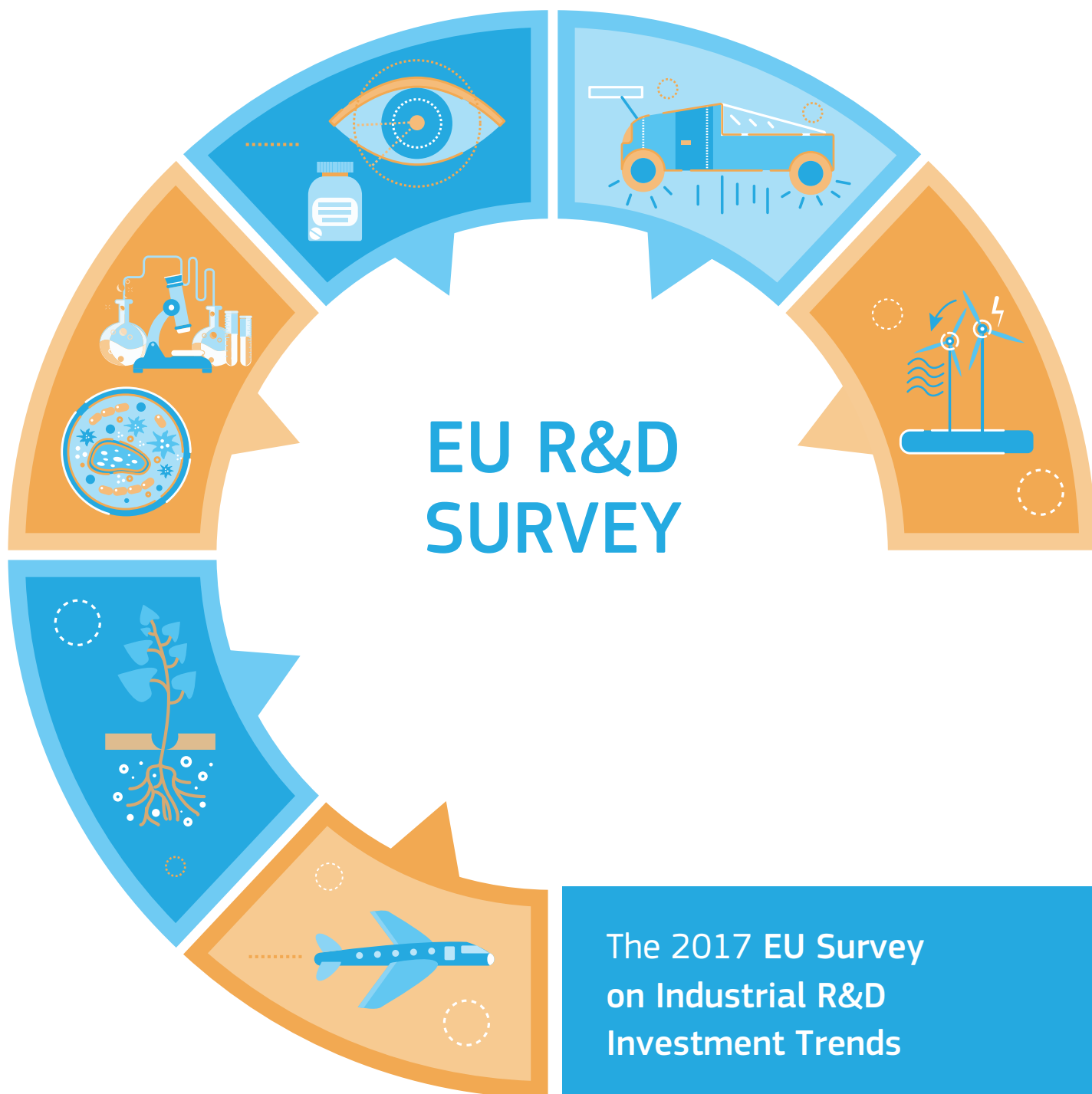




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The project was coordinated under the leadership of Alessandro Rainoldi (Head of B.3 Territorial Development) and Román Arjona Gracia (Head of DG RTD.A4 Analysis and monitoring of national research policies). This document was produced by Lesley Potters, Nicola Grassano and Alexander Tübke (JRC.B) as the main authors. Roberto Martino from DG RTD.A made contributions to the design and review of the survey.

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Title

The 2017 EU Survey on Industrial R&D Investment Trends

Abstract

This twelfth Survey on Industrial R&D investment trends is based on 151 responses of mainly large firms from a subsample of the 1000 EU-based companies in the 2015 EU Industrial R&D Investment Scoreboard. These 151 companies are responsible for €53.9 billion R&D investment, constituting almost one fourth of the total R&D investment by the 1000 EU Scoreboard companies.

EU R&D SURVEY

**The 2017 EU Survey on Industrial
R&D Investment Trends**

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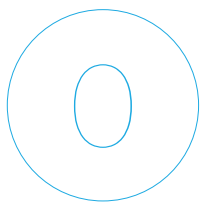
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EXECUTIVE SUMMARY

Executive summary

The companies that participated in the EU Survey on Industrial R&D Investment Trends expect R&D investment to increase by an average of 4.7% in the two years 2017 and 2018, with the highest growth expectations in the 'Automobile and Other Transport' and 'Health' sectors groups. Last year's expected growth was 1.4%. This year's expectations are the highest since 2007. If we compare only those companies that participated in the last three editions of the survey, the growth trend remains clear, with considerably higher growth expected in this year's edition (around 4.0%) than in the last two editions (around 2.5%).

Participating firms expect their R&D investments within the EU to increase by 3.5% p.a., while significant increases are expected in the US (+15.1%), China (+20.2%) and India (+22.1%). The proportion of R&D performed within the EU is expected to decrease slightly from 76.0% to 73.4% and has been around three-quarters throughout the EU Survey editions since 2006.

Quality and availability of researchers and macroeconomic and political stability are the factors that are rated most often as (highly) attractive by firms performing R&D in the EU only. If we look at firms that perform R&D in the US, we see that these firms value proximity to technology poles and access to markets much more highly than firms that do not perform R&D in the US. Firms performing R&D in China or India value low labour costs and proximity to suppliers much more than firms that do not perform R&D in China or India.

Access to markets, macroeconomic stability and quality of personnel are most often rated as the most attractive factors by firms only producing

in the EU. Low employment protection is considered least important. Firms with production activities in the US mainly value quality of personnel and access to markets as important factors for deciding on where to locate production.

Around 80% of the total R&D investment made by the companies surveyed is spent in the later stages of the development process, namely applied and development activities. By contrast, 'Basic research' accounts for only about one-tenth of all R&D investment, but also has the lowest concentration level¹ of all types of R&D, which indicates that many firms consider maintaining a level of 'Basic research' important.

For the first time, we asked companies to provide us with greater insight in their patenting behaviour. **Protecting inventions using patents is concentrated within the largest firms of our sample** of top R&D investors. Just 15 companies are responsible for 80% of all patent applications of the survey participants.

The largest EU R&D investors are true global players, with the US, Germany, China and France being the main locations for R&D activities. One out of three companies performs R&D in each of the four main economic areas. At the same time, **the historical location decision remains an important factor for locating R&D activities:** 87% of the respondents mentioned the companies' headquarters location as the country where the highest proportion of R&D is currently being performed, which indicates that the internationalisation and offshoring of R&D activities does not necessarily lead to the disappearance of the home site. This may also be because of the capital intensive investments that have been made initially at the original location.

¹ The concentration level is measured as a concentration ratio. It is equal to the proportion of total investment in 'Basic research' for which the top four investing firms are responsible. A lower concentration level means that this type of R&D is dispersed among the participating firms.

The UK as a country is expected to see a considerable proportion of its (foreign) R&D investments relocated to other countries. For our sample of the largest R&D investors, Brexit is generally expected to have little or no impact. However, firms performing R&D activities in the UK do expect to downsize operations there. The expected growth of nominal R&D investments in the EU without the UK is predicted to be 4.0% p.a. instead of 3.5% p.a.

China and the US show different profiles for attracting R&D activities: the popularity of the US is determined by the more highly valued access to its market and the proximity to places such as Silicon Valley. On the other hand, China shows that production attracts innovation: proximity to suppliers is valued more highly by companies with R&D activities in China than firms without.

Quality and availability of researchers are factors that companies value the most for the attractiveness of an R&D location, while labour costs are the least important factor. However, low labour costs are rated as much more important by firms that perform R&D outside the EU than by firms that perform R&D only inside the EU. Together with proximity to technology poles, these are the factors that global firms perceive as much more important.

The main production locations are – like last year and like the most popular R&D locations – the US, China and Germany. The most highly rated factors for locating production activities in a certain country are the access it provides to the local market and the availability and quality of the personnel. Here, too, different country profiles can be distinguished: the popularity of the US as a production location stems from its well-developed framework conditions, while China's strongest factors are proximity to suppliers and access to production infrastructure.

When asked about the potential for increasing R&D through the structural reforms that the European Commission is pursuing, the survey found that **the provision of more public research resources and less regulation are considered to have the most positive impact on R&D investments.** This seems to be consistent in all sectors. Policies increasing the availability of resources for research and collaboration with the public sector have a great potential impact on R&D and innovation. The same is true of legislation simplification. As last year, labour market reforms listed are considered irrelevant when it comes to their effect on R&D and innovation activities.

1

INTRODUCTION

1 Introduction

Investment in research and innovation are among the top priorities of the European Commission's €315 billion Investment Plan for Europe.² This EU R&D Survey is part of the Industrial Research and Innovation Monitoring and Analysis (IRIMA II) project of the Joint Research Centre (JRC) Directorate B, jointly undertaken with the Directorate-General for Research and Innovation (DG RTD), which supports the Commission in monitoring progress towards the 3% headline target of R&D investments.

The questionnaire of the EU R&D Survey was sent by post to the top operational level (Chief Executive Officer or similar) or previous year's contact person of the top 1 000 European companies that appear in the 2016 EU Industrial R&D Investment Scoreboard. In total, 151 responses were received, which is a response rate of 15.1%.³ The response rate was similar to the previous year (15.7%) and other years the survey was conducted.

The numbers and sample composition of the responses vary over the years, as there is no obligation to participate. In cases where the sample composition has an impact on the results, or where certain sectors or firms stand out, this is mentioned in the analysis.

The 151 participating companies have a total global R&D investment of €53.9 billion for the financial year 2016, which corresponds to more than one-quarter (27.9%) of the total R&D investment by the 1 000 EU Scoreboard companies in 2015.

In this year's survey we have used a more intuitive sector classification. In previous editions of the survey

we grouped Industrial Classification Benchmark (ICB)⁴ level 4 sectors according to their level of R&D intensity:⁵ high, medium and low R&D intensity sector groups. This year we choose to aggregate ICB4 sectors into seven broad sector groups that can be identified by the reader more easily.

The Low R&D Intensity group coincides mostly with the low R&D intensity sectors of former years, but also includes the ICB4 sector Financial Services. Automobile and Other Transport is a separate sector group, because this sector is traditionally important within the EU and has a big impact on overall outcomes.⁶ ICT includes companies that produce both hardware and software. The Health sector group includes companies from the pharmaceutical and biotechnology sectors, but also from health-related services and health-care equipment. Table 1 provides an overview of the ICB4 sectors for each of the sector groups, and compares the number of responses received with the proportion of R&D of the 1 000 EU Scoreboard companies.

Looking at the respondents to this year's survey, the sector group with the highest percentage of replies is the Industrials sector, while the sector representing the highest proportion of R&D is Automobile and Other Transport. The sector distribution in terms of R&D investment of the respondents mirrors the R&D distribution of the top EU 1 000 companies in the R&D Scoreboard. The only notable exception is the Health sector, which represents 22% of the R&D of the top EU 1 000, while this figure drops to 8% in our sample of respondents (see Figure 1).

² See the 2016 Annual Growth Survey: <http://ec.europa.eu/europe2020/pdf/2016/>

³ See Annex A: The Methodology of the 2017 Survey.

⁴ The ICB is the industry classification taxonomy as also used in the EU R&D Scoreboard. It consists of four levels of detail.

⁵ R&D intensity is the ratio between R&D investment and net sales. An individual company may invest a large absolute amount in R&D but have a low R&D intensity if net sales are high (as is the case of many oil and gas producers, for example). For the sector groupings see Annex A: The Methodology of the 2017 Survey.

⁶ In fact, in last year's survey, the aggregate growth figures were significantly influenced by the Automotive sector and had to be mentioned separately from the overall trends and from the medium-tech sector to which it belongs.

SECTOR GROUP	ICB4 SECTOR	# COMPANIES IN THE EU SURVEY	# COMPANIES IN THE EU1000
Automobile and other transport	Automobiles & Parts; Commercial Vehicles & Trucks	10	61
Basic Materials	Chemicals; Forestry & Paper; Industrial Metals & Mining; Iron & Steel; Mining	17	76
Consumer Goods & Services	Beverages; Clothing & Accessories; Durable Household Products; Food Producers; Food Products; Household Goods & Home Construction; Media; Personal Goods; Tobacco	13	106
Health	Biotechnology; Health Care Equipment & Services; Medical Equipment; Pharmaceuticals	21	177
ICT	Computer Hardware; Computer Services; Electrical Components & Equipment; Electronic Equipment; Fixed Line Telecommunications; Software	30	236
Industrials	Aerospace & Defense; Diversified Industrials; General Industrials; Industrial Machinery; Industrial Transportation; Support Services	32	206
Low R&D intensity	Banks; Building Materials & Fixtures; Construction & Materials; Electricity; Financial Services; Gas, Water & Multi-utilities; Heavy Construction; Oil & Gas Producers; Oil Equipment, Services & Distribution; Water	28	138
Total		151	1000

TABLE 1: NUMBER OF RESPONSES BY SECTOR GROUP.

Source: European Commission JRC-B (2017).

This year's questionnaire asked companies for more information on patent activity and the expected impact of Brexit.

This is our 12th R&D Investment Survey since the 2005 pilot.⁷ This year's questionnaire addresses R&D investment expectations for 2017 and 2018, R&D and production location strategies, R&D employment and the impact of structural reforms on R&D. This last point is closely linked to the Commission's important reforms of the EU's economic governance rules.⁸ Compared with last year's questionnaire, the technological content of R&D has been addressed with direct questions on patents: we asked firms to indicate the number of inventions that had been protected by patents during the period 2010–2014. Finally, to understand how Brexit will affect the largest R&D performers, we asked our respondents an open question on the potential impact of the forthcoming Brexit on their R&D activities.

The respondents to the survey are – on average – the largest companies among the large multinationals of the EU R&D Scoreboard companies.

The survey

respondents declare an average level of R&D investment of €357.6 million for the year 2016, net sales for 2015 of €14.8 billion and more than 40 000 employees. This is around twice the size of the average top 1 000 R&D Scoreboard company, which has R&D investments (2015) of €193.2 million, net sales of €7.4 billion and almost 25 000 employees. The sample contains only five SMEs that have fewer than 250 employees.⁹ Of the large companies, 12 had between 250 and 999 employees, 60 had between 1 000 and 9 999 employees, 31 had between 10 000 and 29 999 employees, and 43 had more than 30 000 employees, making this year's sample more skewed towards larger companies than last year (with an average of 30 000 employees).

The smaller number of responses received corresponds to a slightly shorter response period than in the previous edition. The response rate per day was similar to that of the previous survey and 55% of the previous year's participants also responded this year.¹⁰

⁷ See: <http://iri.jrc.ec.europa.eu/survey.html>.

⁸ See the 2015 Annual Growth Survey: http://ec.europa.eu/europe2020/pdf/2015/ags2015_en.pdf.

⁹ Two SMEs are from the Software & Computer Services sector, and one each from the Chemicals sector, Health Care Equipment & Services sector, and Electronic & Electrical Equipment sector.

¹⁰ Of the 151 responding companies, 81 had participated in the previous survey and 62 had participated in the previous two (2016 and 2015).

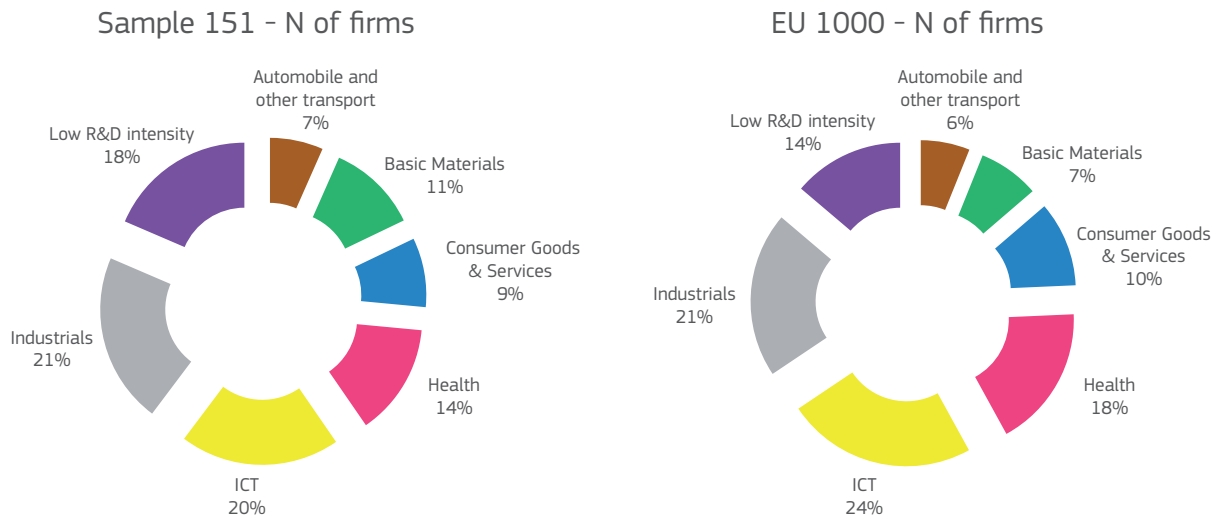


FIGURE 1: DISTRIBUTION OF R&D INVESTMENT IN THE SURVEY COMPARED WITH THE 2016 SCOREBOARD.

Note: The figure refers to all 151 companies in the sample representing 26.5% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2017).

2

R&D INVESTMENT **EXPECTATIONS**

2 R&D investment expectations

In addition to current levels of R&D investment, the questionnaire also asks companies to estimate the yearly growth (in percentage) for the coming two years.

The companies that participated in the survey expect R&D investment to increase by an average of 4.7% p.a. in the two years 2017–2018.¹¹ This is higher than in the surveys since 2007 and shows the current tailwinds that companies are experiencing, partly helped by, for example, improved lending conditions that facilitate investment. However, there is still a large difference from pre-crisis expectations (7% in the 2007 survey), although these may have been unrealistic at that time.

The highest growth in R&D is expected by companies in the Automobile and Other Transport and Health sectors. The Automobile and Other Transport sector shows a positive outlook compared with a negative outlook last year – although the sample of companies that participated in this sector is different. The other sector expecting the highest growth of R&D in the next two years is the Health sector (5.6% p.a.). By contrast, the expectations for the next two years are particularly low for firms in the Industrials sector group (2.5% p.a., see Figure 2 below). Growth expectations for the ICT sector group are below average, but still significant (4.1% p.a.), while sector groups characterised by a low level of R&D intensity are also expecting an important R&D growth in the future (+4.5%).

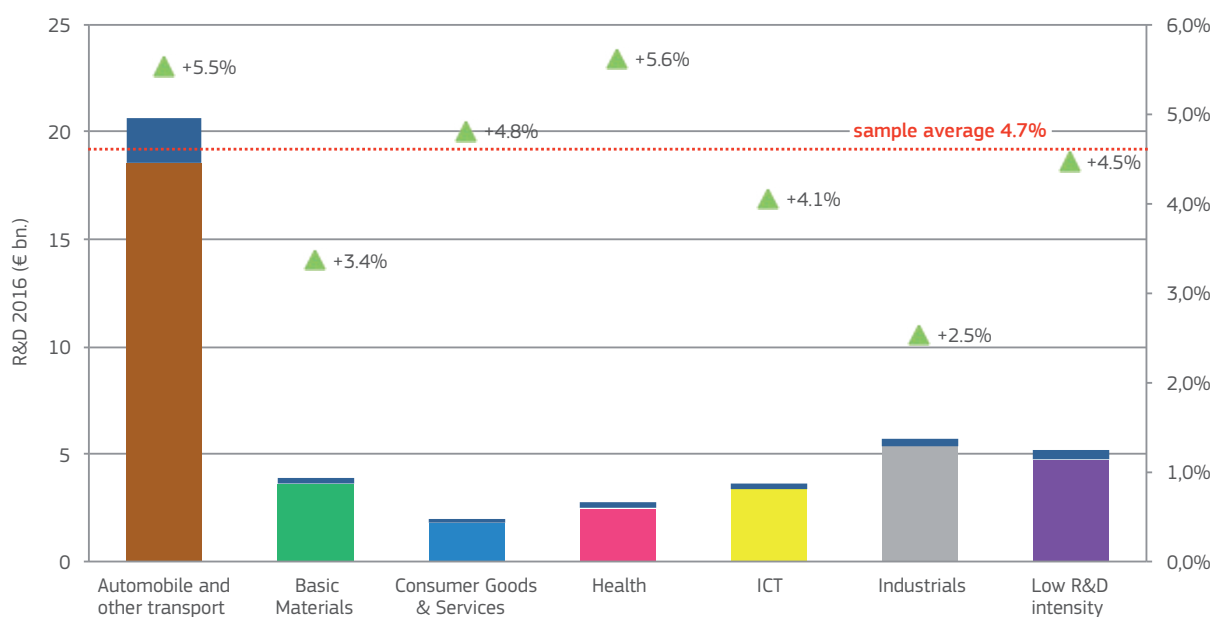


FIGURE 2: EXPECTED LEVELS AND NOMINAL CHANGES IN R&D INVESTMENT IN THE NEXT TWO YEARS, PER ANNUM.

Note: The figure refers to 129 out of the 151 companies in the sample, weighted by R&D investment, representing 20.6% of the total R&D investment by the 1 000 EU Scoreboard companies. Number of companies by sector group: Automobile and other transport (9), Basic materials (15), Consumer Goods and Services (11), Health (20), ICT (20), Industrials (27), Low R&D intensity (27).

Source: European Commission JRC-B (2017).

To put these expectations into perspective, we should consider (i) the initial levels of R&D investment and (ii) the expectations of past surveys, in comparison with both

the expectations reported in this wave and the actual R&D change recorded ex post in the EU R&D Investment Scoreboard.

¹¹ The expectations are per annum over the next two years, weighted by R&D investment.

The initial levels of R&D investment for those companies that provided an estimate of the change in the coming two years are also reported in Figure 2. Firms in the Automobile and Other Transport sector group are investing by far the most among those in our sample that reported their R&D expectations for the future. This sector group is the one driving the forecast R&D growth in the coming two years.

Companies are, in general, more optimistic about R&D growth than in previous years. Figure 3 compares the expected changes in R&D investment for the next two

years (2017 and 2018) for the companies in our sample with the expectations of companies in the previous two surveys.¹² As already mentioned, 2016 was a particular year in terms of R&D expectations. In fact, for the Automobile and Other Transport sector, the expectations expressed in 2016 for the following two years were negative. If we instead compare the companies that responded both in 2015 and 2017, we find that the same sector groups that are above the mean in terms of expected R&D growth in 2017 were also above the average level in the 2015 edition of the survey.

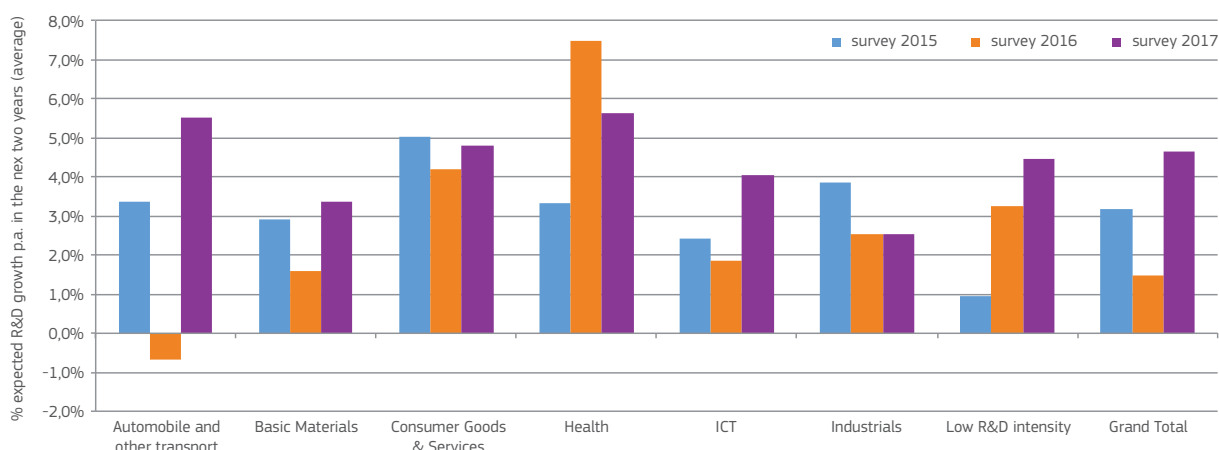


FIGURE 3: EXPECTED CHANGES IN ANNUAL R&D INVESTMENT IN THE CURRENT AND THE TWO PREVIOUS SURVEYS, P.A.

Note: The sample compositions in the surveys vary from year to year. p.a. per annum Growth rates calculated as average for the 2 years. The figures refer to 145 companies in survey 2015, 133 in survey 2016, 129 in survey 2017.

Source: European Commission JRC-B (2017).

Repeating this exercise, but with the smaller sample of firms that replied to the last three editions of the survey

and reported their R&D expected growth, shows a more consistent, but growing, picture (see Figure 4).

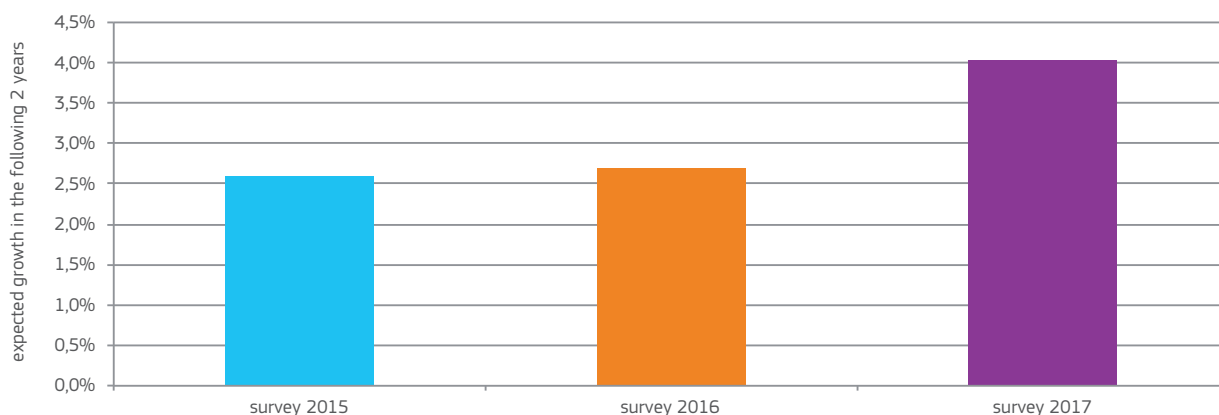


FIGURE 4: EXPECTED CHANGES IN ANNUAL R&D INVESTMENT IN THE CURRENT AND THE TWO PREVIOUS SURVEYS (RESTRICTED SAMPLE).

Note: Growth rates calculated as average for the 2 years. The figures refer to 50 companies present in all the last three surveys.

Source: European Commission JRC-B (2017).

¹² The samples in the different surveys have different compositions.

While their expectations for the future were similar in the previous two surveys (around 2.5% growth p.a.), in the current edition they forecast greater growth (4.0% p.a.) in the two years after this survey. This could be a signal of a change in the attitude towards the future (a more positive outlook) or better capacity to forecast the growth of R&D given that in the past few years survey companies have systematically underestimated their future growth. In fact, the companies that in 2015 edition of the survey forecast

future R&D growth of 2.6% between 2014 and 2015 showed actual growth of 5% in this period, as shown in the reported figures in the R&D Scoreboard, which is based on the annual reports of the firms.

We can compare the expectations of companies participating in the different editions of the survey with the actual R&D growth of the EU sample registered in the following editions of the R&D Investment Scoreboard (Figure 5).



FIGURE 5: EXPECTED (SURVEYS) VERSUS OBSERVED (SCOREBOARDS) R&D INVESTMENT CHANGES.
 Note: *For the Scoreboard referring to the financial year of the latest annual accounts, while Survey growth expectations are for the three calendar years following the exercise. The numbers are weighted by R&D investment and the samples of every year of the Scoreboard and Survey exercises vary in composition.
 Source: European Commission JRC-B (2017).

In the past few years, however, the R&D expectations of survey respondents have led to an underestimation of the actual R&D growth of the EU top 1 000 companies, reflecting an uncertain outlook for the future. When comparing different survey and Scoreboard editions we should keep in mind that they contain samples that are different in both size and sector composition.¹³ Moreover, ex ante R&D change expectations are declared in the survey almost 1.5 years before we can compare them with the ex post figures published in the Scoreboards,

also emphasising the possible differences that might occur between non-audited expected figures by survey participants, often from the R&D departments, and the audited figures in the annual reports from the financial departments. Over the years, we have observed that the 1 000 EU Scoreboard companies generally follow the trend expected by the survey respondents. The expected growth rates of the surveys for the years 2013 and 2014 were very close to the ex post trends observed for the 1 000 EU Scoreboard companies.

Geographical trends

Companies indicated the distribution of R&D investment by world region and also indicated how this distribution will change by 2018. The current distribution in terms of proportions of total R&D investment in each of the seven world regions is displayed in Figure 6 below.

EU firms have declared consistently that they carry out between 75% and 80% of their R&D within the EU. Of the R&D performed outside the EU, the largest part is performed in the Rest of the World (9% of total R&D) and the US (7%).

The EU-based companies carry out one-quarter of their R&D outside the EU, which is similar to last year’s survey and is a fairly constant figure over all surveys since 2006. Since the R&D Survey of 2006, the

Consumer Goods and Services is the sector with the highest proportion of its R&D investment outside the EU, mainly performed in the US and the Rest of the World. This connects well to the finding that these

¹³ The EU Scoreboard contains 1 000 companies, of which 15% to 20% participated in the annual surveys.

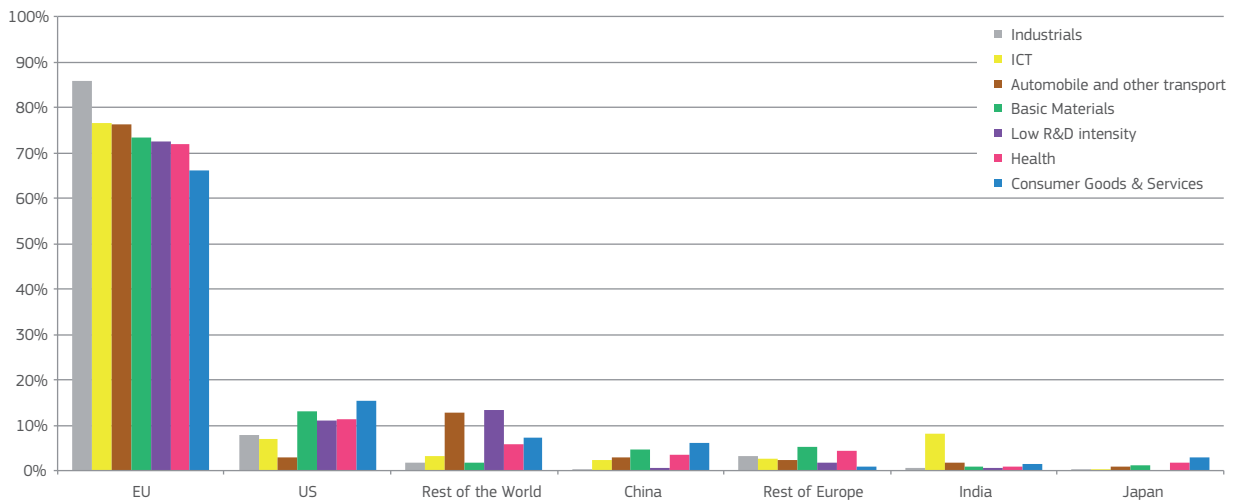


FIGURE 6: DISTRIBUTION OF R&D INVESTMENT BY WORLD REGION AND SECTOR GROUP.

Note: The figure refers to 139 out of the 151 EU companies in the sample. RoE (Rest of Europe) countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Canada, Taiwan, and Brazil. See also Annex B: Questionnaire question D.8 R&D location strategy.
Source: European Commission JRC-B (2017).

companies mention competition from outside the EU as the main factor for adjusting R&D investment levels, as is further described in Chapter 5.

Figure 7 shows that R&D investment in the EU from top EU R&D investors is expected to increase by 3.5%. The US shows high expected growth in R&D investment

levels (+15.1%) and approaches the levels of the group of countries labelled as the Rest of the World. China and India show the largest expected growth, although the levels are still low, but well above Japan. A breakdown at the sector level for the expected annual change in geographic distribution is not possible owing to the impact of individual companies on each sector group.

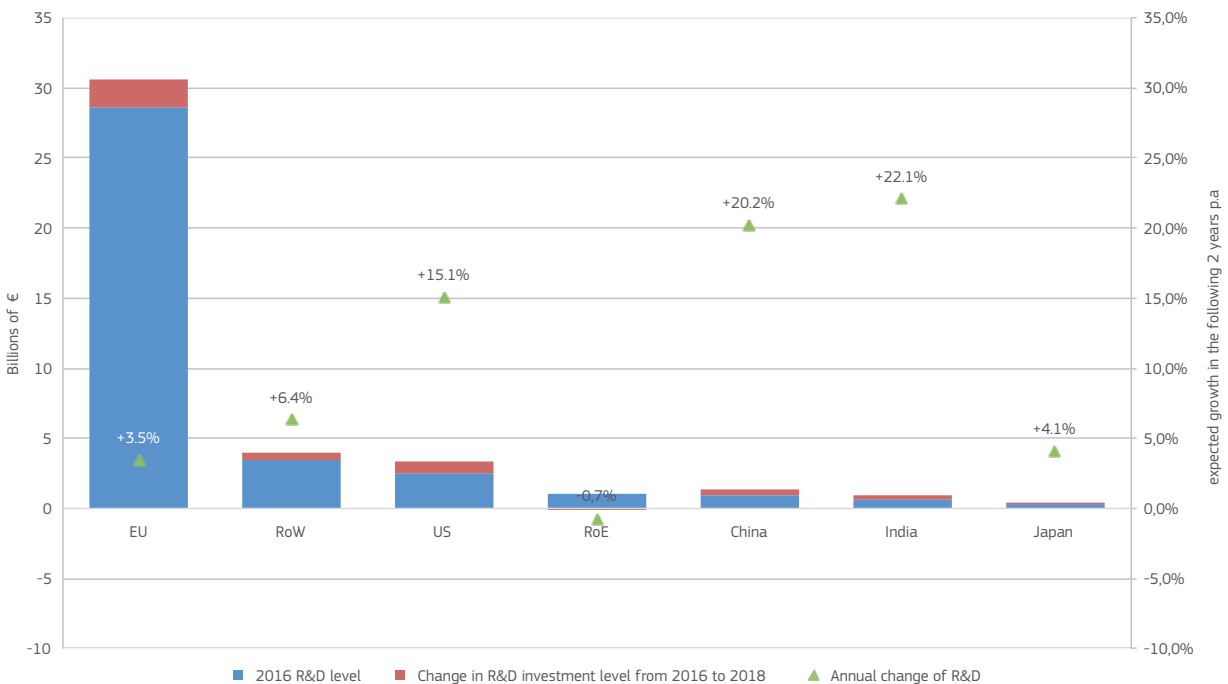


FIGURE 7: EXPECTED ANNUAL CHANGES IN R&D INVESTMENT IN THE NEXT TWO YEARS, PER ANNUM, IN REAL TERMS, BY WORLD REGION.

Note: The figure refers to 115 out of the 151 EU companies in the sample, weighted by R&D investment and after elimination of outliers, representing 30% of the total R&D investment by the 1 000 EU Scoreboard companies. Other EU countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Taiwan, and Brazil. See also Annex B: Questionnaire question E.12 R&D location strategy.
Source: European Commission JRC-B (2017).

The **proportion of R&D investment performed within the EU is expected to decrease slightly** in the coming two years, while the proportion invested in all other world regions except Japan is expected to increase (Figure 8). Here it is worth noting that a decrease in the proportion of R&D performed in the EU has been predicted in many of the former surveys, while the actual proportion has remained constant, as noted earlier.

The patterns were always similar, with the highest growth rates expected for China and India, but here too the proportion of R&D performed in India and China are always predicted to increase, but they have also remained constant since the earliest survey in 2006. Expectations for Japan and other European countries have been the most moderate for the third year in a row, and are now even negative.

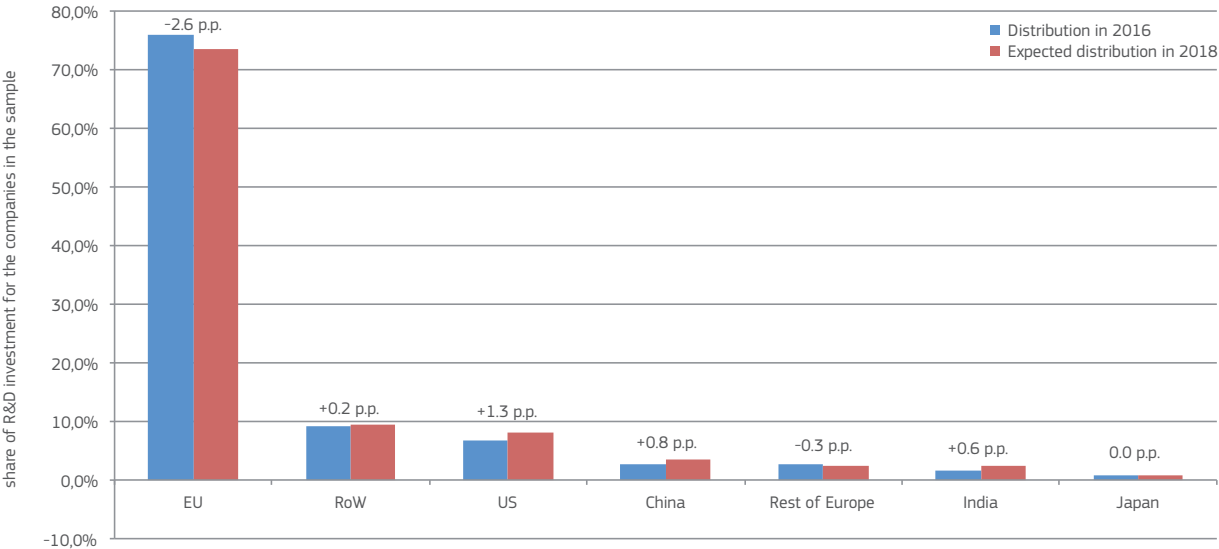


FIGURE 8: PROPORTION OF EU FIRMS' R&D INVESTMENT PERFORMED IN EACH WORLD REGION IN 2016 AND EXPECTED IN 2018.
Note: The figure refers to 115 out of the 151 EU companies in the sample. Other EU countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Canada, Taiwan, and Brazil. See also Annex B: Questionnaire question D.8 R&D location strategy.
Note: Changes are here in percentage points.
Source: European Commission JRC-B (2017).

Expected impact of Brexit on R&D strategies

Given the result of the Brexit referendum in 2016, this year we asked an open question on how it will affect the future

R&D strategy of the companies. Figure 9 report the results codified from the answers as provided.

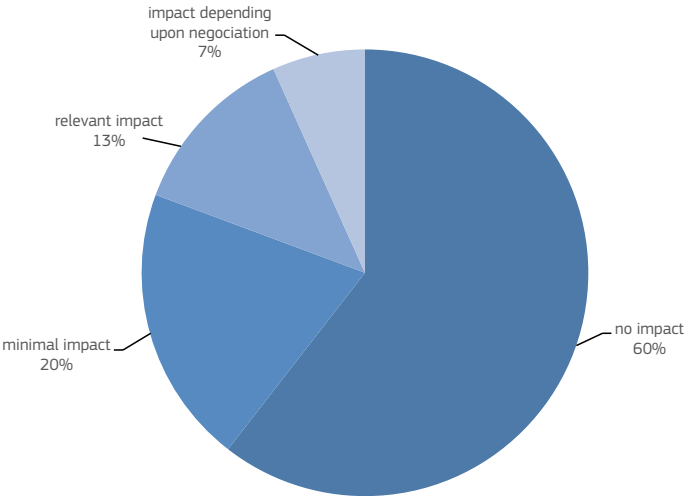


FIGURE 9: BREXIT IMPACT ACCORDING TO RESPONDENTS.
Note: The table refers to 119 out of the 151 companies in the sample, representing 19.2% of the total R&D investment by the 1 000 EU Scoreboard companies.
Source: European Commission JRC-B (2017).

Of the 151 companies surveyed, 119 responded to this question. A high proportion, **80% of respondents, indicated that Brexit will have no or minimal impact on their R&D strategy.** If we cross-check the responses to this question with the current and expected proportion of R&D investment in the UK, we see that 64 out of the 96 companies that indicate that they expect little or no impact at all on their R&D strategies do not have any R&D activities in the UK, while only eight of them have more than 10% of their R&D activities in the UK.

Reading through the individual answers, it appears clear why the big multinationals included in our sample consider the exit of an important member from the union not to be relevant for them. Many indicated that their R&D strategy will not be affected either because they do not have considerable R&D activities in the UK or because they could easily transfer these activities if needed.

Brexit is expected to have an impact, not so much on the top EU R&D investors in our sample, but more on the UK: a considerable proportion of its (foreign) R&D investments is expected to be relocated to other countries. Companies that have R&D activities in the UK expect the average UK share of their R&D investments to decline from 13% to 11%, or in nominal terms a decline of 5.4% p.a. Looking at our sample as a whole as an indicator of the developments among the largest R&D investors, the decline of the proportion of total R&D investment performed in the UK is from 4.3% to 3.5%. If we look at the EU without the UK and compare the changes in R&D investment with the UK, we find that the EU without the UK would expect growth of 4.0% p.a. (compared with 3.5% as shown in Figure 7).

Among the UK companies that participated this year, the opinions differ from the rest of the panel. Five out of 11 companies¹⁴ expect minimal or no impact at all from Brexit, while four expect a significant impact.

¹⁴ A total of 15 UK companies participated, of which 11 responded to the question on the impact of Brexit.

3

R&D EMPLOYMENT

3 R&D employment

The companies in the survey have, on average, 2 540 R&D employees, equal to 6.4% of all employees of the participating firms in 2016. As expected, looking at the sectoral distribution of R&D, there are considerable

differences across sector groups (see Figure 10). The sectors where more R&D is performed (Automobile and Other Transport, ICT, Industrials) are also those with the highest ratio of R&D employees to total employees.

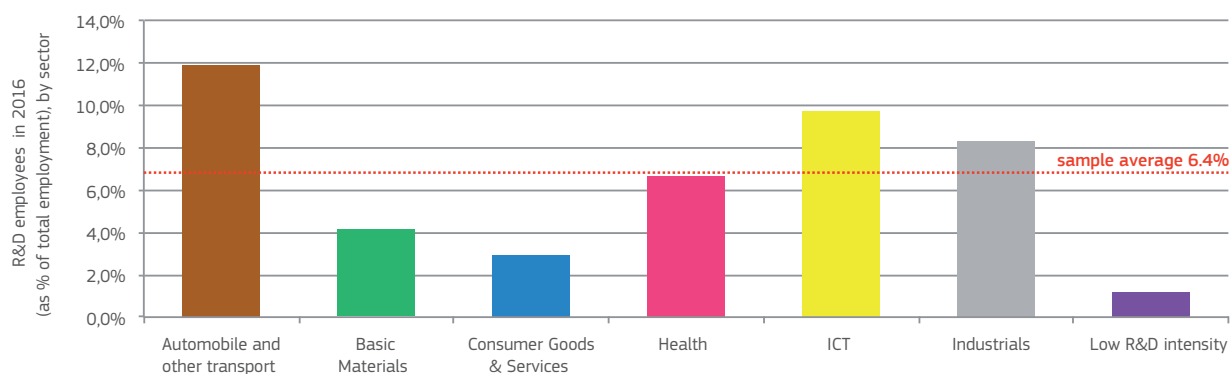


FIGURE 10: R&D EMPLOYEES PER SECTOR.

Note: The figure refers to 140 out of the 151 companies in the sample. Number of companies by sector group: Automobile and other transport (10), Basic materials (16), Consumer Goods and Services (12), Health (19), ICT (28), Industrials (28), Low R&D intensity (27).
Source: European Commission JRC-B (2017).

Geographical distribution of R&D employees differs per sector. Figure 11 gives insight into the geographical distribution of the participating companies' R&D activities. In general, the R&D activity¹⁵ is widespread: on average,

companies have R&D employees distributed over 12 countries. The sectoral distributions of R&D and R&D employees suggest that the sectors with the highest R&D and R&D employee intensities are also those

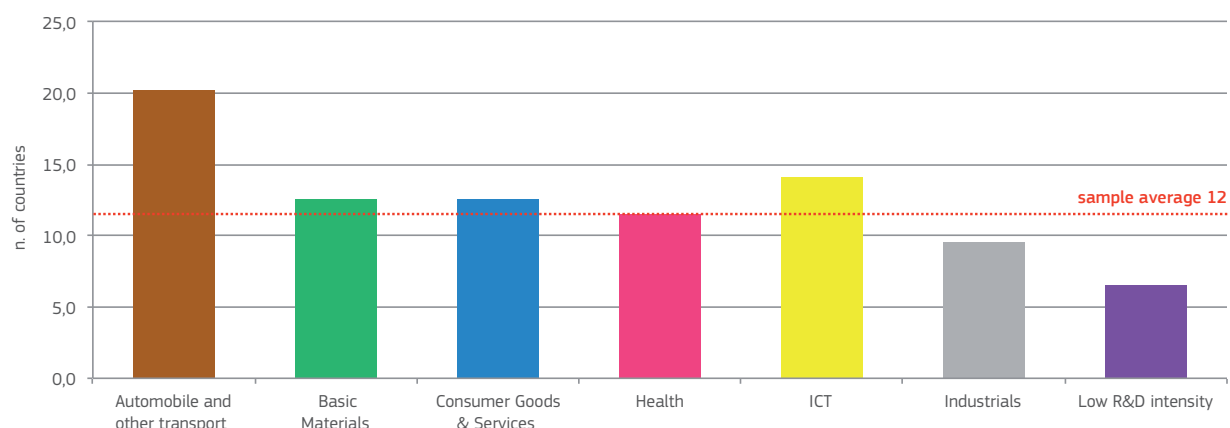


FIGURE 11: AVERAGE NUMBER OF COUNTRIES IN WHICH R&D IS PERFORMED.

Note: The figure refers to 140 out of the 151 companies in the sample. Number of companies by sector group: Automobile and other transport (10), Basic materials (16), Consumer Goods and Services (12), Health (19), ICT (28), Industrials (28), Low R&D intensity (27).
Source: European Commission JRC-B (2017).

¹⁵ Proxied by the number of countries in which the R&D employees are located.

with the highest average number of different locations for R&D activities. This is indeed the case for Automobile and Other Transport and ICT, but not for Industrials. This suggests a higher concentration of R&D activities for firms belonging to this last sector group, likely due to an agglomeration effect: performing R&D in the Industrials sector group requires more labour at the same physical location. By contrast, the R&D activity of firms in Basic Material is more geographically spread out than previous observations would have suggested.

The average number of R&D employees varies widely by sector group, as shown in Figure 12. **The Automobile and Other Transport sector has the highest average number of R&D employees**, which is only due to the ICB4 sector Automobiles & Parts. Interestingly, this sector has not only the highest average number of R&D employees and number of countries these employees are located in, but also the highest average number of R&D employees per location. This is a clear indication of the size and labour intensiveness of R&D projects in this sector – and also the dispersion of the companies' value chains.

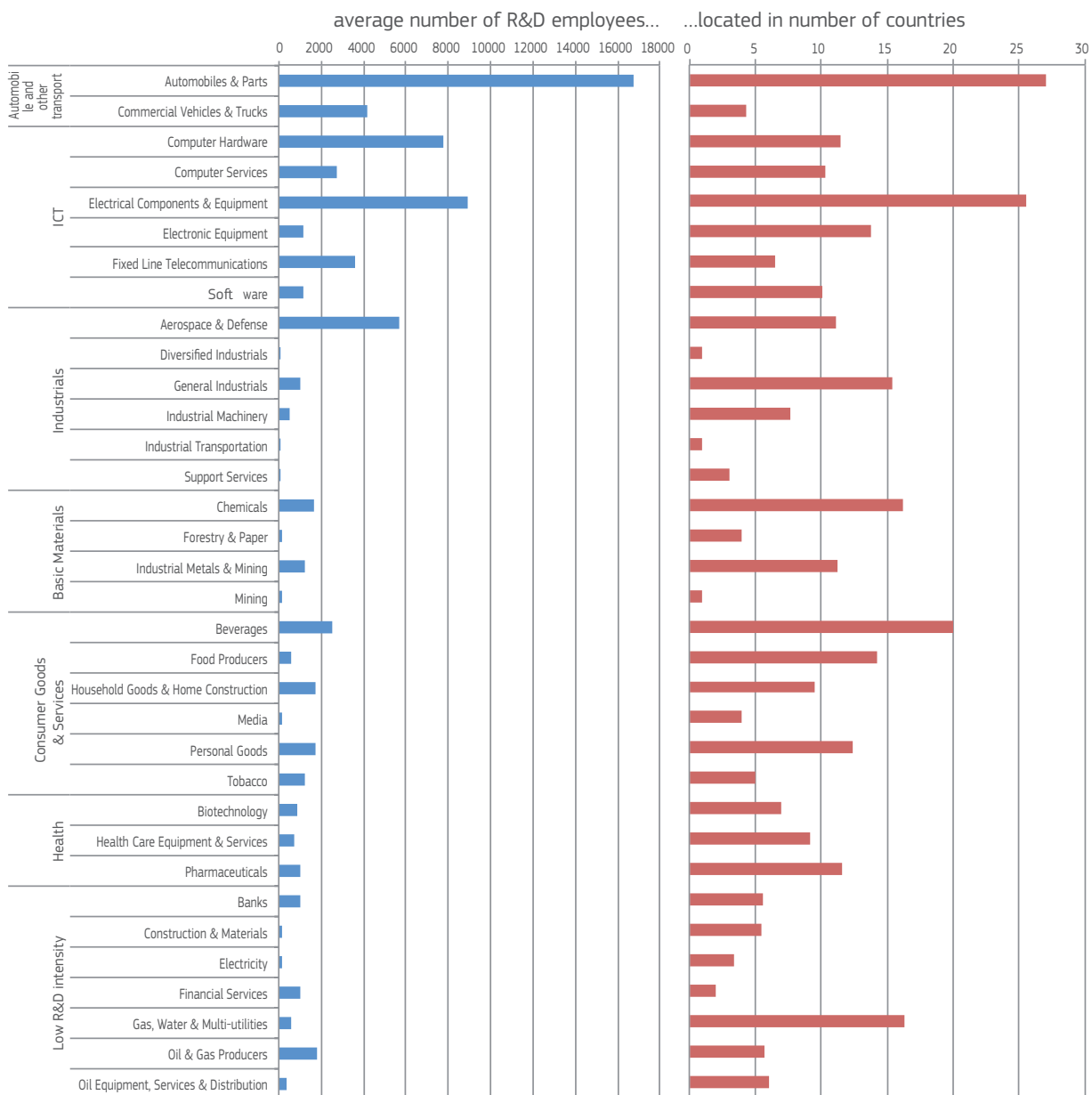


FIGURE 12: AVERAGE NUMBER OF R&D EMPLOYEES PER COMPANY AND NUMBER OF COUNTRIES WHERE THEY ARE LOCATED.

Note: The figure refers to 151 out of the 151 EU companies in the sample.

Source: European Commission JRC-B.3 (2017).

Figure 13 depicts the relation between R&D intensity (R&D investments over net sales) and the proportion of R&D employees of the total number of employees. Indeed we see, as in other years, that these proportions are very much correlated, which is logical because R&D employees'

salaries are reflected in R&D investments. The correlation over the whole sample is 70%, while the maximum correlation is found in the Automobile and Other Transport sector group (95%) and the minimum correlation is found in the Health sector (33%).

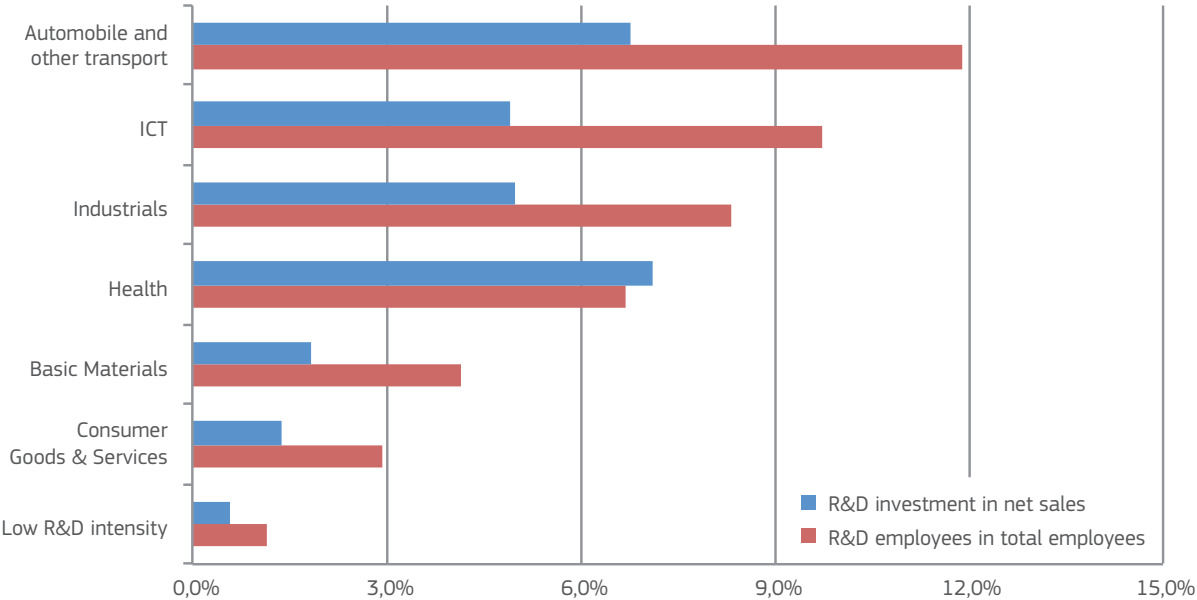


FIGURE 13: R&D EMPLOYEES AS A PROPORTION OF TOTAL EMPLOYEES, AND R&D INVESTMENT AS A PROPORTION OF NET SALES.
 Note: The figure refers to 141 out of the 151 EU companies in the sample that both indicate R&D investment and Net Sales in the 2016 EU R&D Scoreboard.
 Source: European Commission JRC-B (2017).



TYPE OF R&D **UNDERTAKEN**

4 Type of R&D undertaken

We asked our respondents to break down their R&D investment for the financial year 2016 into six different categories (plus one residual category). Figure 14 summarises their answers. The bulk of R&D for 2016 was devoted to

‘Applied research and development activities’ (39% of the total R&D invested), followed by ‘Development for market launch’ (18%) and ‘Development for adapting product to the local market’ (13%).

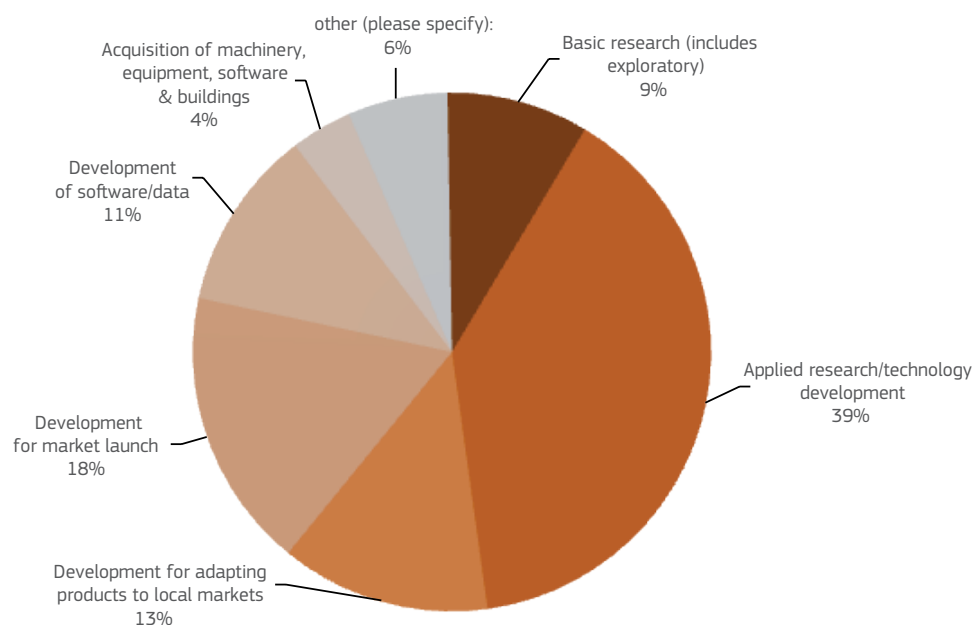


FIGURE 14: PROPORTION OF R&D INVESTMENT BY TYPE OF INVESTMENT UNDERTAKEN.

Note: The figure refers to 133 out of the 151 companies in the sample, weighted by R&D investment, representing 18.6% of the total R&D investment by the 1 000 EU Scoreboard companies.

Source: European Commission JRC-B (2017).

In total, **the applied/development activities absorb around 80% of the total R&D investment made by the companies in our sample.** This is in line with the results of previous editions of the survey, confirming a known fact about top R&D spenders: they invest disproportionately more in Development than in (basic/pure) Research. In our sample, only 9% of the R&D is spent on basic research activities. These riskier endeavours without direct results are often outsourced to research organisations that specialise in a specific field of research – something that does not show up as R&D investment in the companies’ accounts.¹⁶

Besides the low *level* of investment, basic research is characterised by the lowest concentration level¹⁷ among our respondents. Looking at the C4 index (the percentage of investment made by the top four investing firms in each category), investment in basic research is the category that is most evenly spread across the firms in the sample (C4=45.4%), which indicates that many firms consider maintaining a level of basic research to be important. On the other hand, investment in development of software/data is concentrated in a few firms (C4=64.5%).

¹⁶ See the Summary Report of the 8th IRIMA Workshop: <http://iri.jrc.ec.europa.eu/documents/10180/1160082/Final%20Summary%20Report%208th%20IRIMA%20Workshop>.

¹⁷ The concentration level is a measure as a concentration ratio. It is equal to the proportion of total investment in basic research for which the top four investing firms are responsible. A C4 index for basic research of 45.4% means that the top four firms are responsible for 45.4% of all basic research (which automatically means that the rest of the firms perform 54.6% of total basic R&D). The lower the level, the more dispersed among firms the basic R&D is.

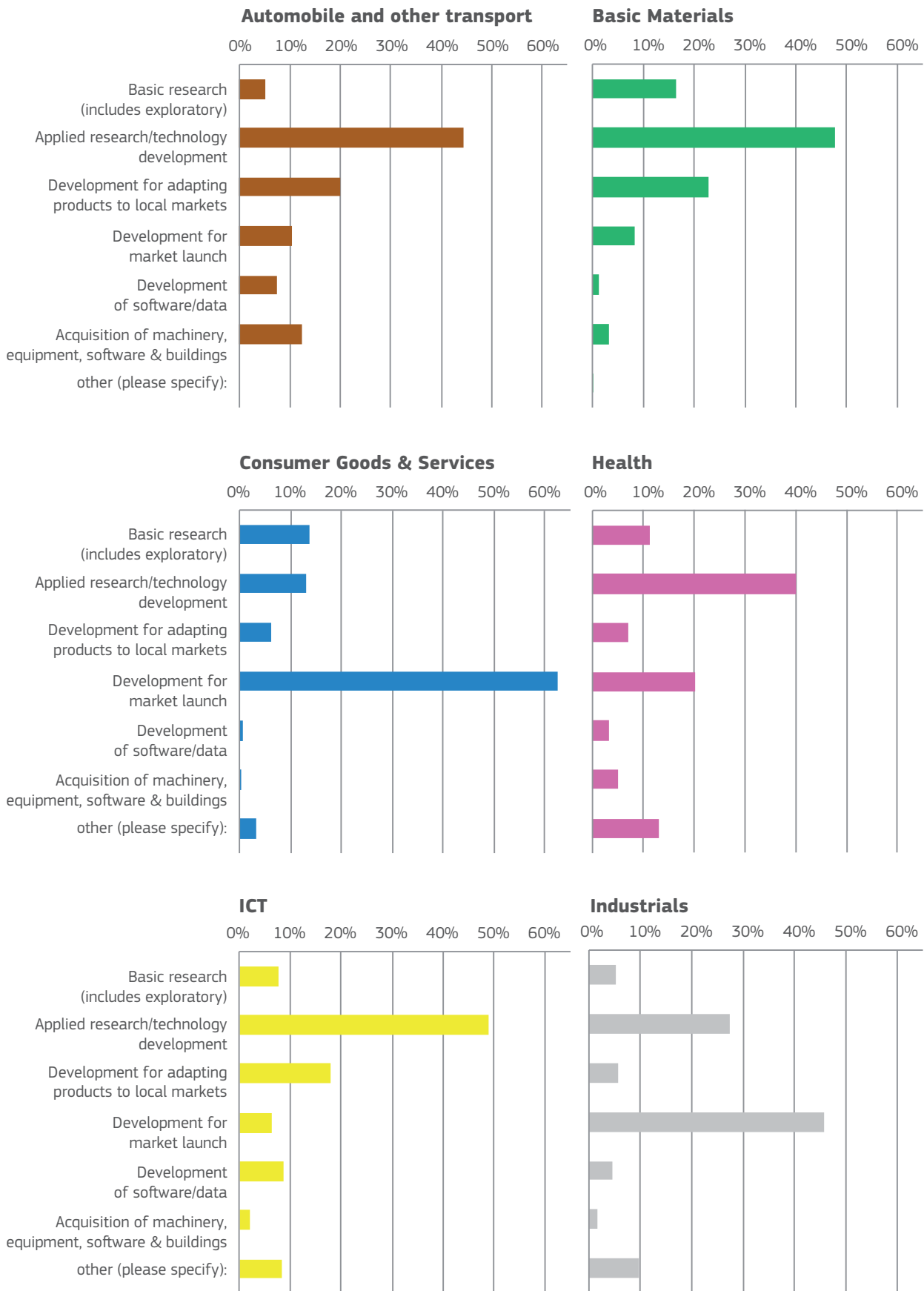


FIGURE 15: PROPORTION OF INVESTMENT BY TYPE OF R&D AND BY SECTOR GROUP.

Note: The figure refers to 133 out of the 151 companies in the sample, weighted by R&D investment, representing 18.6% of the total R&D investment by the 1 000 EU Scoreboard companies. Automobile and other transport (6), Basic materials (14), Consumer Goods and Services (12), Health (19), ICT (27), Industrials (30), Low R&D intensity (not reported) (25). Source: European Commission JRC-B (2017).

R&D TYPE	MAIN SECTORS	R&D investment (€million)
Applied research/technology development	Total	13,799
	ICT	5,870
	Basic Materials	1,790
	Health	1,731
	Industrials	1,510
	Automobile and other transport	1,432
	Low R&D intensity	1,236
	Consumer Goods & Services	230
Development for market launch	Total	6,138
	Industrials	2,528
	Consumer Goods & Services	1,106
	Health	873
	ICT	764
	Automobile and other transport	342
	Basic Materials	312
	Low R&D intensity	213
Development for adapting products to local markets	Total	4,605
	ICT	2,164
	Basic Materials	854
	Automobile and other transport	648
	Industrials	309
	Health	300
	Low R&D intensity	219
	Consumer Goods & Services	112
Development of software/data	Total	3,978
	Low R&D intensity	2,227
	ICT	1,051
	Industrials	256
	Automobile and other transport	244
	Health	139
	Basic Materials	49
	Consumer Goods & Services	11
Basic research (includes exploratory)	Total	3,114
	ICT	910
	Basic Materials	618
	Health	488
	Low R&D intensity	404
	Industrials	286
	Consumer Goods & Services	244
	Automobile and other transport	163
Acquisition of machinery, equipment, software & buildings	Total	1,346
	Automobile and other transport	403
	Low R&D intensity	267
	ICT	238
	Health	217
	Basic Materials	122
	Industrials	92
	Consumer Goods & Services	9

TABLE 2: TOTAL R&D INVESTMENT BY TYPE AND SECTOR.

Note: The figure refers to 133 out of the 151 companies in the sample, weighted by R&D investment, representing 18.6% of the total R&D investment by the 1 000 EU Scoreboard companies. Automobile and other transport (6), Basic materials (14), Consumer Goods and Services (12), Health (19), ICT (27), Industrials (30), Low R&D intensity (25).

Source: European Commission JRC-B (2017).

Unsurprisingly, as Figure 15 shows, applied research/technology development is the type of R&D where the bulk of investments are concentrated, in four out of six of our sector groups.¹⁸ However, there are important differences by sector group in how R&D investment is distributed among the different types of R&D.

R&D investment in basic research ranges from a low of 5.1% for Automobile and Other Transport to a high of 16.5% for Basic Material, mirroring the disproportionate investment in development activities already observed at the level of the whole sample. The nature of the products of these sectors varies considerably and explains the different levels of basic research. R&D in the Automobile & Other Transport sector group relies heavily on (basic) R&D performed across the whole supply chain and R&D is therefore much more targeted at the acquisition of machinery for high-quality production, development for market launch and software developments that occur in later stages of the product development process. The Basic Material sector group, on the other hand, is characterised more as a supplier (to a variety of different sectors, which include the Automobile and Other Transport sector group) and is therefore further upstream in the value chain, with higher proportions of investment dedicated to basic research. A good example of a sector group that deals directly with consumers (see also Chapter 5 on the drivers of R&D change) is the Consumer Goods and Services sector, which spends the highest proportion of its R&D on development related to market launch.

While the above figures display the proportion of R&D investment by type and by sector, Table 2 reports the absolute amounts (also by type and sector) of R&D

investment, to provide more insight into the magnitude of investment.

The ICT sector group is responsible for the majority of the investment in basic research, applied research/technology development and development for adapting products to local markets. Automobile and Other Transport was the sector group responsible for the majority of R&D in 2016 in our sample (see Chapter 1). The difference from what is reported here (ICT as the sector investing the most) is because the two analyses are based on slightly different subsamples of the respondents as a result of missing data. Some big investors in the Automobile and Other Transport sector group did not break down their R&D investment by category, and are therefore excluded from the analysis in this chapter. By contrast, some big R&D spenders in the ICT sector group did not report their expected growth for the future; hence, they are partially excluded from the analysis in Chapter 2.

Finally, if we assume that the distribution of investment by type will not change in the near future, we can combine it with the expected R&D growth for the next two years and gain insight into which kind of investment will grow most.

Applied research/technology development seems to be the area where investment will grow the least in relative terms, although in absolute terms the change will be by far the largest. In contrast, acquisition of machinery, equipment, software & buildings should experience the largest relative growth, but also in this case, if we consider the absolute R&D investment predicted in this specific category, its role will remain marginal (3.3% of the total future forecast R&D).

¹⁸ We did not include a chart for the Low R&D Intensity sector group, which invests most of its resources (in percentage) in the development for software/data (48.6%).

5

DRIVERS OF CHANGES **IN R&D**

5 Drivers of Changes in R&D

We asked companies for the main drivers that have had an impact on the decision to change R&D investment. For each of the drivers included in the survey, Figure 16 shows the percentage of companies that consider them very (4) or highly (5) relevant.

Demand change, improving productivity and the chance to exploit technological opportunities are the factors that drive the expected R&D investment changes of the companies. This result is identical to last year, notwithstanding the fact that of the 151 responding companies just 81 participated in the 2016 survey. Moreover, the importance of market pull and technology push as R&D drivers has also been observed in our previous surveys. Drivers of R&D investment seem very consistent among the largest companies.

Meeting product market regulation is a significant driver of R&D investment; 55% of our respondents marked it

as very/highly relevant, whereas last year the percentage was 45%.

In terms of competition from other firms as a driver of R&D investment, it depends on where the competitor is located. As is to be expected, competition pushes R&D investment mainly when the other players are located in countries next to the technological frontier. In fact, internal competition (i.e. from other EU companies) and competition from companies located in other developed countries are recognised as more important in motivating R&D investment than competition from companies located in emerging countries, such as China and India.

Maintaining R&D as a fixed proportion of net sales is not raised as a significant motivation to invest in R&D. These last two findings are in line with the results of previous editions of the survey.

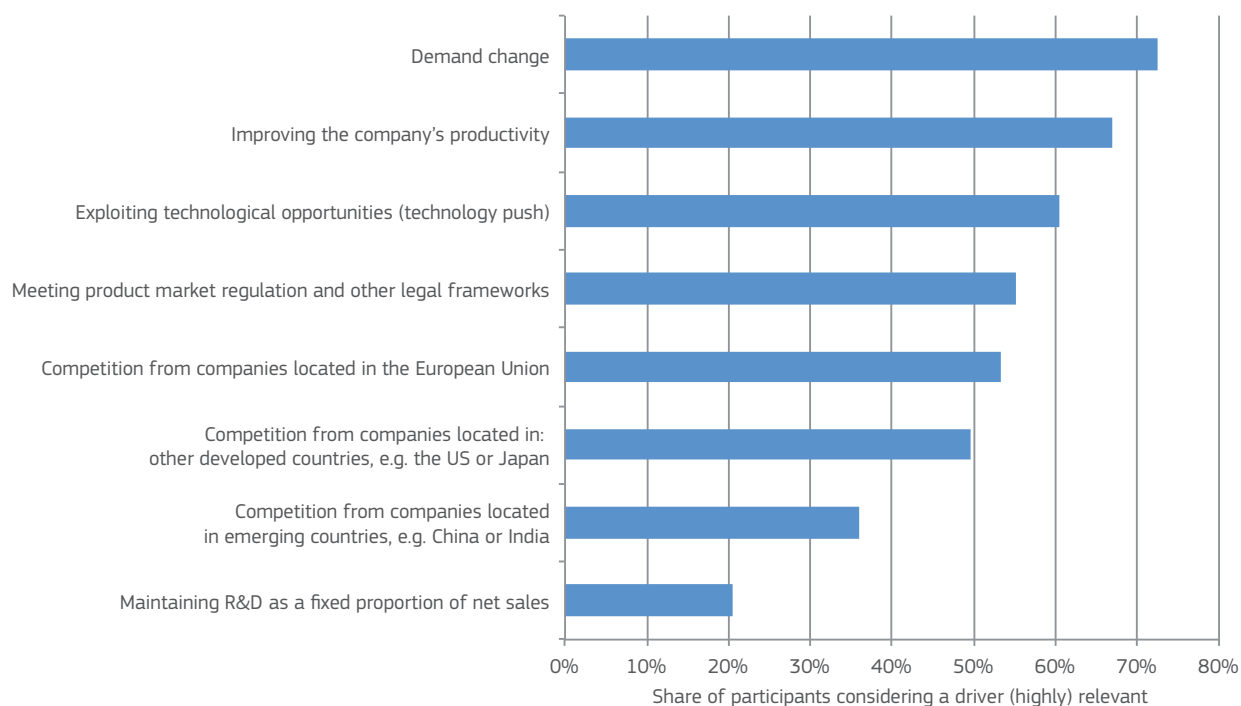


FIGURE 16: DRIVERS OF EXPECTED R&D INVESTMENT CHANGES.

Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 142 out of the 151 companies in the sample, representing 24.4% of the total R&D investment by the 1 000 EU Scoreboard companies.

Source: European Commission JRC-B (2017).

We can get a more detailed picture of what drives R&D investment by looking at the distinct sector groups, where some interesting divergences from the general pattern emerge.

Meeting product market regulation is the most important driver of R&D investment for firms in the

Health sector group, while demand change is the least important factor for adjusting R&D levels. The latter is probably related to the nature of its long R&D trajectories and shows the different nature of the Health sector from more consumer-related sectors.

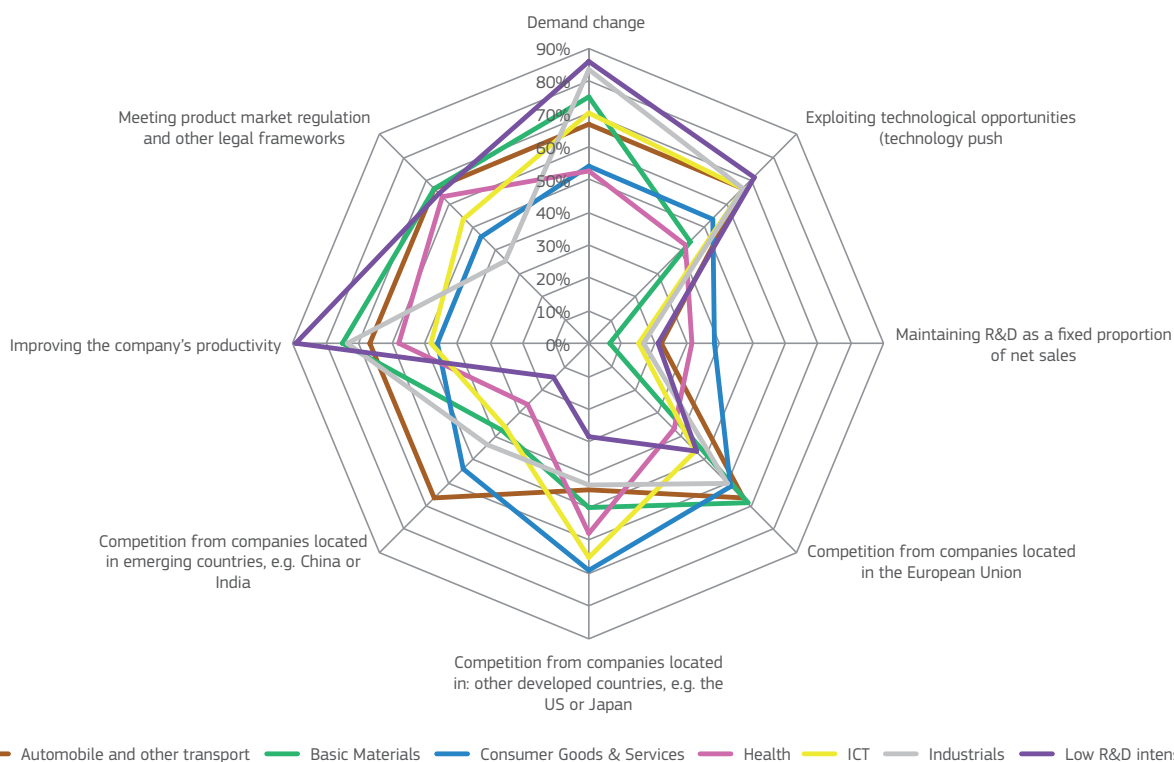


FIGURE 17: DRIVERS OF EXPECTED R&D INVESTMENT CHANGES – DETAIL.

Note: The activities are listed clockwise by average relevance of the major items in the survey. The figure refers to 142 out of the 151 companies in the sample (Automobile and other transport 9, Basic materials 16, Consumer Goods and Services 13, Health 19, ICT 27, Industrials 30, Low R&D intensity 28) representing 24.4% of the total R&D investment by the 1 000 EU Scoreboard companies.
Source: European Commission JRC-B (2017).

Competition pressure within the Consumer Goods and Services sector is the strongest driver for increasing R&D investment – especially from other developed countries such as the US and Japan. This is in line with our finding that this sector group spends the largest part of its R&D investment on development for market launch (as we saw in Chapter 3). The focus of this sector group seems to be on launching new products with more incremental improvements than revolutionary breakthroughs.

Intra-EU competition is the strongest among firms from the Basic Material sector group. On the other hand, and not surprisingly, firms in the ICT sector are those for which competition from companies located in other

developed countries constitutes the biggest driver of investment in R&D.

We examined the expectations in terms of R&D growth in the context of the drivers of R&D investment to investigate if there is a difference in terms of motivation between firms planning a significant increase in their future R&D investment and those expecting a small or even no investment increase. Accordingly, the sample of respondents was split into two groups, using 3% expected R&D increase per year as the threshold. Figure 18 displays the percentages of companies in the two groups and shows the percentage of companies for which each individual driver was reported to be very or highly relevant.

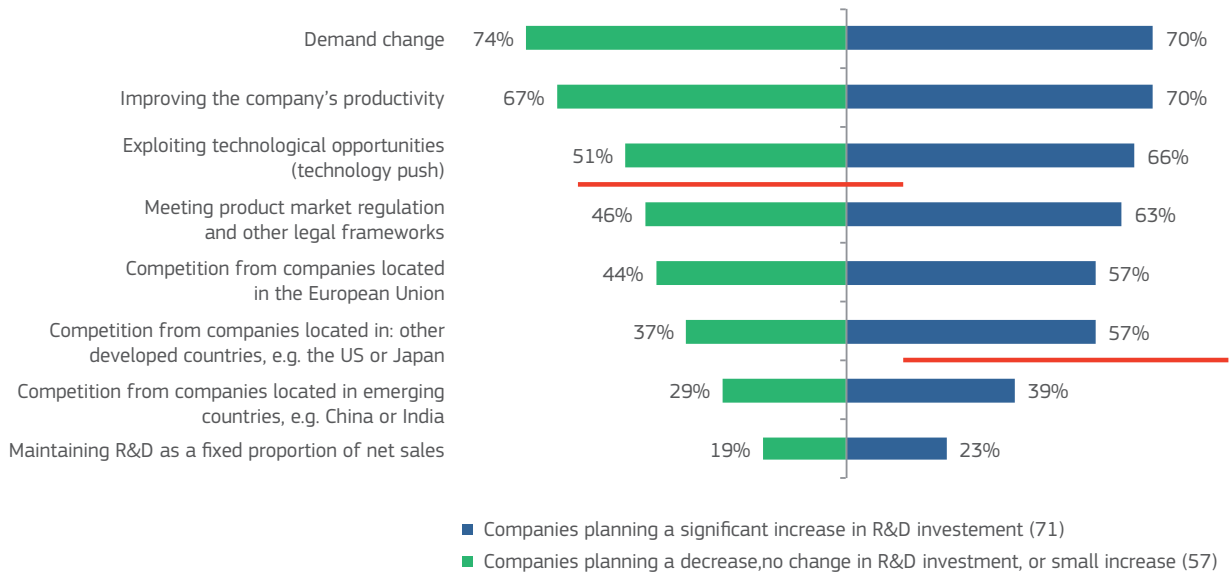
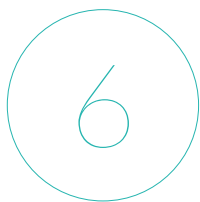


FIGURE 18: DRIVERS OF EXPECTED R&D INVESTMENT– PLANNED SIGNIFICANT R&D INCREASE VERSUS PLANNED R&D SMALL INCREASE OR NO CHANGE.
Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 128 out of the 151 companies in the sample (those that replied to both questions on R&D expectations and R&D drivers).
Source: European Commission JRC-B (2017).

In terms of importance, the drivers are ranked the same for the two groups. Thus, factors that push some companies to predict a substantial increase in R&D investment are the same as those that drive others to a moderate increase or even decrease in R&D investment. Although the rank is the same, the importance of the same driver for the two groups is not. For example, competition from companies located in other developed countries is very relevant for firms planning a big R&D increase, but is not as crucial for the other group. Moreover, if we consider

how many drivers are perceived as very/highly relevant by at least half of the companies in each group (see red lines in Figure 18), we find a remarkable difference. While six out of eight drivers are relevant for at least half of the companies planning a significant increase in R&D, this number goes down to three out of eight drivers for the other group. Thus, while a significant increase in R&D investment can be made for several reasons, the motivation behind a small increase or no increase at all is easier to discern.



PATENTING ACTIVITY

6 Patenting activity

For the first time, we asked companies to provide us with more insight into their patenting behaviour. Specifically, we asked companies how many inventions had been protected by patents¹⁹ during the period 2010–2014, what proportion of their R&D investment was dedicated to patenting activities, and the estimated development costs and commercial value of these patents. Although we realise that some of these questions are difficult to answer for (some) companies, the results show some interesting insights.

The top 1 000 EU firms from the R&D Investment Scoreboard received an invitation to fill in the questionnaire for the survey. As mentioned in the Introduction, this year's

questionnaire asked for the first time for the number of patent applications.

The invitation was sent by post and email. In the invitation that was sent by post, we informed the companies of how many applications to patent families were filed during the period 2010–2014, as extracted from the PATSTAT database in collaboration with the OECD. The PATSTAT database contains data from the three main patent offices (EPO, USPTO and JPO). Owing to technical limitations, this information was not available on the online questionnaire. As the postal invitation arrived considerably later than the digital questionnaire²⁰ the number extracted by us from PATSTAT was unknown to most of the companies.

Number of patent applications

Of the 151 companies that responded to the questionnaire, 118 provided an answer to this question, while the OECD patent database contained data on 65 companies; for 53 companies, both the OECD and company data were available.

The answers provided and the data obtained from OECD vary considerably: there is only one company for which the data are similar. Companies tended to overestimate (70%) more often than underestimate (30%) the number of applications.

The answers provided can still be compared with the data in the patent database, but some caveats should be taken into account. First, the patent database calculates fractions of patents: if a patent family is evenly shared

between two inventing companies, this counts as 0.5 patents, while companies instead tend to count this as one. Second, we use the definition of patent families according to which several individual patents are linked to protect one invention. However, there are multiple interpretations available and these might vary from company to company. Third, according to feedback from some companies, these data are mainly available from and accounted for by the legal departments and not by the R&D or technical departments that mostly responded.

The average number of patent applications is 439 for the period 2010–2014, distributed very unevenly over the companies, with a median of 56 patents, and 14 firms (12% of the companies that responded to this question) were responsible for 80% of all patent applications.

¹⁹ This number refers to patent families, a set of individual patents to protect a single invention.

²⁰ Contact persons – where available – were contacted via email and a link to the online questionnaire was provided.

Proportion of R&D dedicated to patenting

The questionnaire continues by asking companies to indicate the proportion of R&D that is dedicated to patenting activities. A total of 108 companies responded to this question, of which 98 also indicated the number of patent applications.

Here, too, the answers vary considerably, with an average R&D investment of 16% dedicated to patenting and

a median of 5%. The proportion of R&D dedicated to patenting does not appear to be related to any particular type of R&D undertaken: none of the types of R&D show a significant correlation with either the number of patents applications or any other firm characteristic, such as firm size (based on number of employees), number of R&D employees or net sales.

Costs and value of a patent

Feedback from companies on the question regarding providing an estimate of the development costs of a patent indicates that firms do not keep track of this specific information. This resulted in a response rate of only one-third. The average development costs around one invention are estimated at €83 thousand, with a median cost of €30 thousand, because just four firms declared half of all development costs of all the firms.

As with the development costs, the commercial value of patents was considered difficult or impossible to es-

timate because companies do not keep track of this information and the differences between patents or inventions can be enormous. Only 22 companies answered this question, indicating an average commercial value of almost €400 thousand – considerably higher than the development costs. These 22 companies declared development costs of around €66 thousand which leads to a mark-up of around six times these costs for each patent family.

Sector differences

Looking at the detailed sector classification, we lose the option of comparing development costs and commercial value owing to the small number of observations per group. However, the differences in the number of inventions protected by patents is quite pronounced, as shown in Table 3. **The Health sector, which includes**

pharmaceutical companies, seems to protect relatively few inventions, but dedicate a high proportion of R&D investment to patenting. On the other hand, ICT firms have many patented inventions, but only a small proportion of total R&D investments is dedicated to patenting.

Sector group	#	# of inventions protected by patents	#	Share of R&D dedicated to patenting (%)
Automobile and other transport	6	928	25	27,3%
ICT	24	879	17	5,5%
Basic Materials	14	765	14	7,2%
Consumer Goods& Services	9	716	7	15,8%
Industrials	27	177	4	6,6%
Health	17	100	15	27,6%
Low R&D intensive	20	75	16	10,8%

TABLE 3: PATENT ACTIVITY BY SECTOR GROUP.

Size effects

Protecting inventions by patents seems to be something that large firms do more frequently than smaller firms. Even within this selected group of large firms, drawn from the top 1 000 R&D investors, the differences are very large and skewed: patenting seems to be the activity of a selected group of very large firms only.

The largest companies (with more than 50 000 employees) are responsible for the majority of patent applications (69%), which almost follows a Pareto distribution, as

can be seen in Table 4. Even within the size classes, it seems that the number of patent applications is skewed towards the largest companies, as shown by the median of patented inventions per size class (last column).

From a policymaker perspective, it would be interesting to know why size seems to be such an important factor even within this sample of the largest R&D investors, where it is not likely that the smaller (but still very large) firms experience barriers to protecting innovation.

size class # of employees	#	Average # of employees	Total amount of inventions protected by patents	% of patents of all companies	Average # of inventions protected by patents	Median number of patented inventions
up to 2500	37	1133	1067	2%	43	5
2 501-10 000	40	5321	1871	4%	65	9
10 001-50 000	43	24208	12882	25%	322	79
more than 50 000	29	146265	35915	69%	1710	400

TABLE 4: DIFFERENCES IN PATENT ACTIVITY BY SIZE CLASS.



LOCATION AND
ATTRACTIVENESS
**FOR R&D
AND PRODUCTION**

7 Location and attractiveness for R&D and production

Our survey asked the respondents to rank the top three countries for both R&D and production activities together with the factors that influence the decision about where to locate these activities. This section presents the main

countries in which R&D activities are located and the factors that make a country attractive for performing R&D and then repeats this exercise for the location of production activities.

Where do firms perform their R&D?

Only 20% of the companies perform R&D in only one country; half of the companies perform R&D in at least five countries and one-quarter do so in 10 or more countries. However, the bulk of the investments is made in the country in which the headquarters is based. In this year's questionnaire, we asked the companies to provide us with the proportion of R&D performed in each of the top three countries, which allows us to see how concentrated these activities are. Here we see that, although companies perform R&D in more and more countries, the bulk of R&D (60%) is performed in the main R&D country. For companies that have their headquarters in the main R&D country, this proportion is 62% compared with only 48% for those companies that have their headquarters in a different country from the main R&D location.

The largest EU R&D investors are true global players. However, a company's historical location remains an important factor for locating R&D activities.

One out of three companies performs R&D in each of the four main economic areas.²¹ One-quarter of the companies perform R&D only in the EU. Beyond the global presence of R&D activities in more than one country, 87% (compared with 83% last year) of the respondents mention the companies' headquarters location as the country where the highest proportion of R&D is currently being performed. This shows that there is a high degree of path dependency underlying the location of R&D activities and indicates that the internationalisation and offshoring of R&D activities does not necessarily lead to their disappearance at the home site.

Germany and France (EU) and the US and China (non-EU) are the main locations for R&D activities.

Looking at the most popular countries for performing R&D activities outside the home-base country (Figure 19), the United States is clearly in the lead, with almost half of all firms performing R&D activities there (red bar). Germany, China and France follow at considerable distances. German firms make up about half of the firms that perform R&D in Germany. Excluding these German firms, about 20% of all responding firms perform R&D in Germany (blue bar).

China's popularity for performing R&D has been growing since the survey in 2006. This development is reinforced as this is the first time China was mentioned as the most attractive country for R&D (one time), the number of times China was mentioned as the second most attractive country has increased from five to eight, and it remains the most mentioned country as the third most attractive country (16 times).

It is also noteworthy that Belgium and especially Poland report the highest *popularity ratios*, 3.3 and 8, respectively. This ratio is of the number of mentions as a top three R&D location over the number of times a country is a company's headquarters. In the case of Belgium, this means that Belgium has been mentioned 13 times among the top three R&D locations while only four companies have their headquarters in Belgium. For Poland this is eight mentions versus one headquarters location. The higher this ratio, the more often a country is mentioned as a top R&D location by companies without their headquarters there, which is an indication of the attractiveness of a country for performing

²¹ By 'main economic areas', we refer to the EU, North America (US), Asia (China, India and Japan) and the Rest of the World.

R&D. The factor of attractiveness that is valued most highly by firms performing R&D in these countries turns out to be mainly the labour costs for researchers in both

countries: this factor is valued as 24% (Poland) and 16% (Belgium) more highly for firms that perform R&D in these countries than for firms that do not.

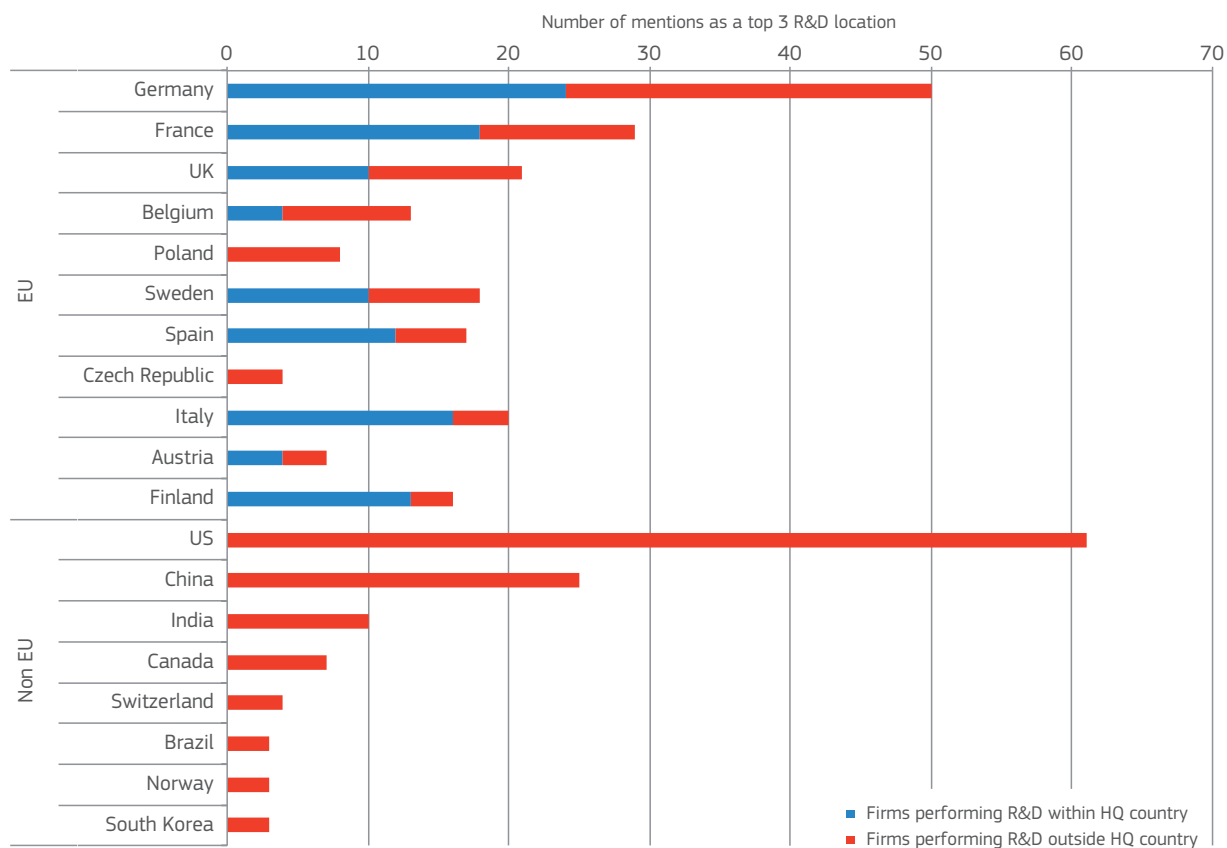


FIGURE 19: MOST POPULAR COUNTRIES FOR THE COMPANY'S R&D.

Note: The figure refers to 131 out of the 151 companies in the sample, although only countries mentioned at least five times are shown. Numbers of mentions refer to one of the three countries currently considered the most attractive location for the company's R&D activities.

Source: European Commission JRC-B (2017).

What factors make a country a popular R&D location?

The questionnaire also looked at the factors for locating R&D activities, where quality and availability of researchers and access to knowledge play the main role, shown in Figure 20.

As in our previous surveys – and again confirmed in Figure 20 – labour costs for researchers do not seem to be an important factor of attractiveness. Instead, the factors that have the highest share of attractive and highly attractive²² are the quality and high availability of researchers and access to specialised R&D knowledge.

We now examine how the different factors are valued by firms with an above-average level of R&D activities located in one of the three main regions: the EU, the US and China or India.²³ Figure 21 shows the proportion of firms that rate the factors as attractive or highly attractive. The factors are ordered by the proportion of firms with only R&D activities in the EU. **Quality and availability of researchers, and macroeconomic stability are most often rated as (highly) attractive by firms that perform R&D in only the EU.** Low labour cost is clearly considered much less important by this group of firms.

²² The questionnaire uses a 5 point Likert scale, from 1 (not attractive) to 5 (highly attractive).

²³ Here, the EU group consists of firms that perform all their R&D in the EU. The groups US and China or India consist of firms that declare R&D activities above the average level in the US and China or India, respectively.

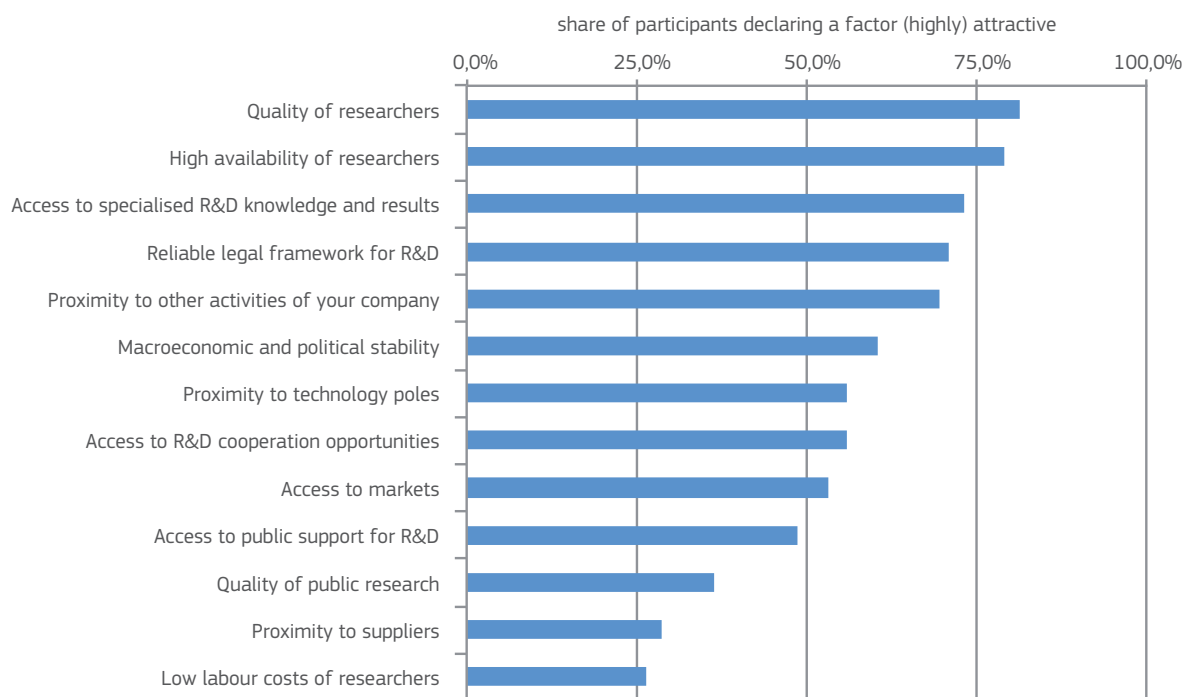


FIGURE 20: FACTORS OF ATTRACTIVENESS FOR R&D LOCATION.

Note: The figure refers to 141 out of the 151 companies in the sample.

Source: European Commission JRC-B (2017).

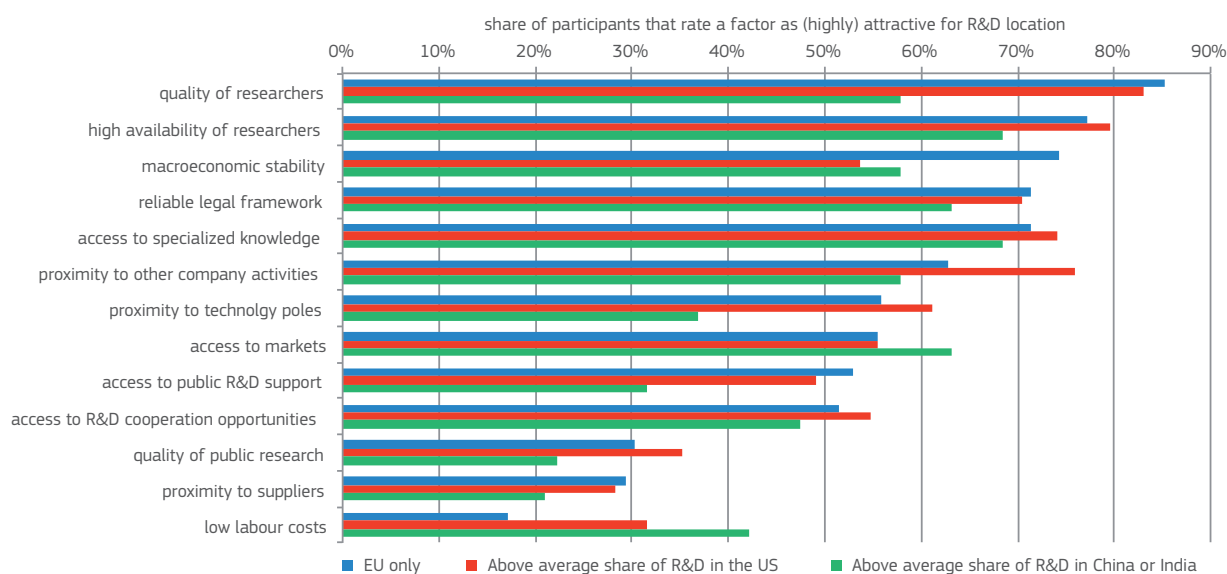


FIGURE 21: COUNTRY ATTRACTIVENESS FACTORS FOR LOCATING R&D OF FIRMS WITH DIFFERENT GLOBAL STRATEGIES.

Note: The figure refers to 141 out of the 151 companies in the sample, of which 37 only perform R&D in the EU and 102 in at least two of four main the economic areas.

Source: European Commission JRC-B (2017).

Interestingly, this factor shows the greatest difference from firms that have a significant proportion of their R&D in the US and – more strongly so – in China or India.

Firms performing an above-average proportion of their R&D in the US consider quality and availability of researchers, and proximity to other activities of the firm to

be the most attractive factors for selecting the location of R&D activities.

We now show how the factors are rated by firms that have made the decision to locate R&D in the US (Figure 22) compared with companies that do not perform R&D in the US, organised by the difference in attractiveness of the

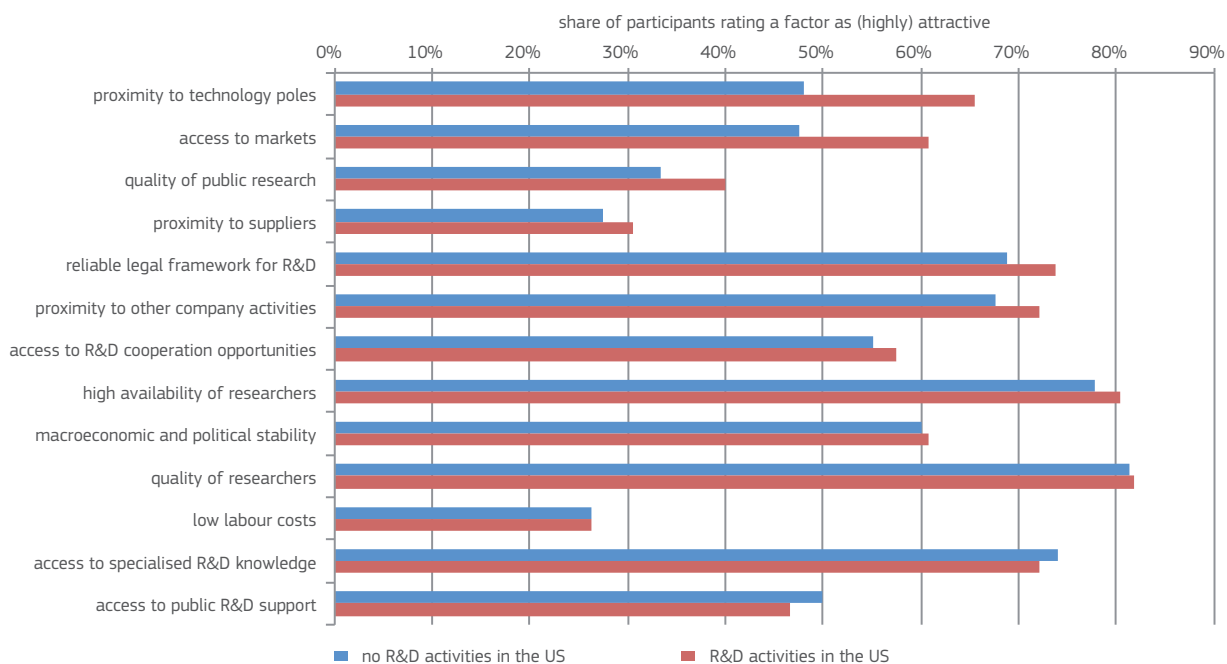


FIGURE 22: FACTORS OF ATTRACTIVENESS FOR FIRMS THAT PERFORM AND THAT DO NOT PERFORM R&D IN THE US.
Note: The figure refers to 141 out of the 151 companies in the sample, of which 62 perform R&D in the US and 79 do not perform R&D in the US (one of the three main locations).
Source: European Commission JRC-B (2017).

factors. Firms that perform R&D in the US rate access to the market and proximity to technology poles much more highly than firms that do not perform R&D in the US.²⁴ An explanation for this might be the

presence of world-class technology poles, such as Silicon Valley, where firms feel the need to be present in order not to miss out on potential technological developments.

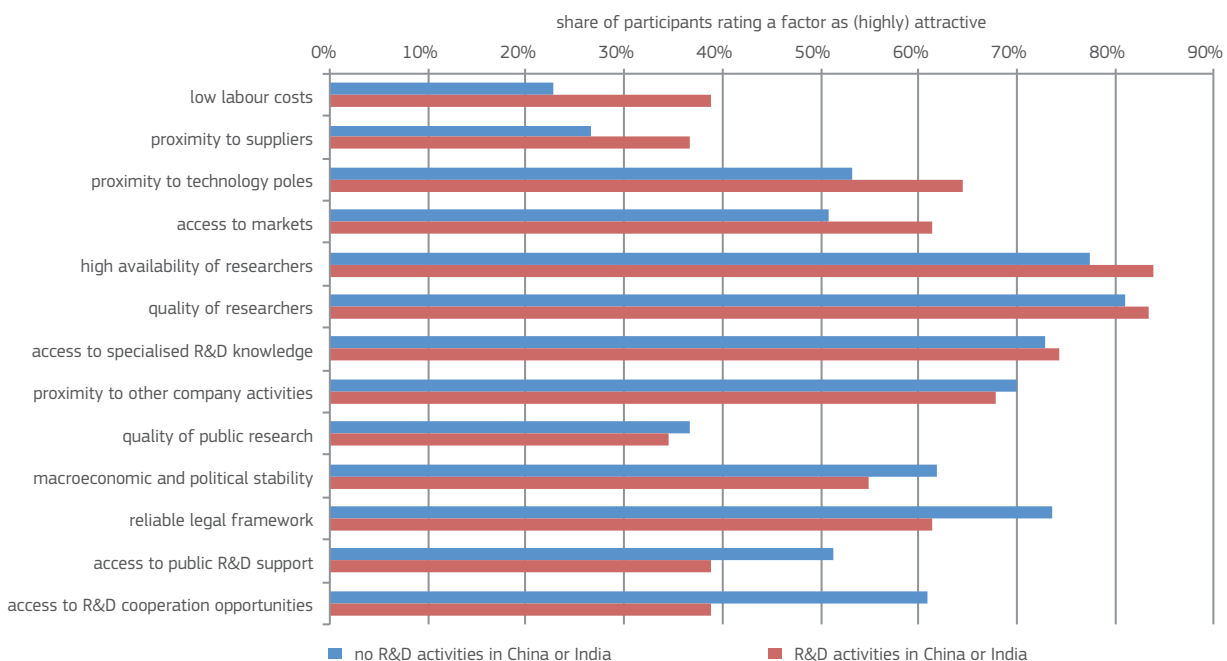


FIGURE 23: FACTORS OF ATTRACTIVENESS FOR FIRMS (NOT) PERFORMING R&D IN CHINA OR INDIA.
Note: The figure refers to 141 out of the 151 companies in the sample, of which 25 perform R&D in China and 116 do not perform R&D in China (one of the three main locations).
Source: European Commission JRC-B (2017).

²⁴ Here we look at whether a firm mentions the US as a top three R&D location or not. Participants are asked not for the attractiveness of specific countries, but for factors that render a country attractive for locating the firm's R&D activities.

In Figure 23, we repeat this exercise, but with firms that have R&D activities in either China or India. **Factors valued more often as (highly) attractive by firms with R&D activities in these countries are low labour costs, proximity to suppliers and proximity to technology poles.** China and India have been able to attract a lot of production activities, partly thanks to low labour costs and

extensive networks of (production) suppliers. Now, these production activities make it interesting for firms to locate R&D in these regions as well, close to the main production sites (e.g. Shenzhen, China, where many ICT companies are located because of its proximity to the main factories related to the production of mobile phones and other ICT products).

Where do firms locate their production activities?

Only 13% of the firms concentrate their production activities in one country – compared with 20% for the R&D activities. We do not have data on the number of countries in which firms perform production activities, but we can see that 78% of the firms do so in at least three countries. Production is less concentrated in one country: the proportion of production²⁵ performed in the main production country is on average only 39% compared with 60% for R&D activities.

Historical reasons for the location of production activities play an important role, though much less so than for R&D activities: 72% of firms have their main production site in the country that contains the company's headquarters. **Figure 24** shows the most popular countries where production activities are located. **The main production locations are – like last year and like the most popular R&D locations – the US, China and Germany.** However, among this year's respondents, both the US and China are much more

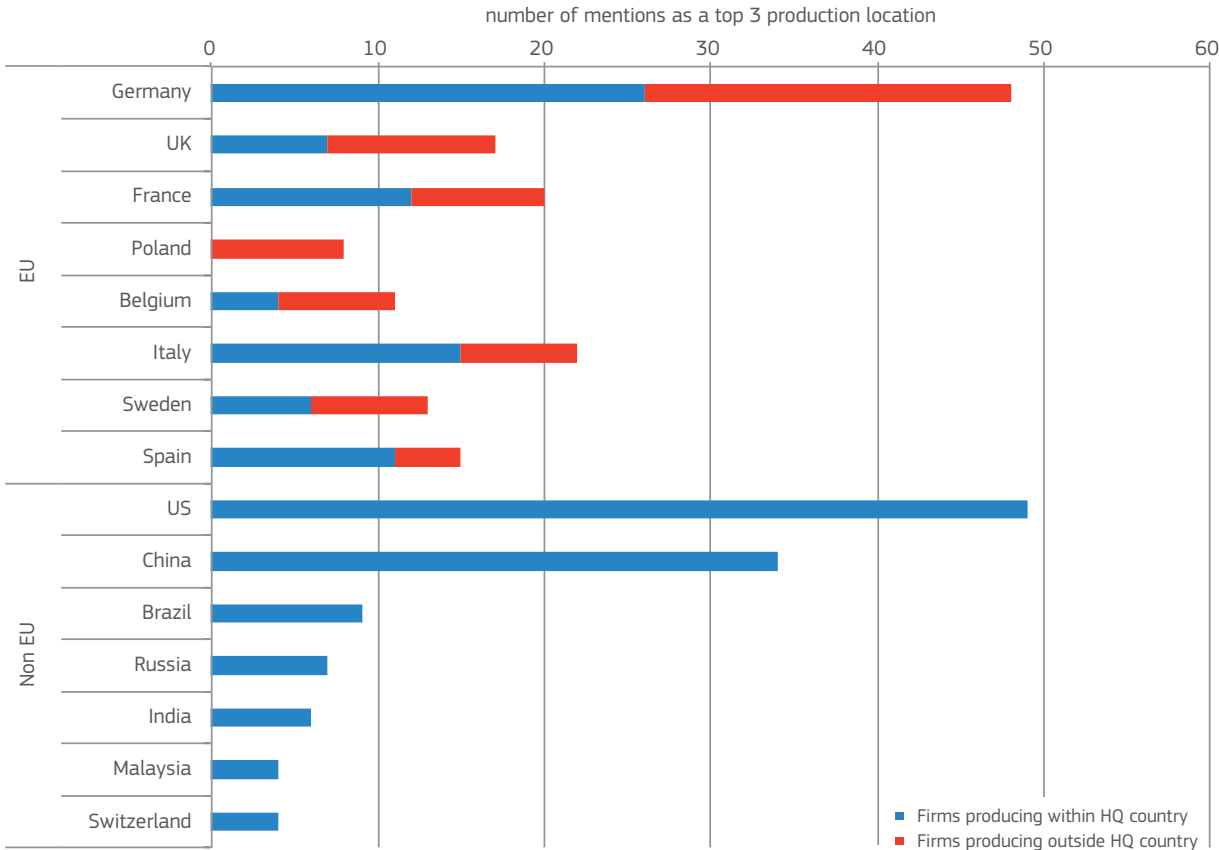


FIGURE 24: MOST POPULAR COUNTRIES FOR THE COMPANY'S PRODUCTION.
Note: The figure refers to 144 out of the 151 companies. Numbers of statements refer to one of the three countries currently considered the most attractive location for the company's production activities. Only for countries mentioned at least five times.
Source: European Commission JRC-B (2017).

²⁵ This has been calculated over the net sales in 2015 from the data as reported in the EU R&D Scoreboard.

often mentioned than last year (US, 48 vs 31; China, 34 vs 13 last year). **One out of eight companies has two of its top three production locations in both the US and China** – in 10 cases, these are German companies that perform the highest proportion of production in the home country.

As with R&D locations, both Belgium and Poland are also the two EU countries with the highest popularity ratios.²⁶ This shows that there is certainly a degree of co-location between R&D and production.

What makes a country a popular production location?

The main reasons for locating production activities in a certain country are the access it provides to the local market, and the availability and quality of the personnel (see Figure 25). Low employment protection is not considered as an important factor of attractiveness for production activities.

As with the attractiveness of factors for locating R&D activities, we look at how firms from the three groups (EU only, US and China or India) value the factors of attractiveness for production location (see Figure 26). **Access to markets, macroeconomic stability and quality of personnel are most often rated as (highly) attractive by firms producing only in the EU**, while low employment protection is clearly the least important factor.

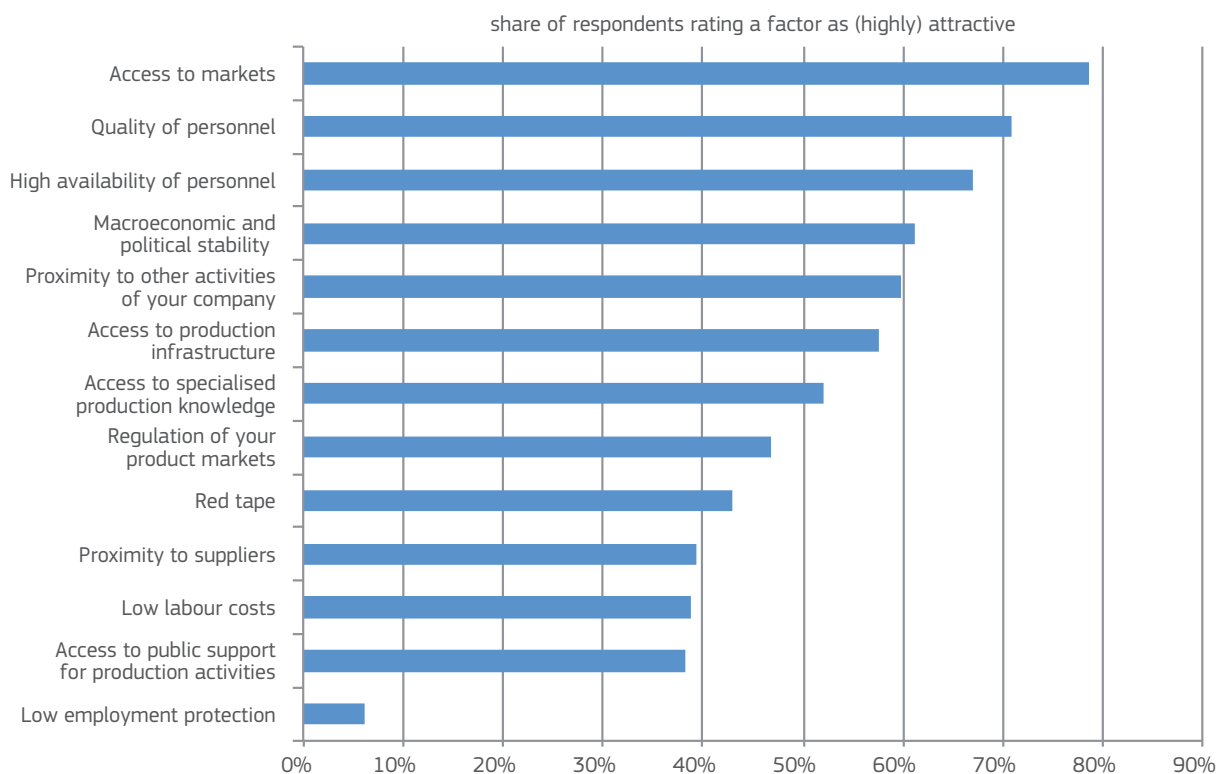


FIGURE 25: IMPORTANCE OF ATTRACTIVENESS FACTORS FOR PRODUCTION ACTIVITIES.
Note: The figure refers to 131 out of the 151 companies in the sample of the 1 000 EU Scoreboard companies.
Source: European Commission JRC-B (2017).

²⁶ Ratio of number of companies mentioning a country as a top production location and number of headquarters locations.

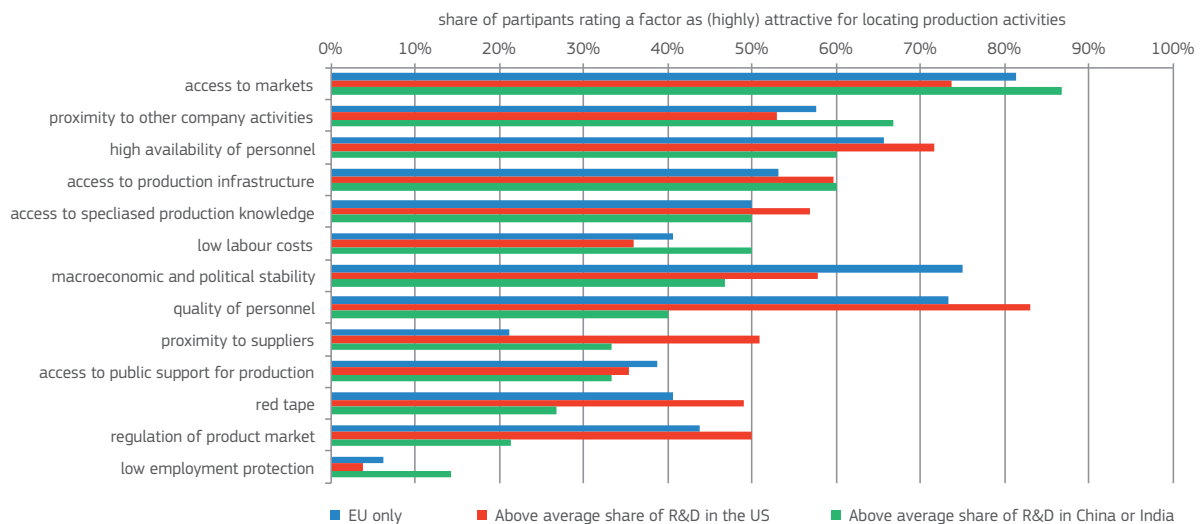


FIGURE 26: DIFFERENCES BETWEEN PROPORTION OF FIRMS RATING FACTORS AS (HIGHLY) ATTRACTIVE – FOR THE GROUPS EU ONLY, US AND CHINA OR INDIA.

We now show how the factors for locating production activities are differently rated between firms that have made the decision to produce in the US (Figure 27) or in China or India (Figure 28) and firms that do not. We see that, **for the US and China or India, the proximity to suppliers and the access to production**

infrastructure are rated much more highly by firms that produce in these countries than by firms that do not. For firms producing in China or India, low labour costs are also more highly valued than for firms that do not produce there.

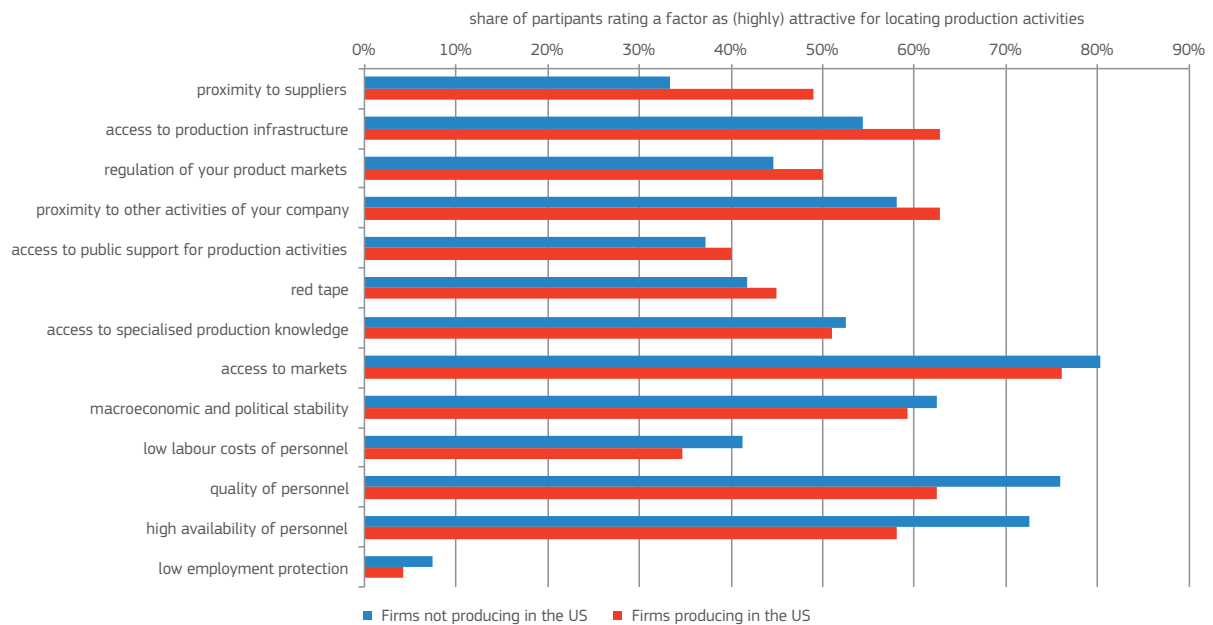


FIGURE 27: FACTORS OF ATTRACTIVENESS FOR FIRMS THAT PRODUCE AND DO NOT PRODUCE IN THE US.

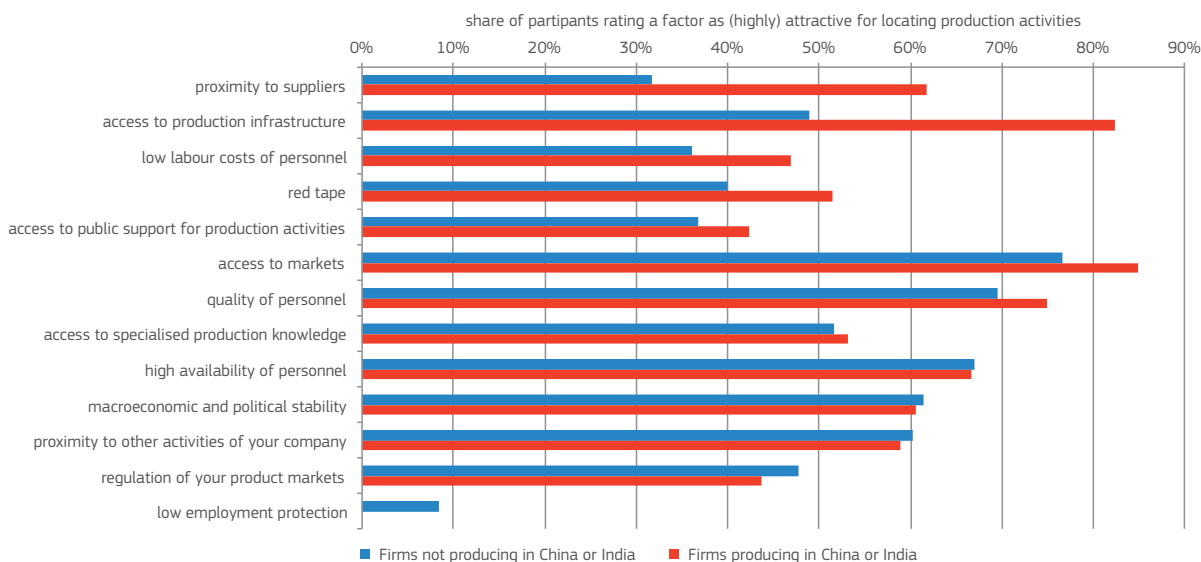


FIGURE 28: FACTORS OF ATTRACTIVENESS FOR FIRMS THAT PRODUCE AND DO NOT PRODUCE IN CHINA OR INDIA.

Production versus R&D location

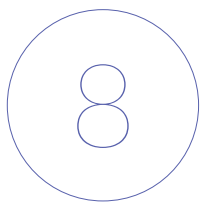
In 2016, we looked for the first time at the difference between the number of companies that mention a country as a top three production location and as a top three R&D location. As with last year's edition, **China, Brazil and Russia can be considered production countries.** For Brazil and Russia, low labour costs are valued more highly by firms with production activities in these countries.

The US, Canada and India can be considered more R&D locations, as shown in Table 5. For India, labour costs seem to be an important factor, valued as 41% more important by companies performing R&D in India than by firms that do not. For Canada, this is not the case: only access to specialised knowledge is valued as more important by firms performing R&D in Canada. For the US, we have already seen that all factors, except macroeconomic stability and public support, are valued as important to the location (see Figure 22).

Country	Difference between mentions as a production and an R&D location	
China	+9	more frequently mentioned as production location
Brazil	+6	
Russia	+5	
Italy	+3	
France	-3	more frequently mentioned as R&D location
Germany	-4	
India	-4	
Canada	-4	
US	-10	

TABLE 5: DIFFERENCE BETWEEN MENTIONS AS A PRODUCTION LOCATION AND AS AN R&D LOCATION.

Note: The table refers to 131 of the 151 companies.
Source: European Commission JRC-B (2017).



STRUCTURAL REFORMS **FOR R&D**

8 Structural reforms for R&D

The Commission continues to push for important structural reforms to improve the framework conditions for innovation within the EU.²⁷ As in previous editions of the survey, we asked the respondents to rate on a scale from 1 (no potential) to 5 (very high potential) a set of 17 structural reforms grouped in seven different categories²⁸ according

to their potential impact on increasing the company's R&D and innovation²⁹ activities. For each reform, the percentage of companies considering it to have a high (4) or very high (5) potential impact on its R&D and innovation activities is reported in Figure 29.

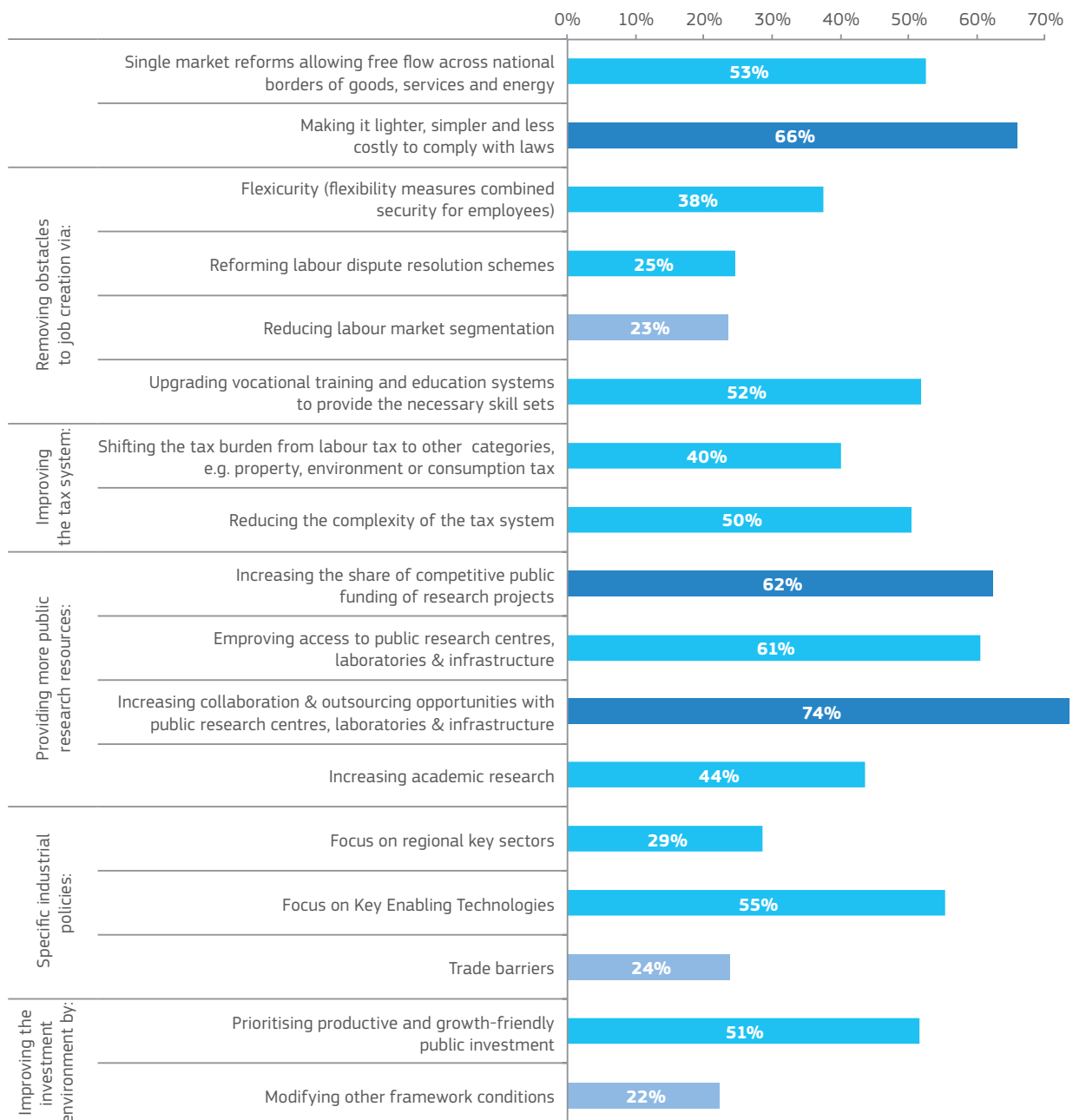


FIGURE 29: POTENTIAL OF STRUCTURAL REFORMS FOR INCREASING R&D AND INNOVATION.

Note: The figure refers to 140 out of the 151 companies in the sample representing 24.7% of the total R&D investment by the 1 000 EU Scoreboard companies.
Source: European Commission JRC-B (2017).

²⁷ See the 2016 Annual Growth Survey: https://ec.europa.eu/futurium/en/system/files/ged/ags2016_annual_growth_survey.pdf.

²⁸ (a) Single market reforms; (b) Making it lighter, simpler and less costly to comply with regulation; (c) Removing obstacles to job creation; (d) Improving the tax system; (e) Providing more public research resources; (f) Specific industrial policies; and (g) Improving the investment environment.

²⁹ Innovation is the introduction of new or significantly improved products, services or processes.

The respondents express the desire for more private–public synergies and more public money invested in research. The three reforms with the highest potential impact on the R&D and innovation activities of the respondents cover two of the seven proposed policy groups. This indicates some specific preferences among our surveyed companies. More specifically, two out of three reforms indicated as most relevant are part of the ‘Providing more public research resources’ group, namely ‘increasing collaboration with public research centres’ and ‘increasing public funding to research’.

This result is in line with what we found in terms of R&D investment type of the firms in the survey (see Chapter

3); the responding companies invest considerably more in the development phases than in earlier stages. This means that these **firms could really benefit from the public sector providing a strong foundation for basic research through more funding and transferring this knowledge via collaborations.**

Less regulation is considered the second most important possible structural reform, in line with previous surveys. If we look at what possible structural reforms have the least potential, reducing the segmentation of the labour market and reforming labour dispute resolution schemes are among the items at the bottom of the list in terms of impact.

		Automobile and other transport	Basic Materials	Consumer Goods & Services	Health	ICT	Industrials	Low R&D intensity
Single market reforms	Single market reforms allowing free flow across national borders of goods, services and energy	77.8%	73.3%	54.5%	52.4%	48.0%	42.9%	46.2%
Comply with regulation	Making it lighter, simpler and less costly to comply with laws	44.4%	80.0%	50.0%	81.0%	65.4%	65.5%	61.5%
Removing obstacles to job creation via:	Flexicurity (flexibility measures combined security for employees)	33.3%	26.7%	33.3%	55.0%	61.5%	31.0%	16.0%
	Reforming labour dispute resolution schemes	33.3%	13.3%	18.2%	45.0%	38.5%	10.7%	16.0%
	Reducing labour market segmentation	37.5%	20.0%	27.3%	30.0%	32.0%	10.7%	20.0%
	Upgrading vocational training and education systems to provide the necessary skill sets	44.4%	66.7%	66.7%	65.0%	38.5%	48.3%	46.2%
Improving the tax system:	Shifting the tax burden from labour tax to other categories, e.g. property, environment or consumption tax	11.1%	46.7%	50.0%	38.1%	58.3%	34.5%	32.0%
	Reducing the complexity of the tax system	33.3%	73.3%	41.7%	57.1%	61.5%	37.9%	44.0%
Providing more public research resources:	Increasing the share of competitive public funding of research projects	66.7%	56.3%	80.0%	52.4%	69.2%	66.7%	53.8%
	Improving access to public research centres, laboratories & infrastructure	62.5%	46.7%	80.0%	57.1%	70.8%	69.0%	44.0%
	Increasing collaboration & outsourcing opportunities with public research centres, laboratories & infrastructure	66.7%	56.3%	91.7%	71.4%	79.2%	73.3%	76.9%
Specific industrial policies:	Increasing academic research	25.0%	31.3%	72.7%	50.0%	41.7%	46.4%	38.5%
	Focus on regional key sectors	11.1%	20.0%	54.5%	40.0%	28.0%	31.0%	16.7%
	Focus on Key Enabling Technologies	55.6%	40.0%	72.7%	42.1%	64.0%	58.6%	54.2%
Improving the investment environment by:	Trade barriers	11.1%	33.3%	40.0%	21.1%	20.0%	24.1%	21.7%
	Prioritising productive and growth-friendly public investment	55.6%	60.0%	54.5%	55.0%	46.2%	53.3%	43.5%
	Modifying other framework conditions	22.2%	31.3%	16.7%	20.0%	7.7%	26.7%	30.8%

TABLE 6: POTENTIAL OF STRUCTURAL REFORMS TO INCREASE R&D AND INNOVATION, BY SECTOR.

Note: The table refers to 140 out of the 151 companies in the sample (Automobile and other transport 9, Basic materials 16, Consumer Goods and Services 12, Health 21, ICT 26, Industrials 30, Low R&D intensity 26) representing 24.7% of the total R&D investment by the 1 000 EU Scoreboard companies

Source: European Commission JRC-B (2017).

Disaggregates the replies by sector group. **The picture we got from the sample does not change much with increased sector detail.** Policies increasing resources for research and collaboration with the public sector are indicated as having a great potential impact on R&D and innovation. The same is true of legislation simplification.

As last year, the labour market reforms listed – with the notable exception of upgrading the vocational training and education system – are considered irrelevant when it comes to their effect on R&D and innovation activities.



- **A:** METHODOLOGY
- **B:** QUESTIONNAIRE

Annex A: Methodology

Background and Approach

The European Commission's Industrial Research and Innovation Monitoring and Analysis 2017-18 (IRIMA II)³⁰ initiative serves to better understand industrial R&D and innovation in the EU and to identify medium and long-term policy implications. IRIMA is carried out by the European Commission's Joint Research Centre (JRC) Directorate B, Growth & Innovation, and the Directorate General for Research Directorate A, Policy Development & Coordination. The project monitors and analyses industrial R&D and innovation activities in order to support the implementation and monitoring of the European research and innovation agenda: the Innovation Union flagship, set in the context of the Europe 2020 strategy aiming

at a smarter, greener and more inclusive economy. The evidence gathered also contributes to policy-making in the "Industrial Policy", the "Digital Agenda" and the "New Skills for New Jobs" flagship initiatives.

The present IRIMA surveys tackle the lack of comparable information on business R&D investment trends at the European level by gathering qualitative information on factors and issues surrounding and influencing companies' current and prospective R&D investment strategies. The survey complements other R&D investment related surveys and data collection exercises (e.g. Innobarometer, Eurostat data collection and other on-going surveys).

Link to the R&D Investment Scoreboards

The EU R&D surveys complement the *EU Industrial R&D Investment Scoreboard*³¹, which is the main IRIMA product. The Scoreboard helps the European Commission to monitor and analyse company R&D investment trends and to benchmark, inform and communicate developments in R&D investment patterns.

The Scoreboard and the Survey take different perspectives on the industrial R&D dynamics in companies. The Scoreboard looks at trends ex-post based on the audited annual accounts of companies, whereas the Survey improves the understanding of the Scoreboard companies by collecting ex-ante information. The survey also addresses location strategies, drivers and barriers to research and innovation activities, or perception of policy

support measures with a questionnaire agreed between JRC-B and DG-RTD. This questionnaire is printed and mailed by post together with the Scoreboard analysis report and the previous Survey analysis report to the 1000 European companies. Also a web-interface and email contacts are made available in order to allow for paperless participation. The Survey makes efficient use of the direct contacts established with the European Scoreboard companies by adding-on to the Scoreboard mailing when the reports are officially released.

For the 2017 Survey, the response period ran for three months: from 6 March 2017 (mailing of the questionnaires) to 5 June 2017.

³⁰ See: <http://iri.jrc.ec.europa.eu/>.

³¹ The Scoreboard is published annually and provides data and analysis on the largest R&D investing companies in the EU and abroad (see: <http://iri.jrc.ec.europa.eu/research/scoreboard.htm>).

Methodology

To improve response rates, the following measures were taken in the course of the survey cycle:

- (1) The questionnaire was revised and streamlined with a view towards keeping it as short and concise as possible and minimise the burden for the respondent.
- (2) The questionnaire was sent together with the Scoreboard report to take advantage of this occasion as a door-opener.
- (3) The cover-letter presented a full colour figure and table with a benchmarking analysis of the company addressed compared to its peers in the same sector.
- (4) As well as physically sending the questionnaire to each company, an online site was provided to facilitate data entry via the European Commission's EU Survey tool,³² where a Word version of the questionnaire was downloadable for offline information input.
- (5) The questionnaire was emailed to the respondents of previous surveys, together with a link to the electronic copy of the latest analysis.
- (6) The contact database was continuously improved. Respondents who had already participated in previous surveys, or their substitutes in cases where they had left their position, were priority contacts. Returned questionnaires and reminder mailings were resent using the latest contact information on the internet or by contacting the company directly via email or phone.
- (7) The response rate is closely followed on a regular basis during the implementation. If necessary, measures for improving the response rate are applied, e.g. by adjusting the number of reminders, allowing more time for questionnaire reception, following up selected candidates by e-mail and phone or searching support from former survey participants

- (8) Personal contact by phone or email was made with several dozen companies when the deadlines were close, especially for those which had participated in the past.

The response rate has been steadily high over the past five years, taking full advantage of the familiarity of the EU Scoreboard companies with the exercise and their mature approach.³³

Outliers were detected by analysing the distribution of the dataset in scatter and boxplots and defining upper and lower quartiles ranges around the median, according to the variable(s) analysed. To maintain the maximum information in the data, outliers were eliminated only in extreme cases and after assessing the impact on the result.³⁴

One-year growth is simple growth over the previous year, expressed as a percentage: $1\text{yr growth} = 100 * ((C/B) - 1)$; 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.

Two-year growth is the compound annual growth over the two years, expressed as a percentage: $2\text{yr growth} = 100 * (((C/B)^{(1/t)} - 1))$; where C = current year amount, B = base year amount (where base year = current year - 2), and t = number of time periods (= 2). 2yr growth is calculated only if data exist for the current and base years. At the aggregate level, 2yr growth is calculated only by aggregating those companies for which data exist for the current and base years.

Unless otherwise stated, the **weighted figures** presented in this report are weighted by R&D investment.

³² See: <https://ec.europa.eu/eusurvey/>.

³³ The response rate of the present survey is 15.1%. This is slightly lower compared to the 16.2% of last year due to a two-week shorter response period. The responsiveness per day has been very steady over the past five surveys.

³⁴ For the systematic detection of outliers, an adjusted methodology from the NIST/SEMATECH e-Handbook of Statistical Methods was applied, see: <http://www.itl.nist.gov/div898/handbook/prc/section1/prc16.htm>.

R&D Investment Definition

To make the survey as easy to complete as possible and to maximise the response rate, only a short definition of R&D investment is provided in the survey.³⁵ The definition refers mainly to R&D as reported in the company's most recent accounts. The definition used in the survey is thus

closely related to the International Accounting Standard (IAS) 38 "Intangible Assets",³⁶ based on the OECD "Frascati" manual,³⁷ and the definition used in the EU Industrial R&D Investment Scoreboards.

Composition of the Responses

The 151 responses were classified according to the ICB classification.³⁸ Sector classifications of individual companies were cross-checked with the Scoreboards. The sectors were grouped as shown in the following.

Table 7, which includes the distribution of the responses among the sectors with their respective R&D investment shares.

Sector group	# responses	# Scoreboard companies	response rate	share of R&D
Automobile and other transport	10	61	16%	32%
Basic Materials	17	76	22%	46%
Consumer Goods & Services	13	106	12%	26%
Health	21	177	12%	10%
ICT	30	236	13%	35%
Industrials	32	206	16%	24%
Low R&D intensity	28	138	20%	28%

TABLE 7: DISTRIBUTION OF THE RESPONSES BY SECTORS.

Source: European Commission JRC-B (2017).

The number of responses by home country is shown in Table 8 below. According to the Scoreboard methodology, the home country is the country of registered office of the

company. Similar to our previous surveys, most participants were from companies located in the three biggest Member States.

Country	# responses	R&D investment share
Germany	29	51.8%
France	18	13.8%
Italy	17	3.2%
UK	15	4.5%
Finland	14	0.7%
Spain	13	6.1%
Sweden	10	10.0%
Denmark	9	5.3%
The Netherlands	8	2.3%
Austria	4	0.7%
Belgium	4	0.8%
Other EU countries	10	0.8%
Total	151	100.0%

TABLE 8: DISTRIBUTION OF THE RESPONSES BY HOME COUNTRY OF THE COMPANY.

Note: Only information for countries with at least four responses is shown.

Source: European Commission JRC-B (2017).

³⁵ See Annex B.

³⁶ See <http://www.iasplus.com/standard/ias38.htm>.

³⁷ See "Proposed Standard Practice for Surveys on Research and Experimental Development: Frascati Manual", OECD, Paris, 2002, <http://www1.oecd.org/publications/e-book/9202081E.PDF>.

³⁸ ICB Industry Classification Benchmark (see: http://www.icbenchmark.com/docs/ICB_StructureSheet_120104.pdf).

It is not obligatory for the respondents to answer all questions, in order to not increase the barrier for responding. The next table provides an overview of all questions of the questionnaire (see Annex B for the complete questionnaire) and the percentage of firms that responded each question.

Question	Response rate
A.1	100.0%
A.2	100.0%
A.3	99.3%
B.4	98.0%
B.5	88.1%
B.6	87.4%

Question	Response rate
C.7	77.5%
C.8	30.5%
C.9	62.9%
C.10	86.1%
D.11	94.0%
E.12	92.1%
E.12_2	81.5%
E.13	95.4%
E.14	93.4%
F.15	90.7%
F.16	86.8%
G.17	89.4%
H	79.5%

Annex B: Questionnaire

A. Corporate background

1. **Number of employees in your company in the past year (2016)?**

Around _____ (FTE³⁹).

2. **How many employees have worked on R&D in the company in the past year (2016)?**

About _____ (FTE³⁹).

3. **In approximately how many countries were these R&D employees located?**

In approximately _____ countries.

B. R&D investment levels and trends

4. **What was your R&D investment in the past year (2016)?**

About € _____ million.

5. **How much of this R&D investment would fall into the following categories?**

(a) Basic research (includes exploratory)	_____	%
(b) Applied research/technology development	_____	%
(c) Development for adapting products to local markets	_____	%
(d) Development for market launch	_____	%
(e) Development of software/data	_____	%
(f) Acquisition of machinery, equipment, software & buildings	_____	%
(g) other (please specify):	_____	%

³⁹ Please indicate the number of employees on either permanent or fixed-term contracts in Full-Time Equivalents (FTE), with part-time employees included on a pro-rated basis in line with their contractual working hours.

6. **At what average rate do you expect the company to change its overall R&D investment over the next two years (2017 and 2018)?**

About _____ % per annum.

C. Patent activity

7. **Please indicate the number of inventions your company protected by patents⁴⁰ in at least one of the two offices (USPTO, EPO) in the period 2010-2014⁴¹. If necessary, provide any additional comments.**

About _____ inventions/patents in 2010-2014

8. **Please state the approximate share of your R&D investment dedicated to patenting activities in the past year:**

About _____ %.

9. **If possible, please estimate the total development costs of one patent for your company:**

About _____ € thousand per invention/patent.

10. **If possible, please estimate the average commercial value of a patent for your company:**

About _____ € thousand per patent.

D. R&D drivers

11. **How relevant are the following drivers for the expected R&D investment change noted under question 6? Please rate on a scale from 1 (irrelevant) to 5 (highly relevant).**

	Irrelevant				Highly relevant
	1	2	3	4	5
(a) Demand change	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) Exploiting technological opportunities (technology push)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Maintaining R&D as a fixed proportion of net sales	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) Competition from companies located in:					
(d1) the European Union	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d2) other developed countries, e.g. the US or Japan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d3) emerging countries, e.g. China or India	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) Improving the company's productivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) Meeting product market regulation and other legal frameworks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) Other (please specify):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

⁴⁰ The number applies to patent families: a set of individual patents to protect a single invention.

⁴¹ See: <http://www.oecd.org/sti/intellectual-property-statistics-and-analysis.htm>.

E. R&D location strategy

12. Please estimate the distribution of your company's in-house R&D activity among the following world areas in the past year (2016) and two years later (2018)?

Distribution in 2016	R&D carried out:	Expected distribution in 2018
%	in the European Union ⁴²	%
%	In the United Kingdom	%
%	in other European countries ⁴³	%
%	in the US	%
%	in Japan	%
%	in China	%
%	in India	%
%	in the Rest of the World	%

13. Please state the three countries where your *main R&D activities* are currently located, ranked by order of importance, also indicating the share of total R&D spent in each country:

1. _____ _____ %	2. _____ _____ %	3. _____ _____ %
------------------------	------------------------	------------------------

14. Which factors render a country attractive for locating your R&D? Please rate on a scale from 1 (not attractive) to 5 (highly attractive).

	Not attractive				Highly attractive
	1	2	3	4	5
(a) Access to markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) High availability of researchers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Quality of researchers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) Low labour costs of researchers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) Access to specialised R&D knowledge and results	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) Quality of public research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) Reliable legal framework for R&D, e.g. Intellectual Property Rights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h) Macroeconomic and political stability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(i) Proximity to technology poles ⁴⁴ and incubators ⁴⁵	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(j) Proximity to other activities of your company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(k) Proximity to suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(l) Access to R&D cooperation opportunities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(m) Access to public support for R&D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(n) Other (please specify):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

⁴² There are currently 28 EU Member States: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

⁴³ Examples of other (non-EU) European countries are: Switzerland, Norway, Iceland, Albania, Moldova, Turkey, Russia, Belarus and the Ukraine (for further examples see the recognised states in: http://en.wikipedia.org/wiki/List_of_sovereign_states_and_dependent_territories_in_Europe#Recognised_states).

⁴⁴ "Technology poles" are areas where R&D active companies, institutions and universities are concentrated.

⁴⁵ "Incubators" are structures that support innovative startup companies in order to increase their survival rates.

F. Production location strategy

15. Please state the three countries where your *main production activities* are currently located, ranked by order of importance, also indicating the share of total production in each country:

1. _____	2. _____	3. _____
_____ %	_____ %	_____ %

16. Which factors render a country attractive for locating your production? Please rate on a scale from 1 (not attractive) to 5 (highly attractive).

	Not attractive				Highly attractive
	1	2	3	4	5
(a) Access to markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) High availability of personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Quality of personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) Low labour costs of personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) Low employment protection ⁴⁶ of production personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) Access to specialised production knowledge and results	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) Macroeconomic and political stability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h) Proximity to other activities of your company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(i) Proximity to suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(j) Access to production infrastructure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(k) Access to public support for production activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(l) Regulation (environmental legislation, red tape...)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(m) Regulation of your product markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(n) Other (please specify):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

G. Structural reforms supporting R&D and innovation

17. The European Commission is pushing for important structural reforms.⁴⁷ In this context, what potential do the following initiatives have for increasing your company's R&D and innovation⁴⁸ activities? Please rate on a scale from 1 (no potential) to 5 (very high potential).

	No potential			Very high potential	
	1	2	3	4	5
(a) Single market reforms allowing free flow across national borders of goods, services and energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) Making it lighter, simpler and less costly to comply with laws	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) Removing obstacles to job creation via:					
(c1) flexicurity (flexibility measures combined security for employees)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c2) reforming labour dispute resolution schemes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c3) reducing labour market segmentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c4) upgrading vocational training and education systems to provide the necessary skill sets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

⁴⁶ i.e. rules concerning hiring (for the disadvantaged, for temporary or fixed-term contracts, training) and firing (e.g. redundancies, prenotification, severance pay, dismissals and short-time work), see the OECD Employment Outlook.

⁴⁷ See: "The 2016 Annual Growth Survey": http://ec.europa.eu/europe2020/pdf/2016/ags2016_annual_growth_survey.pdf.

⁴⁸ Innovation is the introduction of new or significantly improved products, services, or processes.

	No potential		3	Very high potential	
	1	2		4	5
(d) Improving the tax system:					
(d1) shifting the tax burden from labour tax to other categories, e.g. property, environment or consumption tax	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d2) reducing the complexity of the tax system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) Providing more public research resources:					
(e1) increasing the share of competitive public funding of research projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e2) improving access to public research centres, laboratories & infrastructure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e3) increasing collaboration & outsourcing opportunities with public research centres, laboratories & infrastructure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e4) increasing academic research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) Specific industrial policies:					
(f1) focus on regional key sectors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f2) focus on Key Enabling Technologies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f3) trade barriers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) Improving the investment environment by:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g1) prioritising productive and growth-friendly public investment					
(g2) modifying other framework conditions					
Please specify (max 3)					

H. How will BREXIT impact on your R&D strategy in the future?

⇒ _____

I. Your final comments or suggestions

⇒ _____

Thank you very much for your contribution!

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The 2017 EU Survey on R&D Investment Business Trends is carried out by the IRITEC project of the European Commission's Joint Research Centre (JRC) Directorate B Growth and Innovation. The survey is directed at the 1000 European companies in the 2016 EU Industrial R&D Investment Scoreboard.

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