**7**
Mobile Telecom				1			1													3	**5**
Nonlife Insurance				2																1	**3**
Oil & Gas Producers	1					1	1	1				1								3	**8**
Oil Equip., Services & Distrib.								2					1		1					1	**5**
Personal Goods				7				5				3	2								**17**
Pharma & Biotech		4		11	9	4	1	17	1	1	5	6			4		1	10	1	30	**105**
Real Estate Invest. & Services		1		1																	**2**
Software & Computer Services	2			20	2	2	5	19			2				4	2	1	7		44	**110**
Support Services				12				2			1				2			4		19	**40**
Technology Hardware & Equip.	2	2		7	1	1	2	6	1		1				5			8		13	**49**
Tobacco																		1		2	**3**
Travel & Leisure	1			3			1	1				1		1				2		4	**14**
	30	**32**	**2**	**221**	**32**	**21**	**45**	**120**	**2**	**1**	**21**	**47**	**15**	**1**	**49**	**4**	**7**	**90**	**2**	**258**	**1000**

Annex 4 - Access to the full dataset

The 2014 *Scoreboard* comprises two data samples:

- The world's top 2500 companies that invested more than €15.5m in R&D in 2013.
- The top 1000 R&D investing companies based in the EU with R&D investment exceeding €5.0m.

For each company the following information is available:

- Company identification (name, country of registration and sector of declared activity according to ICB classifications).
- R&D investment
- Net Sales
- Capital expenditure
- Operating profit or loss
- Total number of employees
- Main company indicators (R&D intensity, Capex intensity, Profitability)
- Growth rates of main indicators over one year and three years.

The following links provide access to the two *Scoreboard* data samples containing the main economic and financial indicators and main statistics over the past four years.

R&D ranking of world top 2500 companies:

http://iri.jrc.ec.europa.eu/documents/10180/354280/Scoreboard%202014%20Ranking%202500

R&D ranking of EU top 1000 companies:

http://iri.jrc.ec.europa.eu/documents/10180/354280/Scoreboard%202014%20EU%201000

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Abstract

The 2014 "EU Industrial R&D Investment Scoreboard" (the *Scoreboard*) contains economic and financial data for the world's top 2500 companies ranked by their investments in Research and Development (R&D). The sample contains 633 companies based in the EU and 1867 companies based elsewhere. The *Scoreboard* data are drawn from the latest available companies' accounts, i.e. usually the fiscal year 2013/14.

Key findings of the 2014 Scoreboard comprise:

- The world top 2500 R&D investors continued to increase their investment in R&D (4.9%), well above the growth of net sales (2.7%). The 633 EU companies increased R&D by 2.6% and decreased sales by 1.9%.

- Volkswagen leads the global ranking for the second consecutive year, showing again a remarkable increase of R&D (23.4%, up to €11.7bn). Second continues to be Samsung, showing also an impressive R&D increase of 25.4%.

- EU companies in the automobile sector, accounting for one quarter of the total EU's R&D, continued to increase significantly their R&D (6.2%). This reflects the good performance of automobiles companies based in Germany (9.7%) that account for three quarters of this sector's R&D in the EU.

- The poor R&D performance of EU companies in high-tech sectors such as Pharmaceuticals (0.9%) and Technology Hardware and equipment (-5.4%) weighed down the total R&D increase of the EU sample. The overall amount invested in R&D by EU companies in high-tech sectors represents 40% of the amount invested by their US counterparts and the gap between the two company samples is increasing with time.