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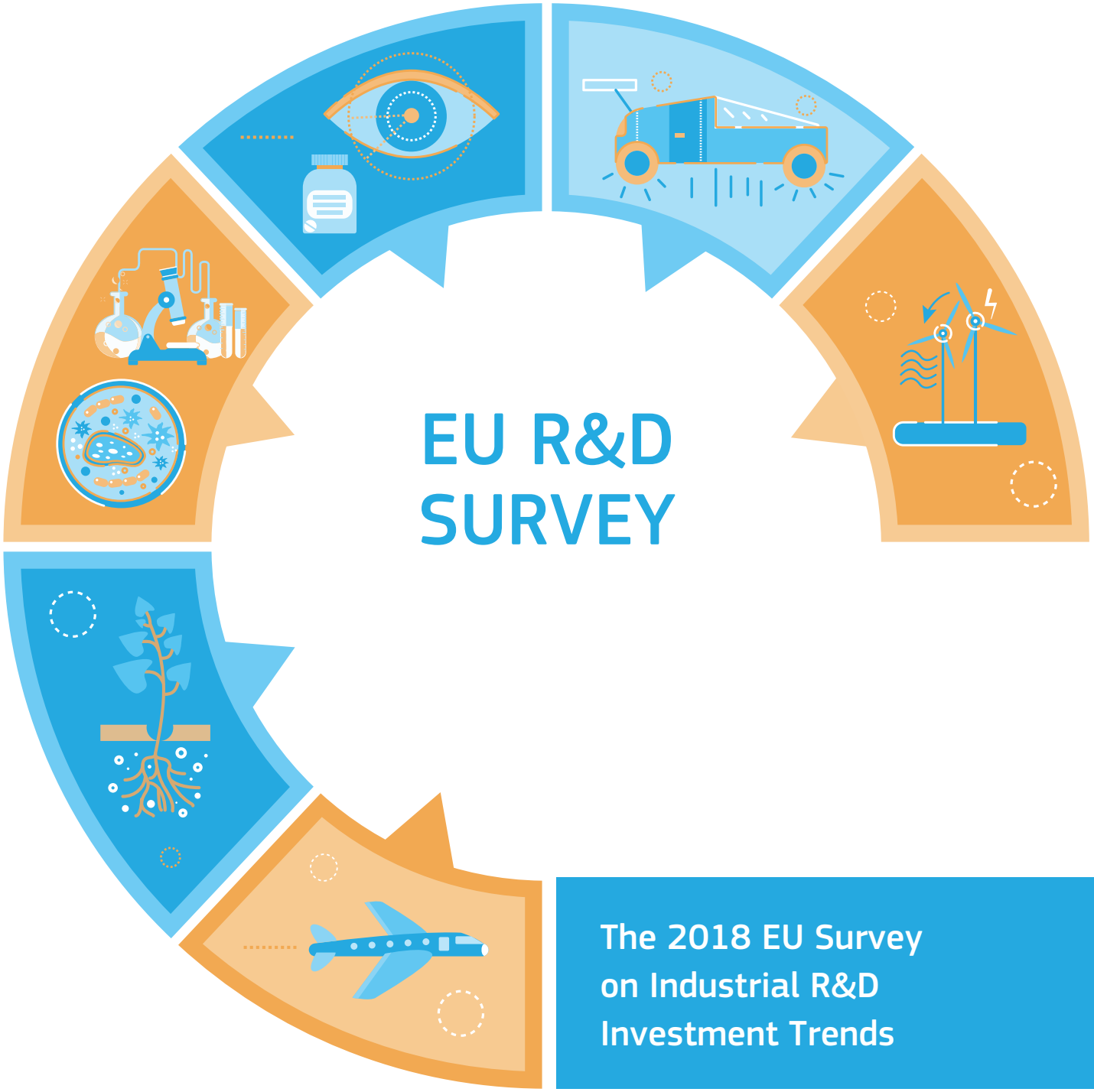

EU R&D SURVEY

The 2018 EU Survey on Industrial R&D Investment Trends

EUR 29458 EN

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GLORIA activities aim to improve the understanding of industrial R&D and Innovation in the EU and to identify medium and long-term policy implications.
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EU R&D SURVEY

The 2018 EU Survey on Industrial R&D Investment Trends

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0 EXECUTIVE SUMMARY

Executive summary

The 142 EU companies participating in the EU Survey on Industrial R&D Investment Trends expect R&D investment to increase by 5.4% per annum in 2018 and 2019. This is higher than last year's expectation (4.7%) and indeed the highest expected increase since the pre-crisis years (2007). Companies in the 'ICT Producers' and 'Automobile and Other Transport' sector groups expect their R&D to increase the most.

These top EU R&D performers expect their R&D within the EU to increase by 4.5% p.a., while their R&D in China and India is expected to show double digit growth (+21.3% and +11.2% respectively). The proportion of R&D investment by EU firms within the EU shows a stable trend since 2006 (at around three-quarters), not showing signs of erosion or offshoring to other regions. In absolute terms, R&D investment levels are higher than ever in the EU.

EU firms are increasingly becoming truly global in their R&D activities. In the 2006 survey, only about 15% of EU firms performed R&D in all four main world regions.[1] This figure has been constantly increasing, now representing 33% of all participating firms. This confirms both the increasingly global character of R&D and the growing need for top R&D investors to be present in the main R&D locations around the world.

China is expected to become the third largest region for the location of R&D activities by EU firms by 2019, after the EU and the US. The proportion of R&D investment by EU firms performed in China is expected to grow to 3.4% in 2019 (from 2.6% in 2017). Since the start of the survey, the third largest region has been the Rest of the World. However, China and India show consistently high growth expectations in all editions of the survey, indicating interesting developments in these countries that are attracting the attention of the EU's main R&D performers.

As in all previous surveys, low labour costs for researchers prove not to be an important factor of attractiveness in locating R&D activities. However, there is an important caveat to this finding: firms performing R&D in China or India rate low labour costs as much more important than firms without R&D activities in these countries. Also, companies that perform R&D in many countries rate this factor as much more important than firms performing R&D in only one or a few countries. India is gaining strength as a popular R&D location and is currently second after the US.

Firms that perform R&D only in the EU rate the proximity to other activities within the company and the quality of public research as highly important for their location of R&D activities. Firms with R&D activities in the US rate the proximity to suppliers and access to specialised R&D knowledge much higher than firms without R&D activities in the US. The quality of researchers is a factor that is rated consistently highly by firms with R&D activities in the EU only, or that focus on either the US or on China or India, which implies that frontier research is geographically dispersed to all regions.

The most highly rated factors for locating *production* by *EU only* firms are macroeconomic stability, access to its production infrastructure and quality of personnel. Overall, the factors most often rated as (highly) attractive by firms are access to markets, quality and availability of personnel and macroeconomic stability.

[1] EU, North America, Asia and Rest of the World.

Low labour costs are perceived as much more important by firms that produce in China or India than firms that do not. China, Brazil, Italy and Russia remain the countries more frequently mentioned as a production location, as in last year's survey. Access to markets is an important factor for locating production activities in China or India, but not R&D.

The average non-R&D expenditure of the respondents is €54 million:[2] 29% of their R&D expenditure or a non-R&D intensity (non-R&D expenditure over net sales[3]) of 0.5%.

Firms invest mainly in applied research activities, rather than basic research. This finding is consistent over many editions of the survey and suggests that **the European Innovation system has to rely on other actors** (i.e. universities and public research institutes, but also start-ups and disruptive companies) **for investment in basic research**.

The main motivation for firms to allow their employees to publish articles in scientific journals is to build the firm's reputation. This helps them to send out a message to two types of audience: venture capital funds (that may be interested in investing in a firm where relevant scientific work is produced) and other talented scientists (who may be interested in working in a scientifically stimulating environment). However, strong differences emerge when comparing firms with high publishing output to those with low output.

Companies do not specifically ask for less regulation, but ask for it to be simplified. When asked what public policies should be implemented to boost private R&D and innovation activities, firms call on public authorities to complement their own action through funding research projects and increasing public-private cooperation.

[2] One response was removed as it was clearly an outlier, probably an error in filling in the questionnaire (€5 100 million).
[3] Net sales for 2016 were used for calculation here.

1 INTRODUCTION

1 Introduction

Investment in research and innovation is one of the EU's highest policy priorities. Among the top priorities in the Investment Plan for Europe (the 'Juncker Plan'), investment in research and innovation is one of the main objectives to trigger funding and mobilise investment in the real economy. This 2018 EU Survey on Industrial R&D Investment Trends aims to support policy making by analysing the top EU industrial players in R&D. These companies are responsible for very large shares of Europe's total business R&D investments and their global flows. The survey forms part of the Global industrial Research and Innovation Analyses (GLORIA) project of the Joint Research Centre (JRC) Directorate B, jointly undertaken with the Directorate-General for Research and Innovation (DG RTD).

The questionnaire for 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, at the top 1 000 EU companies (EU1000) appearing in the 2017 EU Industrial R&D Investment Scoreboard.[4] In total, 142 responses were received from EU companies; a response rate of 14.2%. More than half (54%) of the firms that participated last year also participated this year. The response rate was similar to the previous year (15.1%) and other years the EU Survey has been conducted.

The participating EU firms have a total R&D investment of €69.2 billion, 36% of the total R&D investment by EU firms in the 2017 EU R&D Scoreboard (compared to €53.9 billion and 28% last year). Figure 1 shows that the survey participants (blue) are mainly among the firms between the top 2% of the EU1000 firms (light grey bars) and the top 40% of the EU1000 firms – about half of the participants can be found in this group. The survey is underrepresented among the smaller firms in terms of R&D investment.

This year's survey also received six replies from non-EU firms: two from the US, two from Taiwan, one from Japan and one from Switzerland. These firms[5] have been left out of the analysis (except when stated otherwise), since our main interest is to look at the trends in industrial R&D investment by EU firms. These firms invested a total of €19.9 billion (€3.3 billion on average) and are therefore much larger than the EU participants (average €495.4 million).

The numbers and sample composition of the responses vary over the years, since 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.

[4] See 2017 EU R&D Scoreboard and link.

[5] The non-EU companies received the questionnaire mainly via their EU subsidiaries.

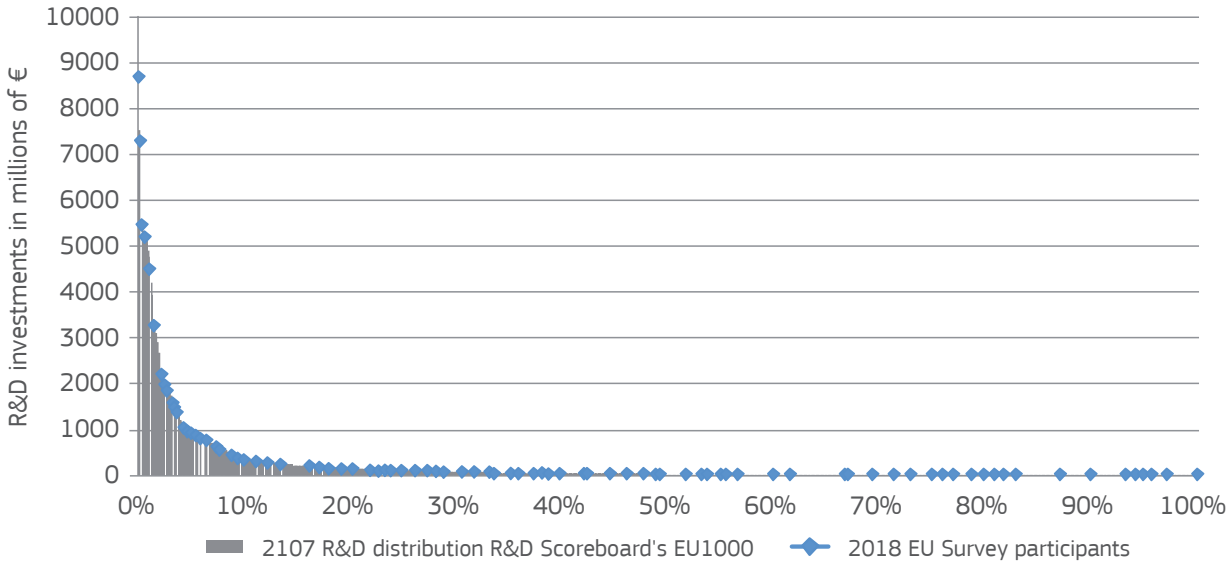

FIGURE 1: DISTRIBUTION OF R&D INVESTMENT IN THE SURVEY COMPARED WITH THE 2016 SCOREBOARD.
Note: The figure refers to all 151 companies in the sample representing 26.5% of the total R&D investment by the 1000 EU Scoreboard companies.
Source: European Commission JRC-B (2017).

The respondents to the survey are – on average – the largest of the large multinationals among the EU R&D Scoreboard companies. The average R&D investment of this year's survey respondents is considerably higher than last year (€495.4 million compared to €357.6 million) but somewhat smaller in terms of net sales (€12.1 billion compared to €14.8 billion) and employees (35 000 compared to 40 000).

The average participating company is still two-and-a-half times the size of the average top EU 1 000 R&D Scoreboard company, which had R&D investment (in 2016) of €198.3 million. The respondents have average net sales of €12.0 billion (also considerably higher than last year's sample, which had an average of €7.4 billion) and an average of almost 35 000 employees (25 000 last year). The sample contains only three SMEs that have 250 or fewer employees. Of the large companies, 14 companies had between 250 and 999 employees, 54 had between 1 000 and 9 999 employees, 31 had between 10 000 and 29 999 employees, and 40 had more than 30 000 employees; a very similar distribution to last year.

This year's survey will use the following sector groups for some of its analyses. We aggregate Industrial Classification Benchmark (ICB) level 4 sectors into seven broad sector groups (using ICB level 1 and level 2 of aggregation) that can be identified by the reader more easily. An eighth residual category (Others) includes all ICB level 4 sectors with few responses.

Looking at the respondents to this year's survey, the sector group with the highest percentage of replies is the Others sector, while the sector representing the highest share 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 (see Table 1).

Sector group	ICB 4 digit name	Companies in the EU Survey (# and %)		Companies in the EU1000 (# and %)		% of R&D in Survey	% of R&D in EU1000
Aerospace & Defence	Aerospace & Defence	3	2%	24	2%	4%	5%
Automobiles & other transport	Auto Parts	14	10%	64	6%	33%	29%
	Automobiles & Parts						
	Commercial Vehicles & Trucks						
Chemicals	Chemicals	8	6%	42	4%	5%	3%
Health industries	Biotechnology	24	17%	191	19%	23%	23%
	Health Care Equipment & Services						
	Pharmaceuticals						
ICT producers	Electrical Components & Equipment	15	11%	110	11%	16%	13%
	Electronic Equipment						
	Electronic Office Equipment						
	Semiconductors						
	Telecommunications Equipment						
ICT services	Computer Services	15	11%	129	13%	8%	7%
	Fixed Line Telecommunications						
	Mobile Telecommunications						
	Software						
Industrials	Aluminium	26	18%	154	15%	4%	6%
	Diversified Industrials						
	General Industrials						
	Industrial Engineering						
	Industrial Machinery						
	Industrial Metals & Mining						
Others	Alternative Energy	37	26%	286	29%	8%	15%
	Banks						
	Construction & Materials						
	Conventional Electricity						
	Electricity						
	Food Producers						
	Food Products						
	Forestry & Paper						
	Gas, Water & Multi-utilities						
	Heavy Construction						
	Household Goods & Home Construction						
	Media						
	Oil & Gas Producers						
	Oil Equipment, Services & Distribution						
	Personal Goods						
	Real Estate Holding & Development						
	Recreational Products						
	Support Services						
Total		**142**	**100%**	**1000**	**100%**	**100%**	**100%**

TABLE 1: SAMPLE COMPOSITION.
Note: The table refers to 142 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

2

R&D INVESTMENT **EXPECTATIONS**

2 R&D investment expectations

To obtain data on the future expectations of the top EU R&D investors, the questionnaire asks companies to estimate expected yearly growth for the next two years. Of the 125 EU companies that responded to this question, only two companies expect R&D to decrease in the next two years, while 13 firms (10%) expect R&D to remain the same.

On average, the EU firms that participated expect their R&D to grow by 5.4% per annum[6] **in the two years 2018-2019**, higher than the 4.7% p.a. in last year's survey. The median and mode expected growth rate is 5%, indicating positive expectations across the board. This might reflect the current positive economic situation (see section 5), even in the face of mixed messages for R&D investment caused by increased uncertainty such as rising interest rates in the US, a looming trade war and the reduced European Central Bank (ECB) stimulus programme.

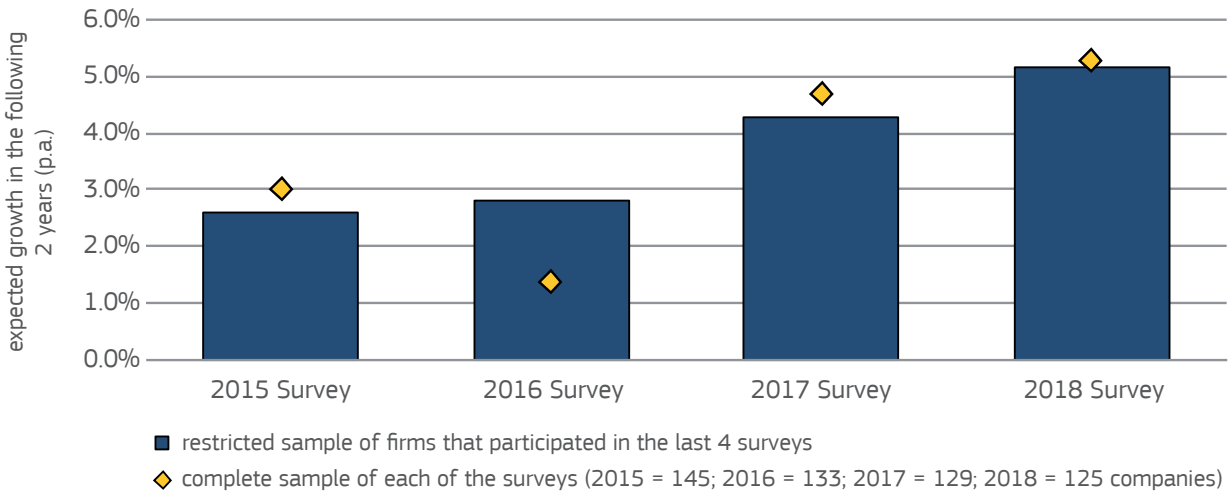

FIGURE 2: EXPECTED GROWTH FOR THE LAST FOUR SURVEYS – COMPLETE SAMPLE OF EACH OF THE SURVEYS VS SELECTED SAMPLE OF FIRMS THAT PARTICIPATED IN LAST FOUR SURVEYS.
Note: The yellow marker series in the figure refers to the complete sample in each of the four surveys (2015 = 145; 2016 = 133; 2017 = 129; 2018 = 125 companies). The blue bars refer to the restricted sample of 35 firms that have participated in all of the last four surveys.
Source: European Commission JRC-B (2018).

The positive growth expectations for R&D investment are confirmed and show a steady rise over the last four years, when looking at the restricted sample of companies that participated in the last four surveys (Figure 2). Both for the restricted sample of 35 companies that participated in the last four surveys and the 45 companies that participated in the last three years (not depicted due to very similar results), growth expectations follow a very similar trend.

[6] Normalized by R&D investments.

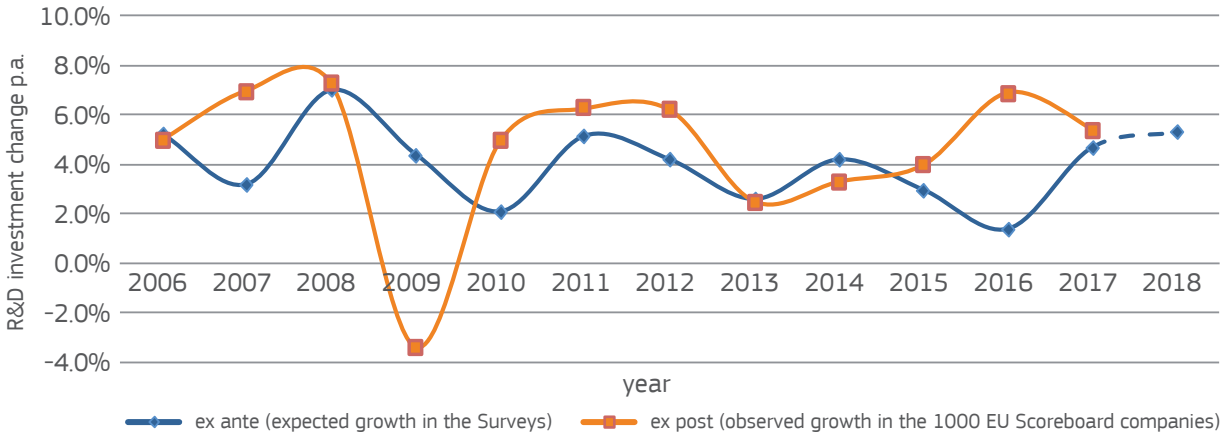

FIGURE 3: EXPECTED (SURVEYS) VERSUS OBSERVED (SCOREBOARDS) R&D INVESTMENT CHANGES.
Note: The ex ante series refers to the whole sample in each of the 12 surveys (2006-2017). The ex post series refers to the top 1000 EU companies for each of the years.
Source: European Commission JRC-B (2018).

Since 2005, the survey has provided a reliable ex ante indication of the real observed growth of the top EU R&D investors in the Scoreboards, except for a few years (notably 2009 and 2016 – see Figure 3). In general, companies tend to underestimate the actual growth. We must take into account here that the ex ante and ex post expectations refer to different samples: the ex post observed growth refers to the top EU 1 000 in each Scoreboard, while the ex ante refers to the survey participants (around 15% to 20% of the top EU 1 000). 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 Annual Reports (and consequently in our Scoreboard). This could lead to possible differences between the figures expected by our contact persons, often from the R&D departments, and the audited figures.

2.1 | R&D distribution and expectations by region

Companies are asked to indicate the geographical distribution of their R&D investment by world region[7] for the latest (completed) financial year (2017) and the coming year (2019).

The EU firms carry out just under three-quarters of their R&D activities within the EU, a figure that shows a stable trend since 2006, not showing any signs of erosion or offshoring to other regions. Moreover, in absolute terms, R&D investment levels are higher than ever in the EU and the US. China[8] and India show consistently high expectations for growth above the current low levels of R&D activities, indicating that interesting ongoing activities there are attracting the attention of the EU's main R&D performers. This year's participants expect the proportion within the EU to decrease from 72.9% (2017) to 72.0% (2019).

China may surpass what has traditionally been the third largest region for R&D levels after the EU and the US, the Rest of the World.[9] The expected growth outside the EU shows similar trends as in earlier years: double-digit growth expectations for China (+21.3%) and India (+11.2%). Moreover, significant increases in R&D investment are expected in Japan (much stronger than in the last 5 years) and the US. The highest nominal growth is expected in the US and China.

[7] EU, Rest of Europe, US, China, India, Japan and Rest of the World.
[8] China refers to mainland China, not including Taiwan and Hong Kong.
[9] A heterogeneous group of countries, including countries such as South Korea, Taiwan, Canada and Brazil.

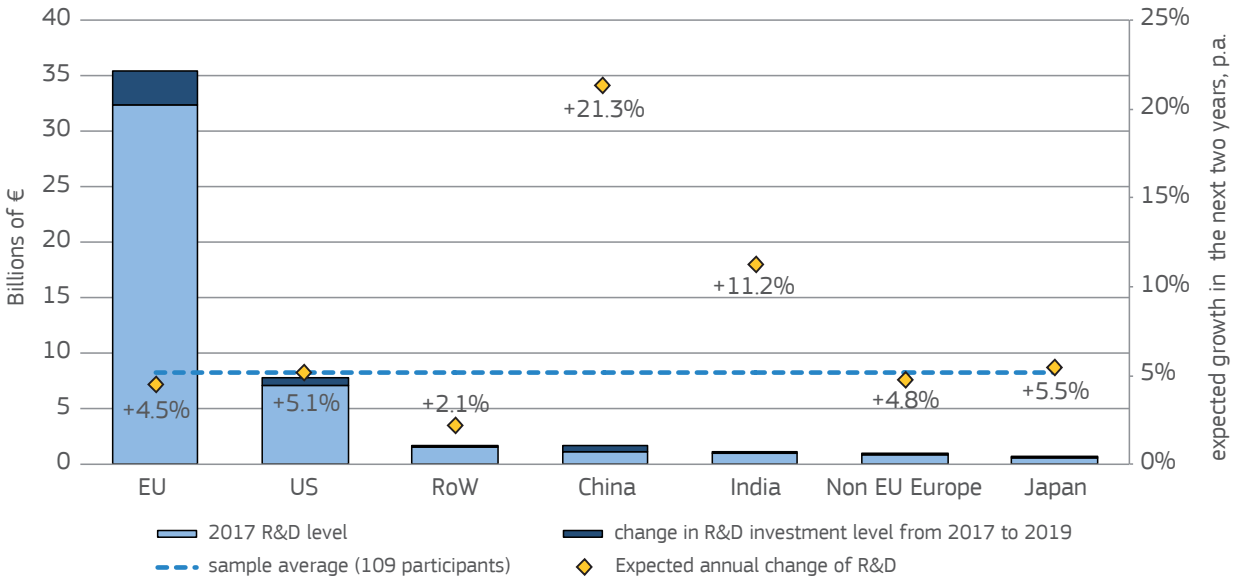

FIGURE 4: EXPECTED PER ANNUM GROWTH IN R&D INVESTMENT IN THE NEXT TWO YEARS, IN REAL TERMS, BY WORLD REGION.
Note: The figure refers to 117 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

The current distribution in terms of proportions of total R&D investment in each of the seven world regions, for each of the sector groups, is displayed in Figure 6. EU firms in the Health Industries and Chemicals sector groups, in particular, perform R&D in the US. China is increasingly attracting R&D from firms in the ICT producers sector group, while India seems to be most attractive for firms in the ICT producers and ICT services sector groups.

2.2 | R&D distribution and expectations by sector

Companies in the ICT producers and Automobile and Other Transport sector groups expect their R&D investments to grow the most, as shown in Figure 5. The growth expectation of the latter sector group is in line with last year's expectations (+5.5%) and has picked up after the expected decrease in R&D two years ago. The sector group with the lowest growth expectations - Industrials - still has a solid 3.8% growth outlook, higher than last year's 2.5%, when it was also the sector group with the lowest growth expectations. Both in the survey and in the Scoreboard, R&D performed by firms in the Automobile sector group has the highest impact on the overall outlook of the top R&D investors.

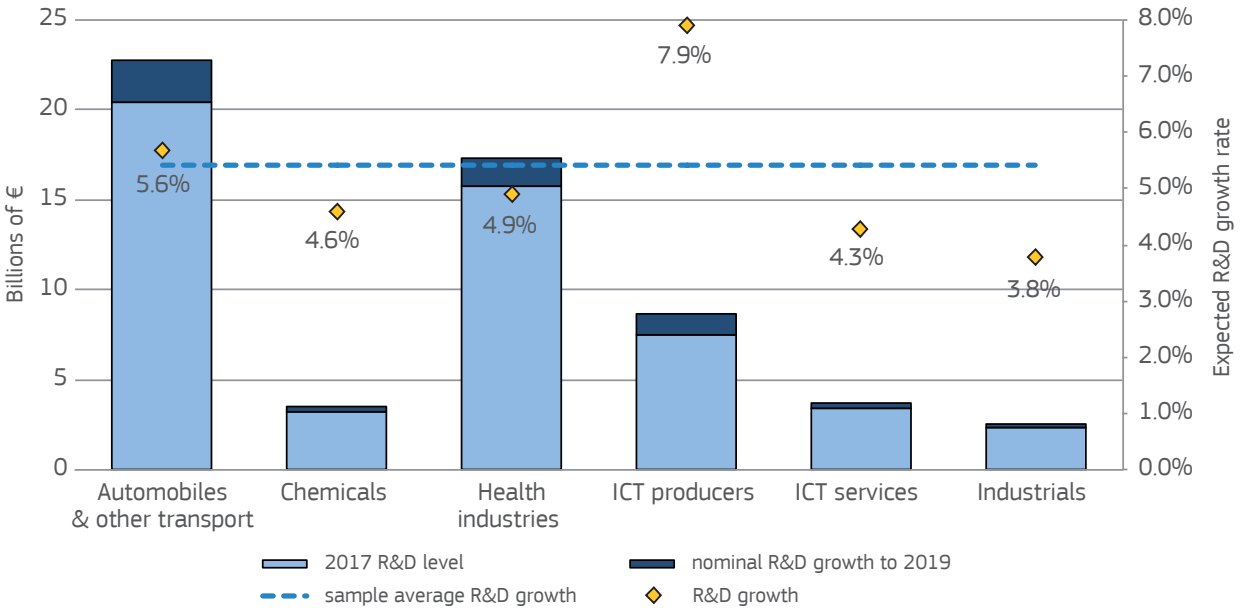

FIGURE 5: EXPECTED LEVELS OF R&D INVESTMENT AND NOMINAL GROWTH IN THE NEXT TWO YEARS, PER ANNUM AND BY SECTOR.
Note: The figure refers to 125 out of the 142 companies in the sample. Automobile and other transport (12), Chemicals (8), Health Industries (23), ICT producers (10), ICT services (13), Industrials (23), Aerospace and Defence (not reported) (3), Others (not reported) (33).
Source: European Commission JRC-B (2018).

EU firms in the Automobile, ICT services and Industrials sector groups perform the highest proportion of their R&D within the EU (all around 85%). The Health industries sector group performs the lowest proportion of R&D within the EU (just above 60%) and has a significant concentration in the US, with almost 30% of R&D activities by EU firms located there.

R&D activities by EU firms in the ICT producers sector group are the most dispersed over the regions. ICT producers carry out equal proportions of their R&D in the US and in China, while India and the Rest of the World are also major locations. This is in contrast to sector groups where R&D activities are more concentrated, such as Health industries and Chemicals.

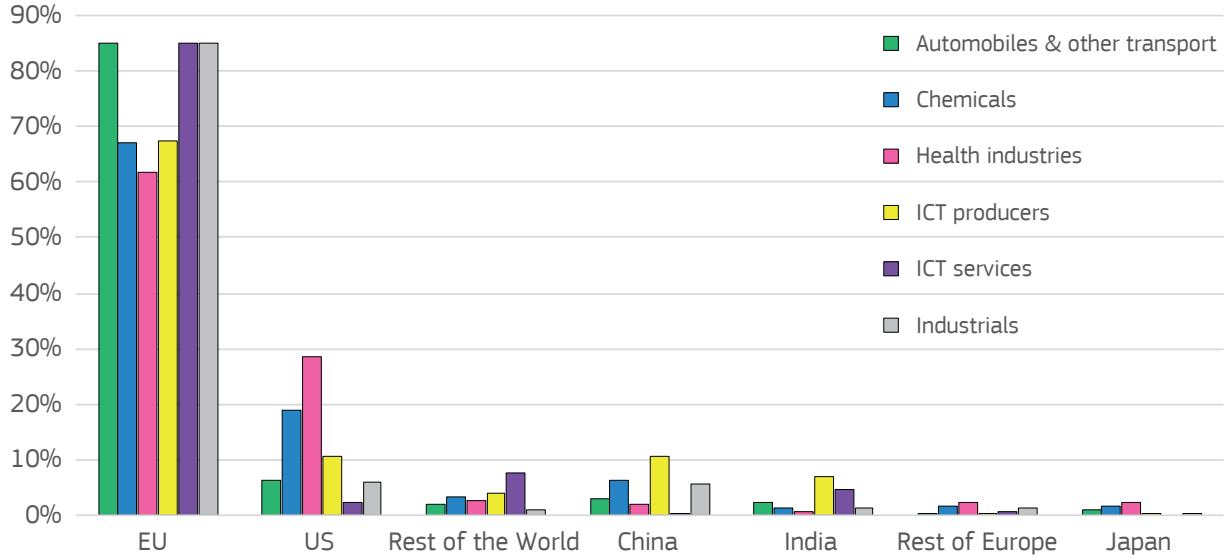

FIGURE 6: DISTRIBUTION OF R&D INVESTMENT BY WORLD REGION AND SECTOR GROUP.
Note: The figure refers to 115 out of the 142 companies in the sample. Automobile and other transport (9), Chemicals (7), Health Industries (22), ICT producers (8), ICT services (12) Industrials (25), Aerospace and Defence (not reported) (3), Others (not reported) (29).
Source: European Commission JRC-B (2018).

2.3 | Expected impact of Brexit on R&D strategies

Given the result of the Brexit referendum in 2016 and the upcoming exit of the United Kingdom (UK) from the EU in April 2019, this year we again asked the open question on how Brexit will impact the future R&D strategy of the companies. Figure 7 reports the results codified from the answers as provided.

The majority of firms state that Brexit will have no or minimal impact on their R&D strategies. Almost 80% of the participants provided us with insight on how Brexit might impact on the firm's R&D strategy. An important caveat is that almost one out of four companies is waiting to see how the Brexit negotiations develop and will act accordingly.

There are significant differences between firms that have R&D activities in the UK and those that do not. Figure 7 shows the distribution of the impact of Brexit[10] for (i) all participants, (ii) firms with R&D activities in the UK, (iii) firms without R&D in the UK, and

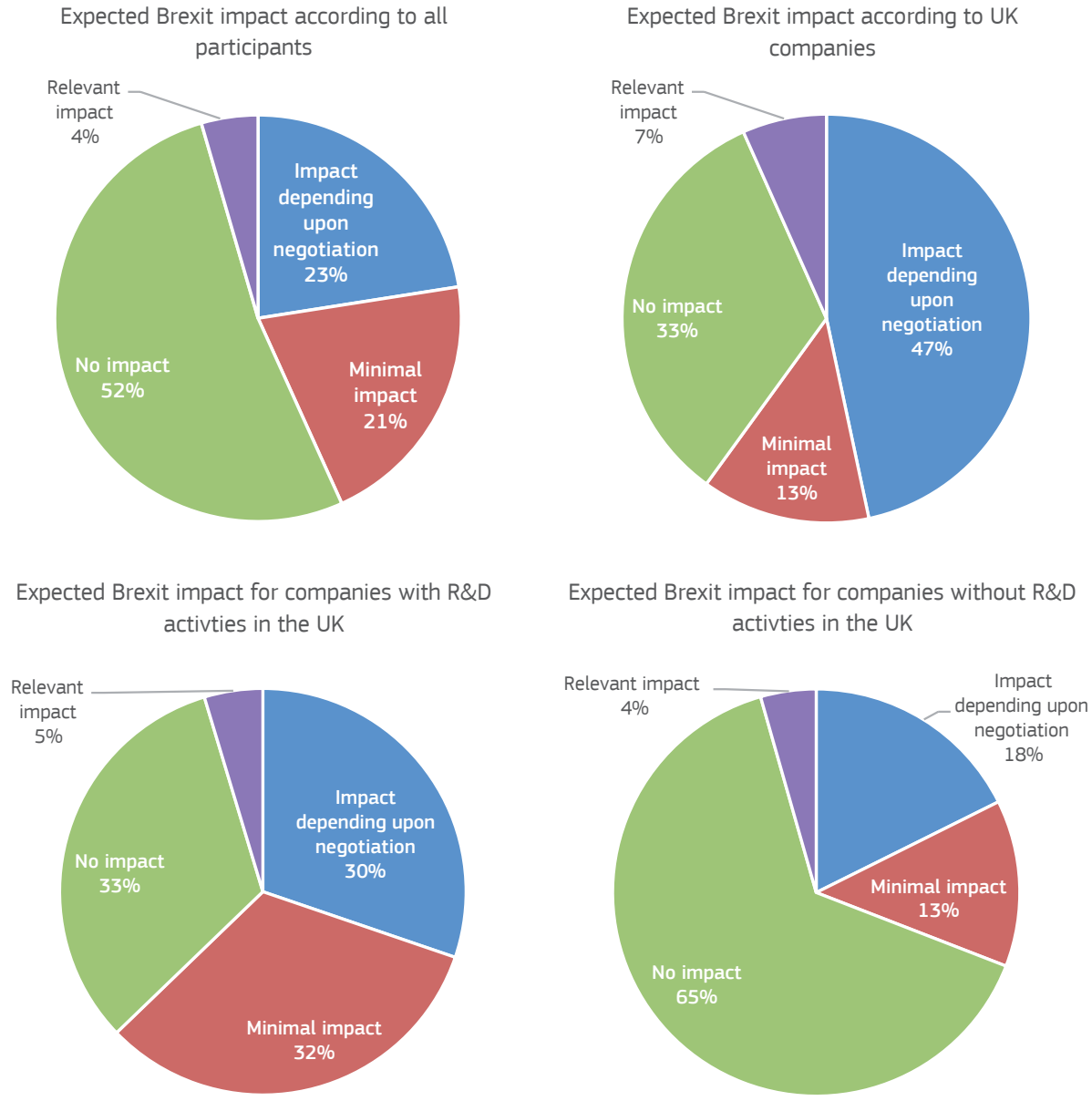

FIGURE 7: EXPECTED BREXIT IMPACT ACCORDING TO PARTICIPANTS.
Note: The figure refers to 111 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

[10] No impact, minimal impact, relevant impact and impact depending upon negotiations.

(iv) UK firms. For all firms (upper left), we see that overall expectations of the impact of Brexit on R&D strategy remain limited. While firms with R&D activities in the UK are much more hesitant in quantifying Brexit's impact – two third foresee no or minimal impact (upper right). For firms without R&D activities in the UK, two thirds foresee no impact at all (lower right). The participating UK companies are – understandably – more hesitant: almost half the firms await the negotiations for an impact assessment and a considerably higher proportion of firms expects relevant impact (lower left).

Last year's expectations on the impact of Brexit on R&D strategies were much more negative than this year. Among firms performing R&D in the UK, 20% expect to decrease their activities in the UK, 11% expect this share to increase, and 69% expect it to remain the same. R&D performed in the UK is expected to increase by 3.5%, which is lower than the overall increase of R&D (5.4%), but still positive and contrary to last year's expected decrease.

Among all companies with R&D activities in the UK, the proportion of R&D performed in the UK is expected to decrease slightly: from 8.3% in 2017 to 8.0% in 2019, although the absolute R&D investments are expected to increase by 5% p.a. This in contrast to last year's survey, when the participating firms with R&D activities in the UK had a more negative outlook and expected to decrease their activities from 13% to 10%,[11] while also expecting a decrease in absolute terms (-16%). The participating firms from the UK perform 42% of their R&D in the UK (they all perform some R&D in the UK) and they expect this proportion to remain stable. Absolute R&D investments are expected to increase by 6% p.a.

There were 61 companies that responded to both this year's and last year's question on the expected impact of Brexit on R&D investments. Table 2 provides an overview of how firms responded in both years, with the majority repeating last year's answer (main diagonal). A notable exception concerns companies that in 2017 expected Brexit to have a relevant impact on their R&D investments, which changed their stance mostly to 'no impact' or 'depends on negotiations'.

	2018 Survey responses				
2017 Survey response	**no response**	**Depends on negotiation**	**No impact**	**Minimal impact**	**Relevant impact**
No response	65%	0%	29%	6%	0%
Depends on negotiation	0%	67%	33%	0%	0%
No impact	6%	6%	76%	12%	0%
Minimal impact	19%	25%	13%	44%	0%
Relevant impact	11%	33%	33%	0%	22%

TABLE 2: RESPONSES TO THE QUESTION ON THE IMPACT OF BREXIT ON R&D STRATEGY.
Note: The figure refers to 61 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

[11] The difference in the proportions of R&D performed in the UK between the 2017 survey (13%) and this year's survey (8.5%) is due to the participation in 2017 of some firms with high R&D investments in the UK that did not participate in this year's survey. These figures do not imply that the proportion of R&D performed in the UK has decreased from last year to this year.

Table 3 shows how companies adjusted the proportion of R&D performed in the UK. Surprisingly, the two groups that foresaw an impact (minimal or relevant) of Brexit on their R&D strategy are also the groups where the highest percentage of companies actually increased the proportion of R&D performed.

	Observed change in share of R&D performed in the UK from 2017 Survey to 2018 Survey		
Brexit expectations in 2017 Survey	**decrease**	**no change**	**increase**
No response	0%	88%	12%
Depends on negotiation	33%	67%	0%
No impact	12%	76%	12%
Minimal impact	13%	63%	25%
Relevant impact	11%	56%	33%

TABLE 3: EXPECTATIONS OF IMPACT OF BREXIT (FROM 2017 SURVEY) AND OBSERVED CHANGE IN PROPORTION OF R&D PERFORMED IN THE UK.
Note: The figure refers to 78 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

3 R&D EMPLOYMENT

3 R&D employment

The EU firms that participated employ a total of around 5 million people around the world; an average of 35 000 employees per company. Firms have on average just under 3 000 R&D employees, or 8% of the total number of employees. This average is heavily skewed towards the larger firms – the median is 500 R&D employees. Figure 8 shows how the 140 firms responded to this question**.** The sector groups with the highest ratio of R&D employees to total employees are Aerospace (38%), ICT producers (14%), Health industries and Automobile (both 12%).

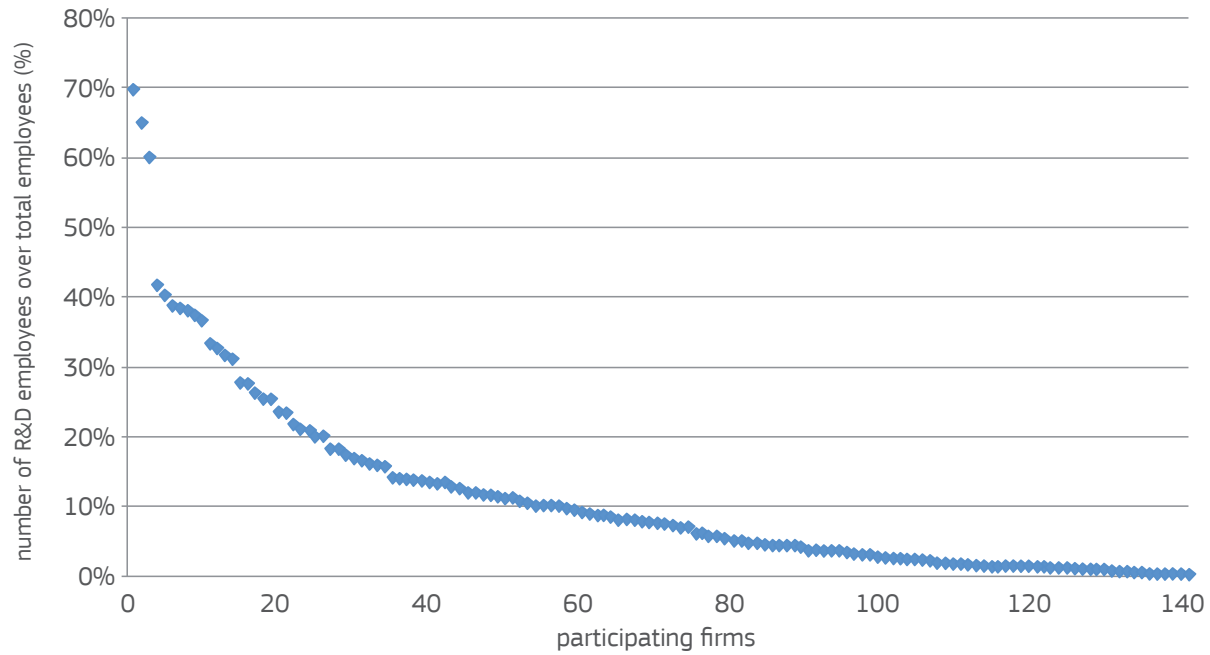

FIGURE 8: R&D EMPLOYEES AS A PERCENTAGE OF TOTAL NUMBER OF EMPLOYEES.
Note: The figure refers to 140 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

The average number of countries where R&D employees are located (10) is also heavily impacted by a few large firms. The median number of countries is five; the mode is four. One out of nine firms has R&D employees located in only one country. There are considerable differences across sector groups.

Looking at the median[12] number of countries in which a company performs R&D, Figure 9 shows that Automobile and Other Transport is the sector group with the most geographically spread out R&D employees, while companies in the Health industries sector group are the most concentrated. This connects to the finding that the large Health (especially pharmaceuticals) companies perform R&D in a few main labs, while firms in the Automobile sector group perform R&D closer to the final customer.[13] However, this decision seems to be very company specific, since there is low correlation (<26%) between the number of countries and other variables such as R&D investment, net sales, number of R&D employees or R&D intensity.

[12] This is a better measure given that the distribution is rather skewed, as seen earlier.
[13] This was confirmed by interviews with firms from the Automobile sector for a project on Global Value Chains, as described in the Summary report of the study prepared by IDEA Consult and VDI Technologiezentrum: "R&D and innovation activities in companies across Global Value Chains" (2018, to be published).

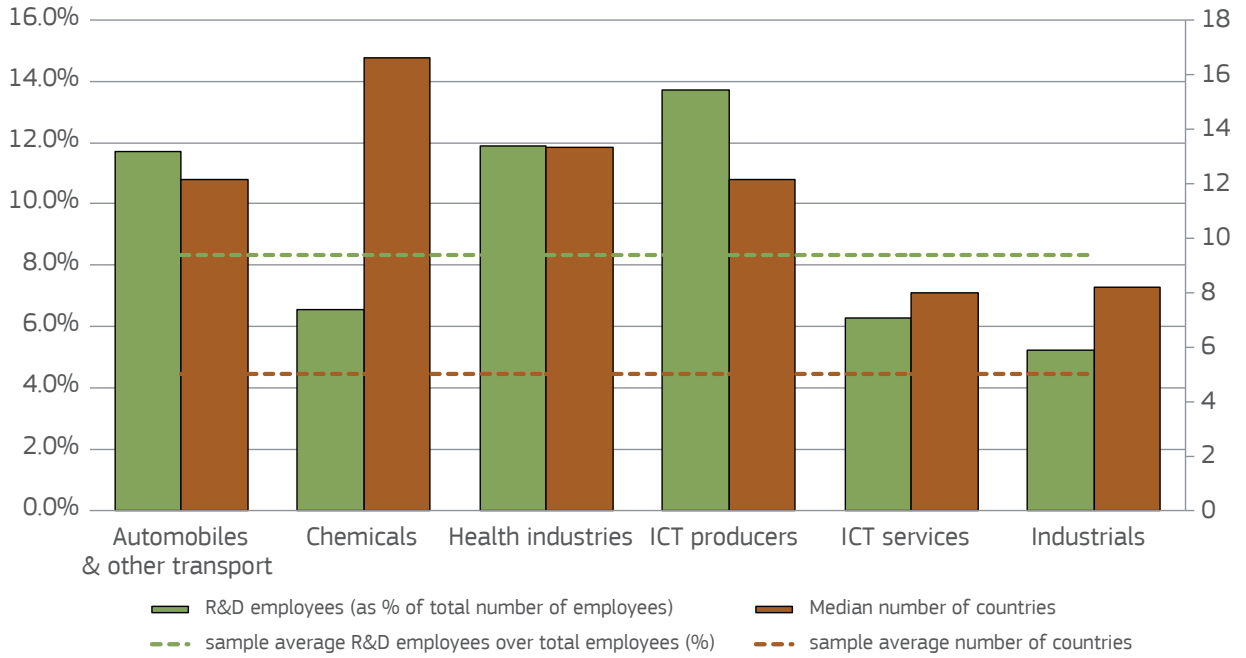

FIGURE 9: R&D EMPLOYEES AND NUMBER OF COUNTRIES WHERE R&D IS PERFORMED, BY SECTOR.
Note: The figure refers to 140 out of the 142 companies in the sample. Automobile and other transport (13), Chemicals (8), Health Industries (24), ICT producers (14), ICT services (15) Industrials (26), Aerospace and Defence (not reported) (3), Others (not reported) (37).
Source: European Commission JRC-B (2018).

Figure 10 shows the relation between R&D intensity (R&D investments over net sales) and R&D employees as a proportion of the total number of employees. These proportions are highly correlated, as in earlier years, since R&D employees' salaries are part of the R&D investments. The correlation for the whole sample is 78% (compared to 70% last year), with maximum correlations in the sectors Automobiles & other transport, Chemicals, Health industries and ICT producers (around 95%), and minimum correlation in the Industrials sector (33%).

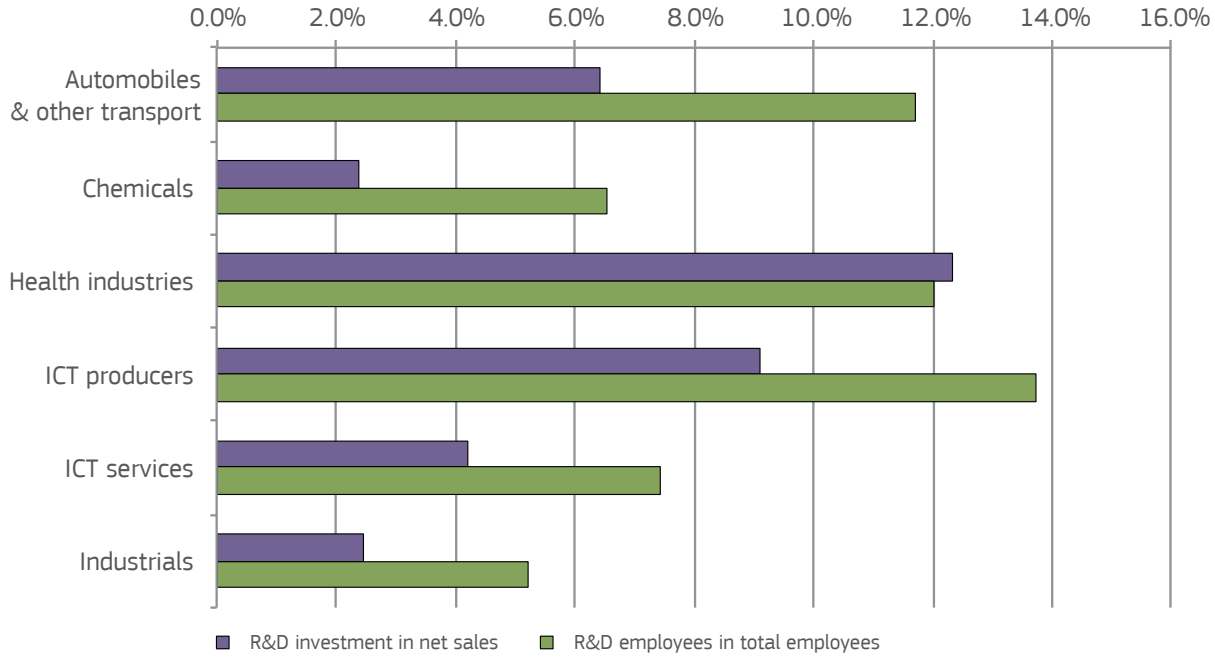

FIGURE 10: R&D INTENSITY AND PROPORTION OF R&D EMPLOYEES OUT OF THE TOTAL NUMBER OF EMPLOYEES, BY SECTOR.
Note: The figure refers to 136 out of the 142 companies in the sample. Automobile and other transport (14), Chemicals (8), Health Industries (23), ICT producers (15), ICT services (14) Industrials (23), Aerospace and Defence (not reported) (3), Others (not reported) (36).
Source: European Commission JRC-B (2018).

The average number of R&D employees varies by sector group, as shown in Figure 11. Automobiles & Parts has a high geographical spread, but also a high number of R&D employees per company, which is an indication of the size and labour intensiveness of R&D projects in this sector.

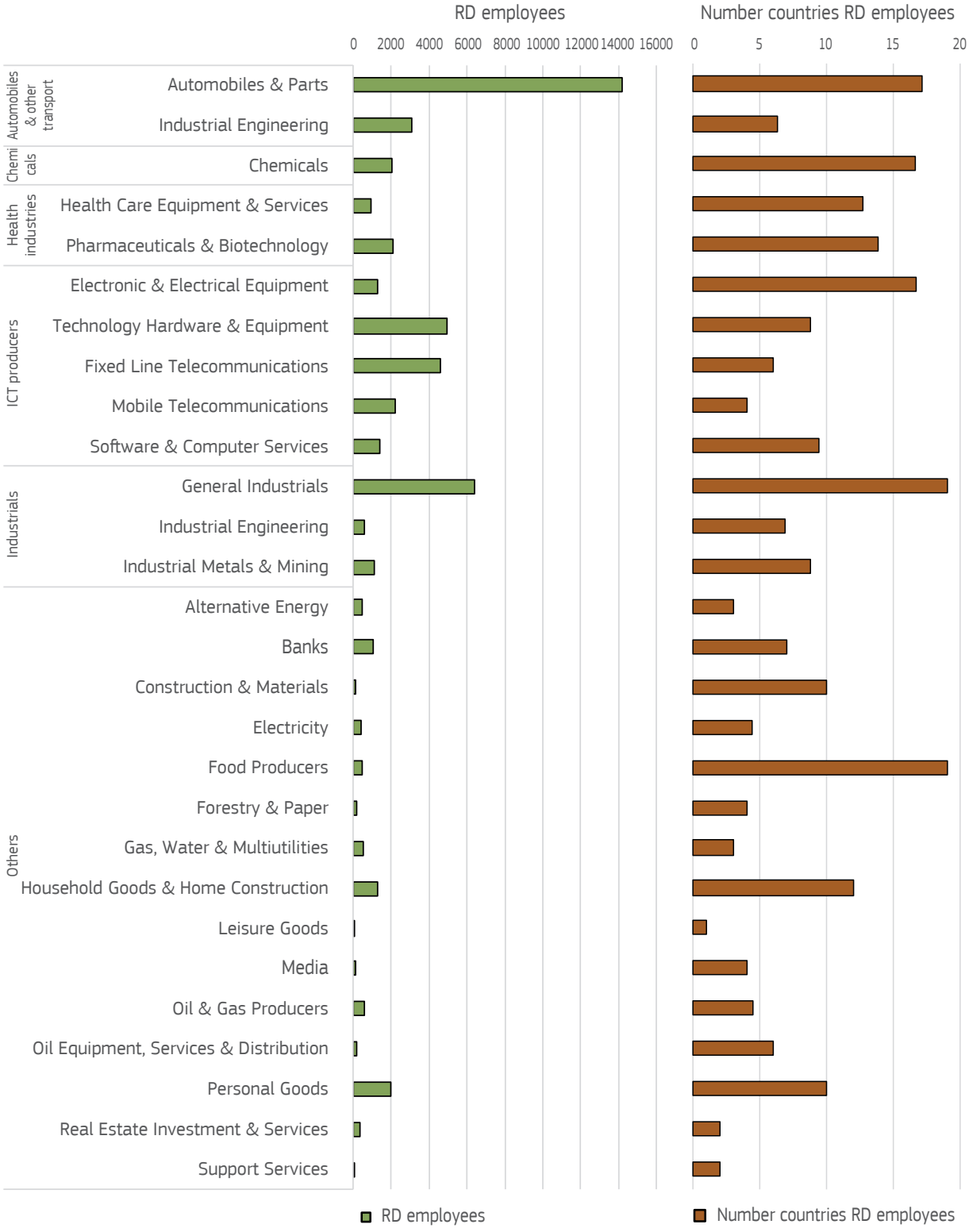

FIGURE 11: R&D EMPLOYEES AND NUMBER OF COUNTRIES WHERE R&D IS PERFORMED, BY SECTOR - DETAIL.
Note: The figure refers to 140 out of the 142 companies in the sample. Automobile and other transport (13), Chemicals (8), Health Industries (24), ICT producers (14), ICT services (15) Industrials (26), Aerospace and Defence (not reported) (3), Others (37).
Source: European Commission JRC-B (2018).

4

TYPE OF R&D **UNDERTAKEN**

4 Type of R&D undertaken

Figure 12 shows how total R&D investments in 2017 were divided between the "R" and the "Ds". The companies specified what percentage of their R&D investment is dedicated to R" (meaning 'Basic research, includes exploratory') and how much to the various "Ds" ('Applied research/technology development'; 'Development for adapting products to local markets'; 'Development for market launch'; 'Development of software/data'; 'Acquisition of machinery, equipment, software & buildings').

As consistently recorded over the past editions of the survey, **the development activities absorb around 80% of the total R&D investment**, the main fields of investment being 'Applied research/technology development' (30%), 'Development for market launch' (22.4%) and 'Development for adapting product to the local market' (16.7%).

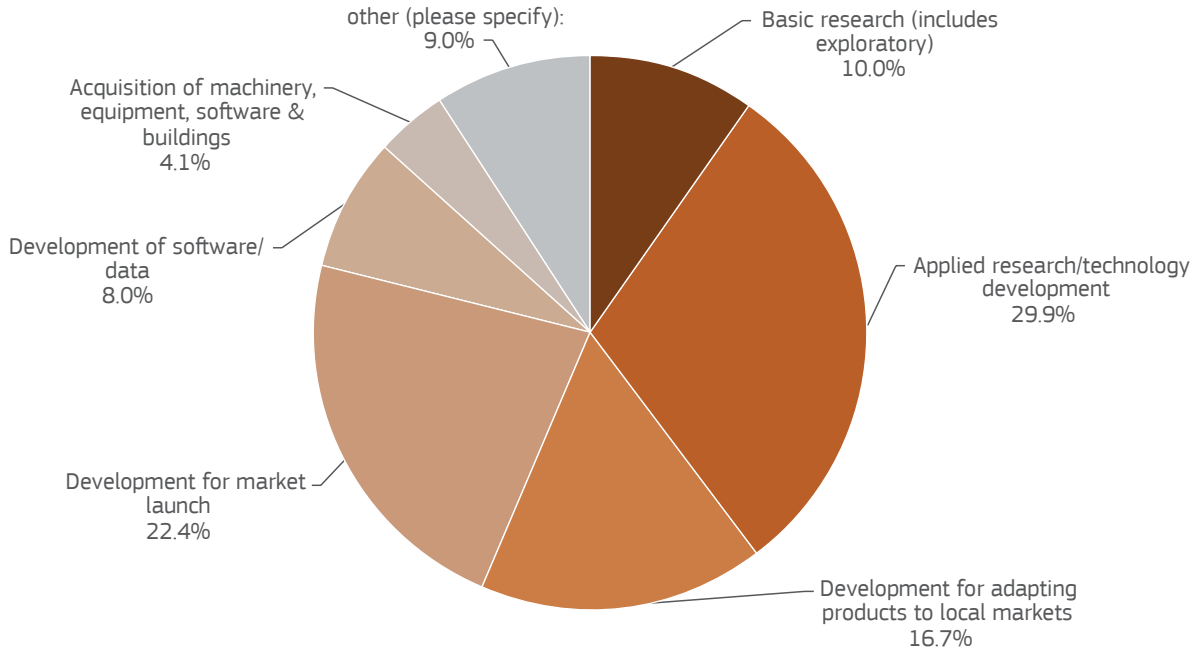

FIGURE 12: PROPORTION OF R&D INVESTMENT, BY TYPE OF INVESTMENT.
Note: The figure refers to 124 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

Although the composition of the respondent sample changes every year, the findings consistently show that basic research is a minority investment for top R&D investors, when compared to development activities. This confirms how much the European Innovation system has to rely on other actors (i.e. universities and public research institutes, but also start-ups and disruptive companies) for investment in basic research. Basic research is not immediately translatable into profit (hence the low level of interest from private companies - only 10% of the total R&D investment in our sample), but it is indispensable for laying the foundations for the next technological revolution (whatever that may be).

This lack of private company investment in basic research calls for policies to support public investment in this area. The companies surveyed seem to suggest this themselves, by indicating 'increase of public funding to research projects' as the reform with the highest potential impact on their R&D and innovation activities (see Section 8 on Structural Reforms).

FIGURE 13: PROPORTION OF INVESTMENT, BY TYPE OF R&D AND BY SECTOR GROUP.
Note: The figure refers to 124 out of the 142 companies in the sample. Automobile and other transport (10), Chemicals (8), Health Industries (21), ICT producers (12), ICT services (13) Industrials (24), Aerospace and Defence (not reported) (3), Others (not reported) (33).
Source: European Commission JRC-B (2018).

Figure 13 focuses on types of R&D undertaken by different sectors. Unsurprisingly, given the general pattern observed in the whole sample, in every sector [14] the bulk of R&D is devoted to development activities. Nevertheless, some interesting differences emerge.

There is confirmation of sectoral differences in how companies are positioned within a value chain.[15] While in sectors like Automobile and Other Transport, 'Basic research' represents only 3% of total R&D investment, in Chemicals and Health Industries there is significantly higher R&D investment in basic research (17% and 15% respectively). This sectoral pattern was also observed last year, reflecting the differences in products sold and in structure of the value chains within these sectors.

Health Industries and ICT services are the only two sectors in the survey where 'Applied research/ technology development' is not the main type of R&D performed. For Health Industries, the bulk of R&D investment is in 'Development for market launch' (28%). This is typically due to the amount invested by the pharmaceutical sector in clinical trials to get drugs approved by the control authorities before market launch. For the ICT services sector, the bulk of investment is in 'Development of software/data' (31%), which correlates with their core business.

The twin sectors ICT producers and ICT services clearly have different investment patterns, with the first group investing mainly in applied research and development, for adapting products to the market, and the second group in software development (as already noted).

While Figure 13 shows percentages, Table 4 reports the absolute amount of R&D investment, by type of activity and by sector. The Health industries sector is the biggest investor in 'Applied research/technology development', 'Development for market launch' and 'Basic research (includes exploratory)'. ICT producers are the leading investors in 'Development for adapting products to local markets' and in 'Acquisition of machinery, equipment, software & buildings', while ICT services is the sector investing the most in 'Development of software/data'.

[14] We did not include a chart for Aerospace and Defence (only three firms replied) or Other sector groups (difficult to interpret, being a residual category).
[15] See Potters, L.; Grassano, N. and Tübke, A.: *The 2017 EU Survey on Industrial R&D Investment Trends*; EUR 28871 EN.

R&D type	main sectors	R&D investment (€ million)
Applied research/technology development	Total	14.243
	Health industries	4.114
	ICT producers	3.062
	Others	2.038
	Chemicals	1.638
	Automobiles & other transport	1.604
	Industrials	691
	Aerospace & Defence	561
	ICT services	535
Development for market launch	Total	10.686
	Health industries	4.224
	ICT producers	1.581
	Aerospace & Defence	1.385
	Others	1.192
	Automobiles & other transport	813
	ICT services	604
	Industrials	579
	Chemicals	308
Development for adapting products to local markets	Total	7.951
	ICT producers	2.784
	Health industries	1.793
	Automobiles & other transport	942
	Others	598
	Chemicals	583
	ICT services	492
	Industrials	431
	Aerospace & Defence	326
Basic research (includes exploratory)	Total	4.761
	Health industries	2.186
	ICT producers	828
	Others	597
	Chemicals	532
	ICT services	213
	Industrials	207
	Automobiles & other transport	108
	Aerospace & Defence	90
Development of software/data	Total	3.826
	ICT services	1.496
	ICT producers	932
	Others	463
	Health industries	386
	Industrials	286
	Automobiles & other transport	160
	Aerospace & Defence	56
	Chemicals	46
Acquisition of machinery, equipment, software & buildings	Total	1.933
	ICT producers	785
	Health industries	619
	ICT services	114
	Industrials	110
	Chemicals	107
	Automobiles & other transport	99
	Others	87
	Aerospace & Defence	12

TABLE 4: TOTAL R&D INVESTMENT, BY TYPE AND BY SECTOR.
Note: The figure refers to 124 out of the 142 companies in the sample. Automobile and other transport (10), Chemicals (8), Health Industries (21), ICT producers (12), ICT services (13) Industrials (24), Aerospace and Defence (not reported) (3), Others (not reported) (33).
Source: European Commission JRC-B (2018).

5

DRIVERS OF CHANGES **IN R&D**

5 Drivers of Changes in R&D

As in previous editions of the survey, companies were asked to rate the significance of some potential drivers on the decision whether to change future R&D investment. For each of the drivers included in the survey, Figure 14 shows the percentage of companies that consider them very (4) or highly (5) relevant.

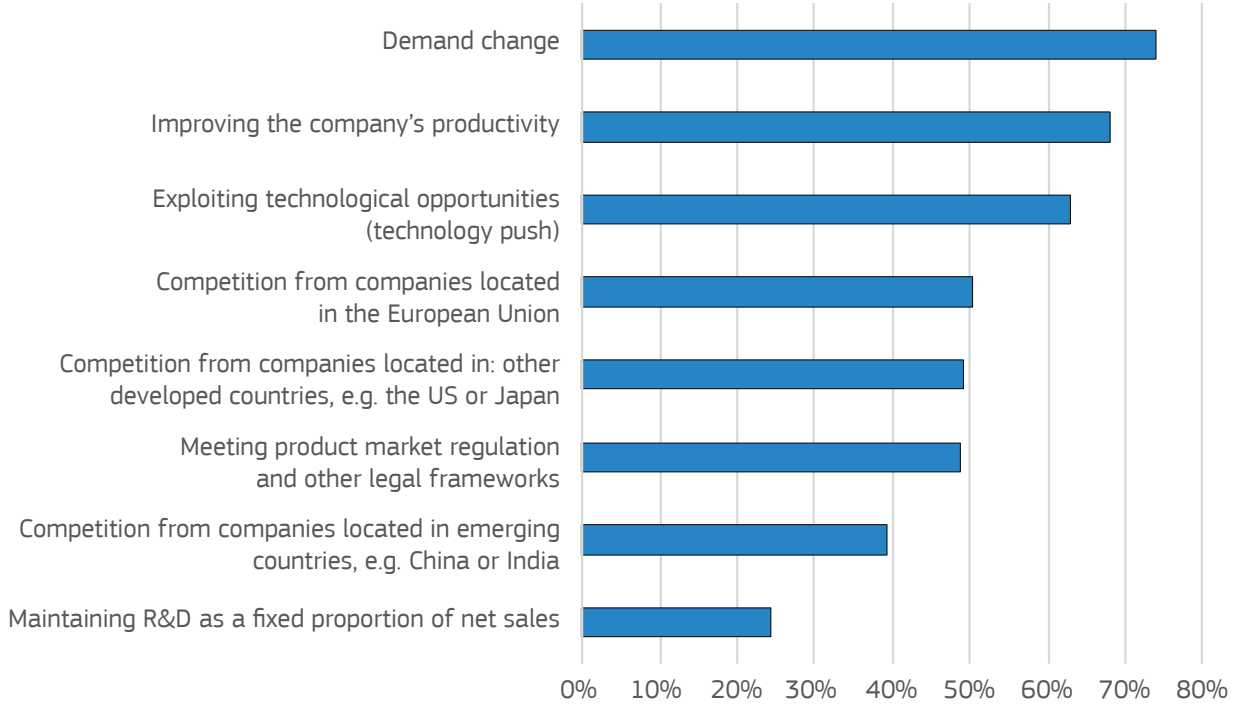

FIGURE 14: DRIVERS OF EXPECTED R&D INVESTMENT CHANGES.
Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 136 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

The three main factors driving future changes in R&D investment are the same as last years: demand change, improving productivity and the chance to exploit technological opportunities. This consistency, regardless of changes in the sample of respondents, indicate that private R&D investment is mainly driven by market considerations and technological opportunism.

In terms of the other drivers, the results are also more or less in line with previous editions of the survey. Drivers linked to competition from other companies are important, with distance from the competitors (both geographic and in terms of level of development of the economy in which the other company is located) playing a significant role. The main driver is competition from other EU companies, then from companies located in other developed economies, and finally from companies located in emerging economies.

Companies do not regard maintaining R&D as a fixed proportion of net sales important in driving their R&D strategies, but meeting product market regulation is a considerable driver of R&D investment for half of the sample.

We can learn more about the relative importance of each driver by looking at how companies from different sectors responded. Figure 15 shows, for each driver, the percentage of companies in each sector that consider it very or highly relevant for their R&D strategy.

There are drivers that are important for every sector (e.g. demand change), while there are others that are very important for one sector but less so for the others (e.g. competition from companies located in other developed economies, for the ICT producers).

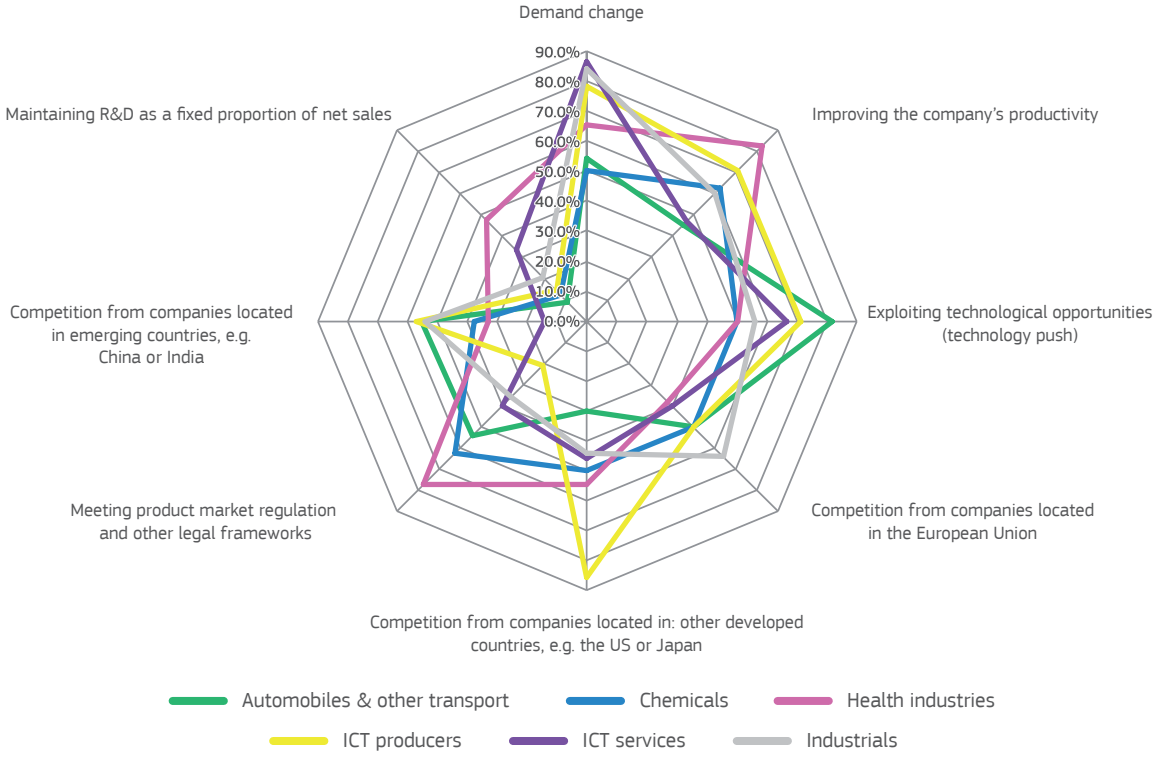

FIGURE 15: DRIVERS OF EXPECTED R&D INVESTMENT CHANGES – DETAIL.
Note: The activities are listed clockwise by average relevance of the major items in the survey. The figure refers to 136 out of the 142 companies in the sample. Automobile and other transport (11), Chemicals (8), Health Industries (23), ICT producers (14), ICT services (15) Industrials (25), Aerospace and Defence (not reported) (3), Others (not reported) (37).
Source: European Commission JRC-B (2018).

'Meeting product market regulation' is one of the top two drivers for both the Health industries and the Chemicals sector groups, while it is listed among the bottom two by the ICT producers and Industrials sector groups. This is probably simply a reflection of differences in the importance of regulations for these sectors

The Automobile and Other Transport sector is clearly a technology push sector, while ICT services and Industrials are definitely market pull sectors when it comes to R&D investment decisions. Industrials is the sector that pays the most attention to competition from inside the EU.

To get a different angle on R&D investment motivations, we split the sample of respondents into two groups, using 3% expected R&D increase per year as the threshold: those planning a decrease, no increase or a small increase (i.e. 3% or below) in R&D investment, and those planning a moderate or significant increase (i.e. more than 3%). The relevance of the different drivers for the two groups is reported in Figure 16.

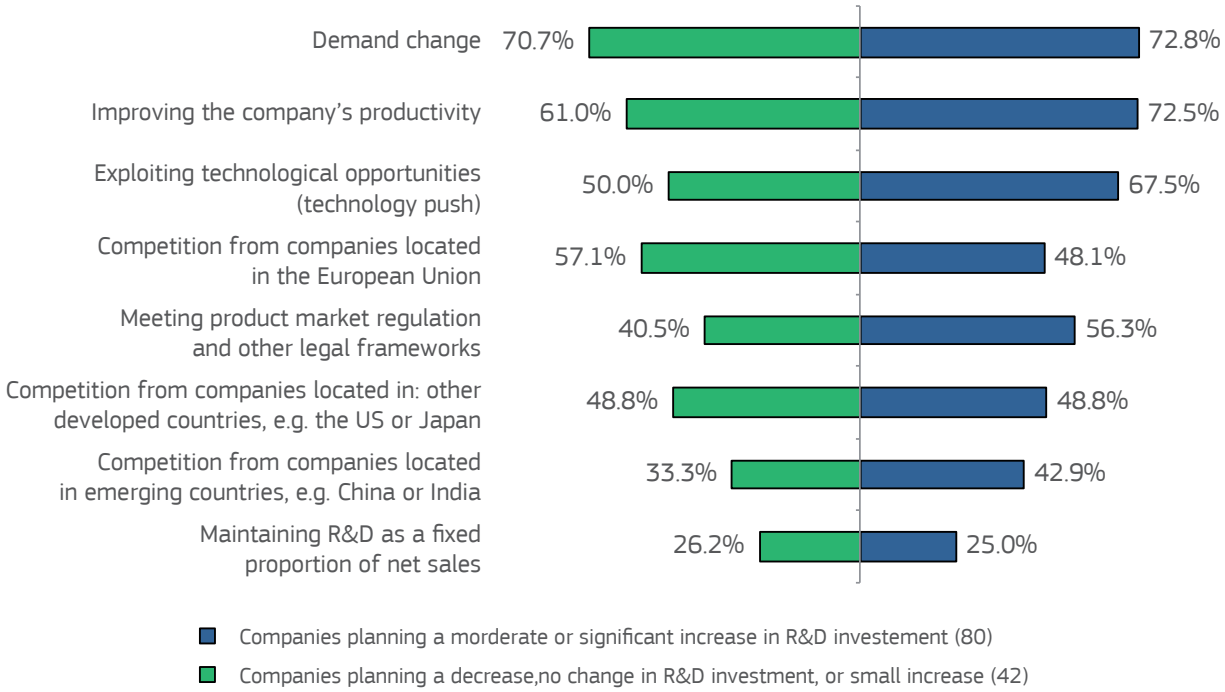

FIGURE 16: DRIVERS OF EXPECTED R&D INVESTMENT – PLANNED SIGNIFICANT R&D INCREASE VERSUS PLANNED R&D SMALL INCREASE OR NO CHANGE.
Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 123 out of the 142 companies in the sample (those that replied to both questions on R&D expectations and R&D drivers).
Source: European Commission JRC-B (2018).

The two highest ranking and two lowest ranking factors are the same for the two groups of companies. Thus, the factors driving a significant increase for some companies are the same as those driving a decrease, no change, or only small increase for others. An interesting difference emerges when looking at the middle of the ranking, where competition from other EU companies is much more a deterrent than a driver for R&D growth, while the opposite is true for meeting product regulations. These differences in ranking were not observed in past editions of the survey and will merit further investigation if they recur.

However, looking at differences in terms of the relative importance of each driver for the two groups, the only statistically significant[16] difference is in the 'Exploring technological opportunities driver'. In other words, the only real difference between the two groups in what motivates (or not) future R&D growth is the technology push factor. The relevance of this factor seems to increase in line with the company's R&D investment.

[16] T-test value below 0.05.

6

NON-R&D **INVESTMENT**

6 Non-R&D investment

6.1 | Non-R&D innovative activities

This year we asked companies to provide us with more insight into non-R&D innovative activities. These activities are difficult to grasp through official data but do have an important impact on innovation output.[17] In particular, we asked about the importance[18] of activities specified in the Frascati Manual[19]:

- Market research for innovations
- Training of staff for innovative activities
- Market introduction of innovations
- Organisational innovations
- Form and appearance design of new products
- Acquisition of licenses and other knowledge

Market research, training and market introduction are considered (highly) important[20] by two thirds of the companies. Organisational innovation (40%), design (31%) and acquisition of licenses (42%) are considered much less important.

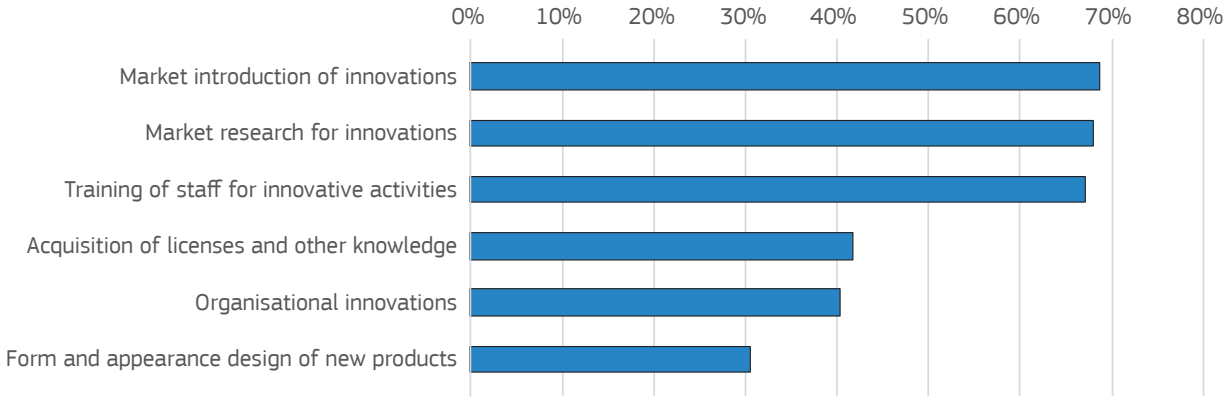

FIGURE 17: PERCENTAGE OF FIRMS CONSIDERING THE NON-R&D INNOVATIVE ACTIVITIES AS (HIGHLY) IMPORTANT.
Note: The figure refers to 134 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

Approximately half of the participating companies provided us with (an estimate of) their non-R&D expenditure. This is a relatively low proportion, due to accounting regulations not requiring companies to track this.[21] In addition, some companies responded that they do not keep clear track of these specific non-R&D expenditures as such.

The average non-R&D expenditure of the responding companies is €54 million:[22] 29% of their R&D expenditure or a non-R&D intensity (non-R&D expenditure over net sales[23]) of 0.5%.

[17] See e.g. Brouwer E, Kleinknecht A. Measuring the unmeasurable: a country's non-R&D expenditure on product and service innovation. Research policy. 1997 Jan 1;25(8):1235-42..

[18] From 1 (not important) to 5 (highly important) on the Likert scale.

[19] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264239012-en.

[20] 4 (important) or 5 (highly important) on the Likert scale.

[21] Non-R&D innovation costs, such as market research, organisational innovation, design, and training of staff for innovative activities, may not be reported separately on the annual accounts but rather integrated under the (year-to-year) change in intangible assets or charged to expense, together with other costs or expenses and are therefore not distinguishable.

[22] One response was removed as it was clearly an outlier, probably an error in filling in the questionnaire (€5 100 million).

[23] Here, net sales for 2016 were used for calculation.

The responding companies are smaller than non-responding companies in terms of R&D (-40%), net sales (-25%), number of employees (-35%) and R&D employees (-35%), but they do have similar R&D intensities (4% vs 5%) and perform R&D in a similar number of countries (10 vs 11).

No significant correlations have been found between size (in terms of sales and employees), type of R&D, sector, location of R&D activities and the importance of non-R&D activities for their innovation output.

6.2 | Publication activity

The Scoreboard companies translate their research effort into patents[24] and publications.[25] An analysis of their publication activity revealed how top R&D investors are also major publishers of research papers.

Based on the findings of this recent analysis, we decided to go deeper into what motivates companies to publish their research. While it is obvious for researchers working in academia why they should publish the results of their work, for companies it is a little less straightforward. Publishing the results of its research activity literally means the firm 'makes public' its achievement to its competitors, which can give rivals an insight into future strategies, giving them an edge in future market competition.

Nevertheless, literature on the topic has identified reasons why firms can be eager to publish in academic journals. This literature has been recently systematised by Rotolo et al, who have summarised five broad categories of incentives for firms to publish: 'Accessing external knowledge and resources'; 'Attracting, recruiting, and retaining researchers'; 'Signalling and building reputation'; 'Supporting IP strategies'; 'Supporting marketing and commercialisation strategies'.

We asked respondents to rate the importance of these factors in their decision to publish, indicating their relevance on a scale from 1 to 5. Figure 18 shows the percentage of companies that consider each of the motivations very (4) or highly (5) relevant in allowing their employees to publish scientific papers.

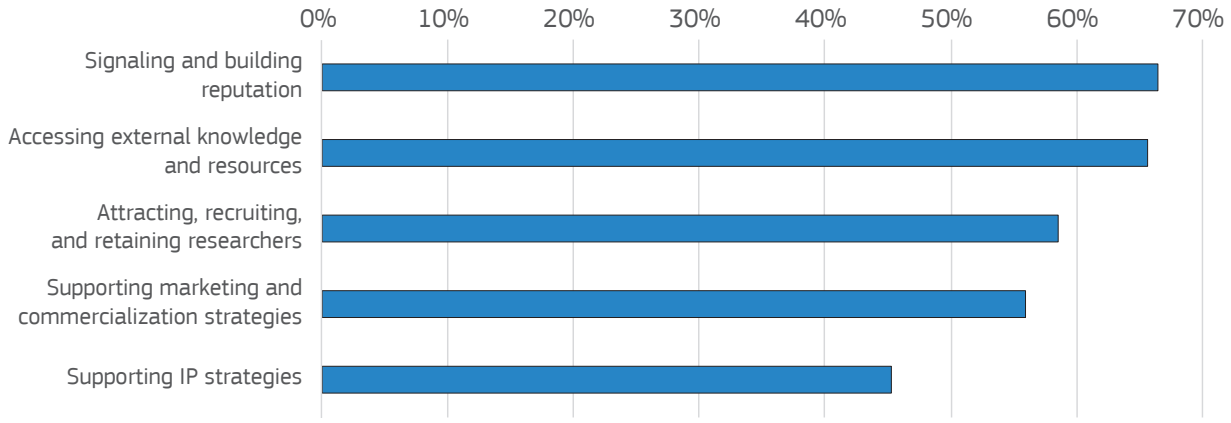

FIGURE 18: COMPANIES' MOTIVATIONS FOR PUBLICATION ACTIVITY.
Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 129 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

These results show how companies use publications strategically.

They allow their researchers to publish in order to build their reputation, which in turns helps to attract venture capital (especially for biotech firms) and also other talented researchers (66.4%).

They publish to access and be part of the broader research community that deals with the topics at the

[24] See Daiko T., Dernis H., Dosso M., Gkotsis P., Squicciarini M., Vezzani A. (2017). *World Corporate Top R&D Investors: Industrial Property Strategies in the Digital Economy*. A JRC and OECD common report. Luxembourg: Publications Office of the European Union..

[25] http://iri.jrc.ec.europa.eu/documents/10180/948317/Scientific%20Publication%20Activity%20of%20Scoreboard%20Companies.

core of their business. By paying the fee (i.e. publishing some of their results) they get recognition from the community and gain access to a broader set of knowledge (65.6%).

If you want your R&D investment to be fruitful, you need talented researchers, and talented researchers want to publish. So allowing them to do so is a way of attracting and retaining the best scientists in the field (58.6%).

Making your research visible to the general public is also a good marketing strategy. Especially in the pharmaceutical sector, practitioners may be more inclined to prescribe drugs they've read about in specialised journals, and patients also have more trust in brands they have heard of in the specialised press (55.9%).

Using publication as an IP tool seems less of a motivation for our companies (45.3%), although the use of publications in patents is far from uncommon.

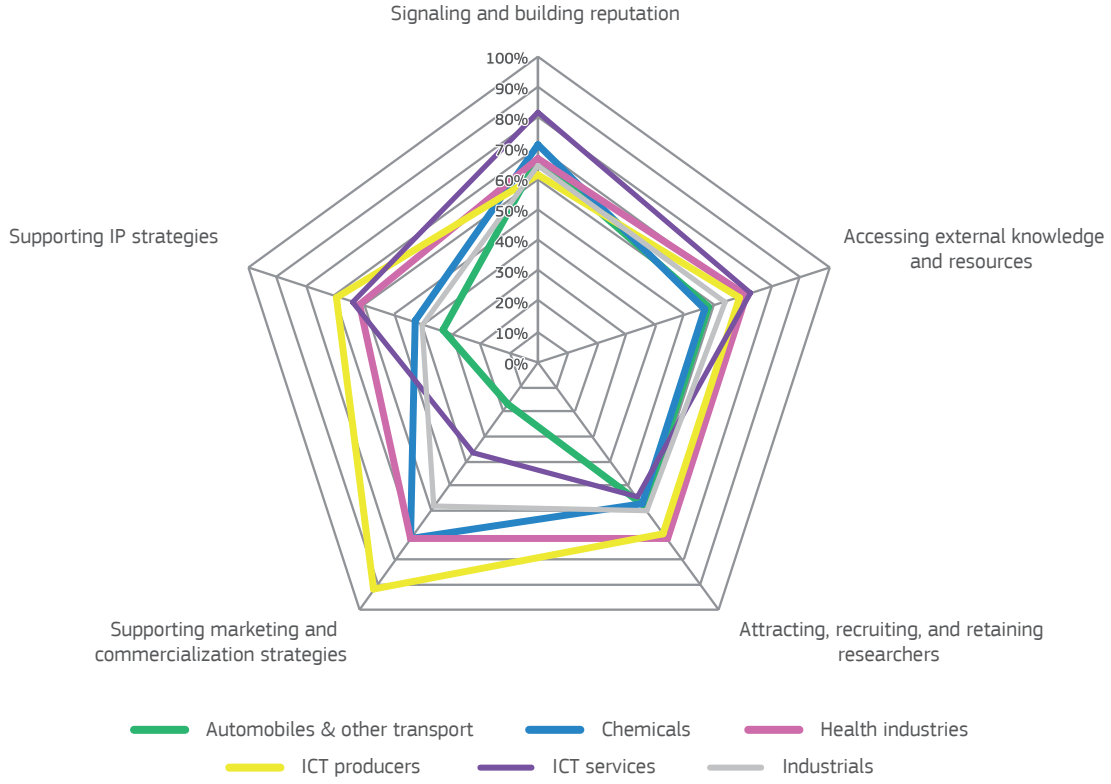

FIGURE 19: COMPANIES' MOTIVATIONS FOR PUBLICATION ACTIVITY - DETAILS.
Note: The activities are listed clockwise by average relevance of the major items in the survey. The figure refers to 129 out of the 142 companies in the sample. Automobile and other transport (12), Chemicals (7), Health Industries (21), ICT producers (13), ICT services (11) Industrials (25), Aerospace and Defence (not reported) (3), Others (not reported) (37).
Source: European Commission JRC-B (2018).

Figure 19 disaggregates the data by sector to see if sectoral patterns emerge. Some interesting observations can be made.

For example, for the ICT producers sector the main motivation to publish is supporting marketing and commercialisation strategies, which on the contrary is the least important for the ICT services sector. For the ICT services sector, signalling and building reputation is the main reason to publish, while for the ICT producers this is what matters the least. Thus, the two ICT sectors show opposite patterns in motivations for allowing their employees to publish. The Health industries sector rates all these motivations very similarly as highly relevant, while the remaining sectors tend to clearly favour one or two motivations.

By cross-referencing the results of the survey with the results of the PASCO project,[26] we can retrieve data on

[26] The PASCO project examines the extent to which companies included in the EU Industrial R&D Investment Scoreboard are involved in publication activity. The project uses the 2014 edition of the Scoreboard and the final report is available here.

publication activity. For 104 out of our 142 responding companies, we have data on the number of publications for the period 2011-2015.

Using this data, we can split our respondents into two groups: those publishing below and those publishing above the median in the period 2011-2015. We can then see whether different patterns of motivations to publish emerge. This is reported in Figure 20 below.

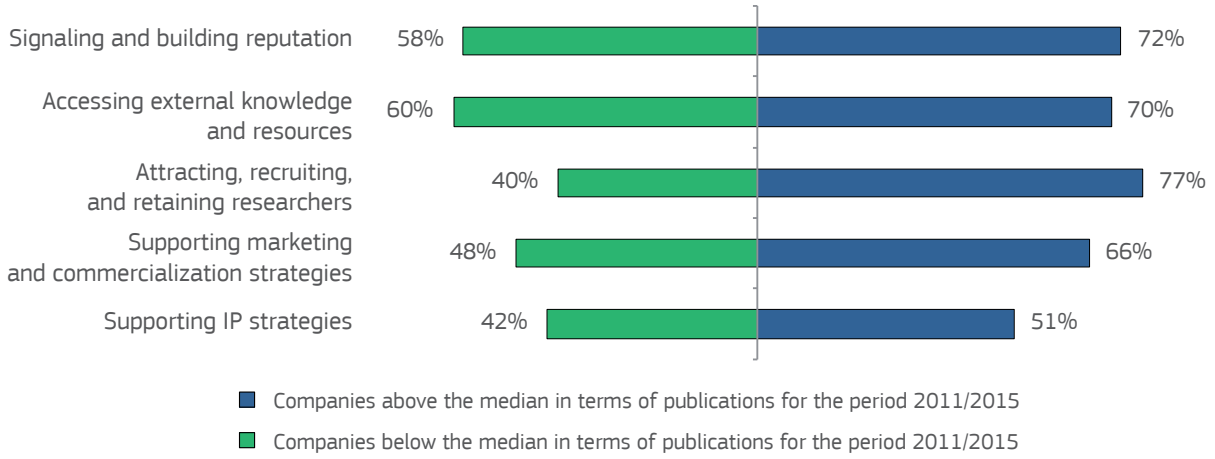

FIGURE 20: COMPANIES' MOTIVATIONS FOR PUBLICATION ACTIVITY – COMPANIES ABOVE THE MEDIAN IN TERMS OF PUBLICATIONS VERSUS THOSE BELOW THE MEDIAN.
Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 95 out of the 142 companies in the sample (those that replied to question on motivations and where part of the PASCO project).
Source: European Commission JRC-B (2018).

In general, firms that publish below the median tend to attach less importance to all the motivations proposed, indicating less interest in allowing their researchers to publish.

The most striking difference is in Attracting, recruiting and retaining researchers, which is the most important motivation for firms with high publishing output and the least important for those with low output. This difference is statistically significant[27] and is an interesting result worthy of further research in future.

[27] Of the differences between the two groups in the five motivations, three are statistically significant at 95% (t-test below 0.05). These are the differences in 'Signaling and building reputation', 'Accessing external knowledge and resources' and 'Attracting, recruiting, and retaining researchers'. The differences in 'Supporting marketing and commercialization strategies' and 'Supporting IP strategies' are not statistically significant.

7

LOCATION OF R&D **AND PRODUCTION**

7 Location of R&D and Production

7.1 | R&D location

One out of eight companies in the survey performs R&D in only one country, while one-third of the firms do so in 10 or more countries. The main R&D location seems to be more important when this is also the location of the company's headquarters. In this case, 58% of total R&D (60% last year) is performed at this location, compared with 51% for companies that locate their main R&D activities away from the company's headquarters.[28]

By far the most popular R&D locations away from the company's headquarters are the US (45% of the participants have major R&D activities in the US) and Germany (21%, after excluding German companies), as shown by the green bars in Figure 22**.** Within the EU, Germany is followed by France and the UK, as last year, then at a considerable distance by Sweden. Italy, Belgium, Spain, Ireland and Poland are all mentioned a similar number of times as a main R&D location. It is notable here that Poland is the only country without participants in the survey that still seems able to attract a considerable number of main R&D locations.

After the US, by far the most popular R&D locations outside the EU are China and India. Brazil, Canada and South Korea are also among the top R&D destinations.

As in last year's survey, one out of three companies performs R&D in all four main economic areas,[29] almost twice the proportion as in 2006. As shown in **Figure 21**, this proportion has been increasing since the start of the survey.[30] This is clear evidence of the global character of R&D and the increasing need for top R&D investors to be present in the main R&D locations. Germany and France (EU) and the US and China (non-EU) are the most popular locations for R&D activities. See Figure 22.

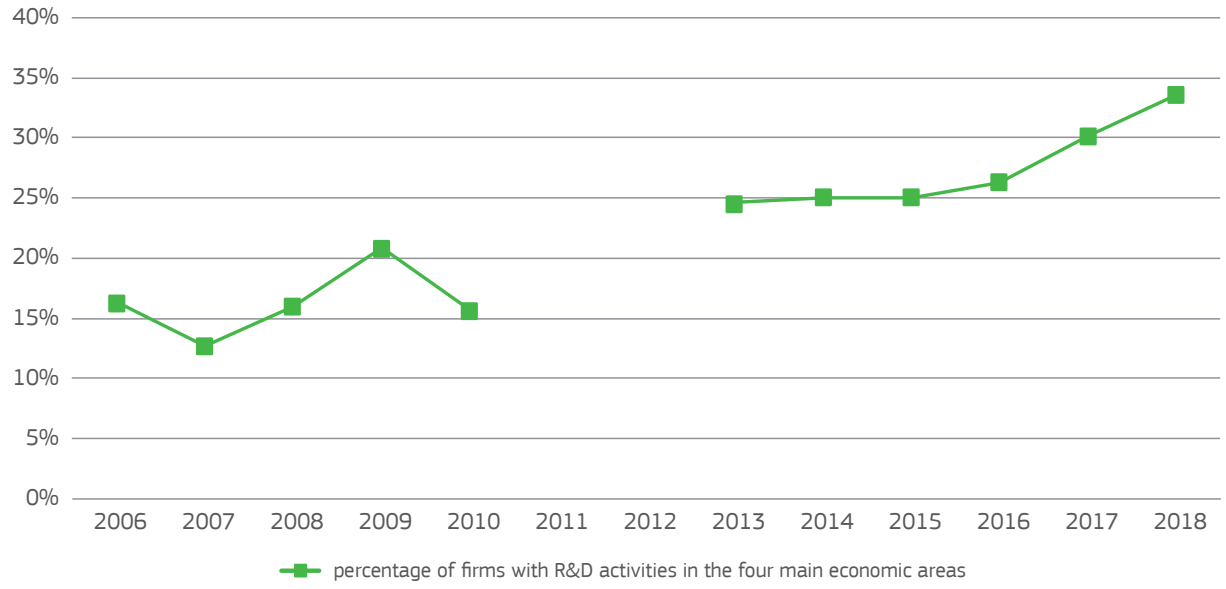

FIGURE 21: PROPORTION OF SURVEY PARTICIPANTS WITH R&D ACTIVITIES IN ALL FOUR MAIN WORLD REGIONS, 2006-2018.
Note: The figure refers to the participants of each of the survey editions from 2006 to 2018. In the surveys of 2011 and 2012 this question was not asked and therefore no data are available.
Source: European Commission JRC-B (2018).

[28] Statistically significant.
[29] EU, North America, Asia and Rest of the World.
[30] In the surveys of 2011 and 2012 this question was not asked and therefore no data are available.

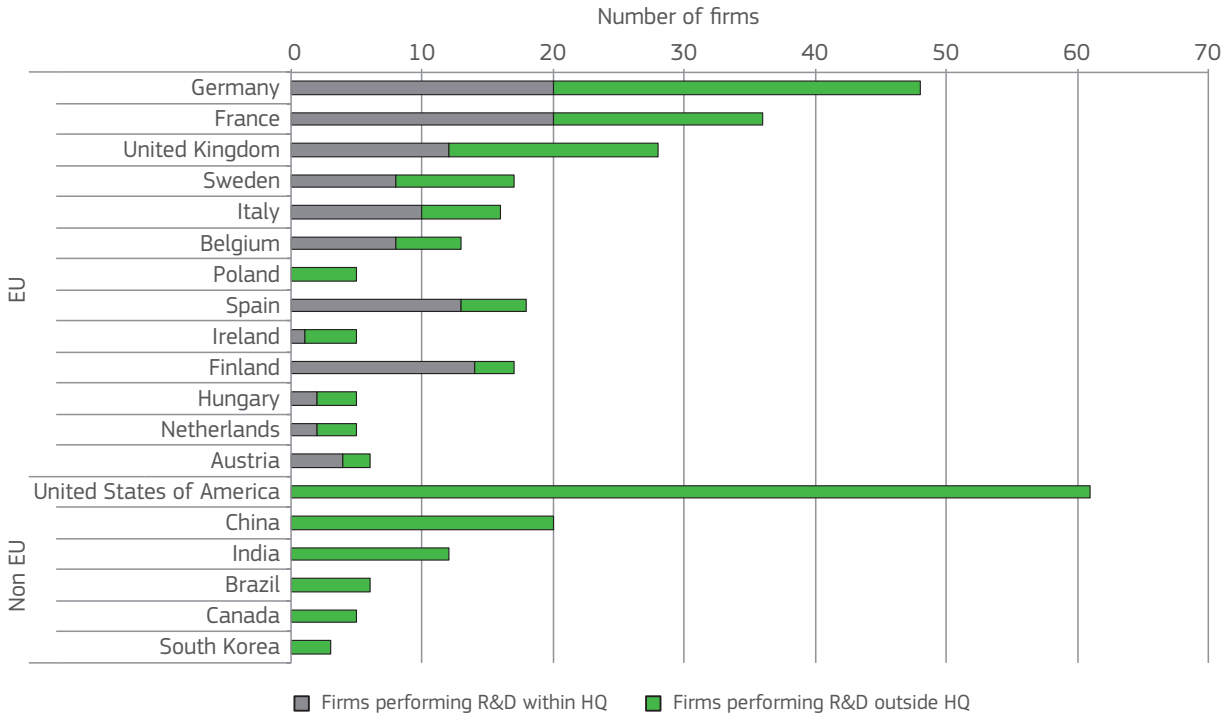

FIGURE 22: R&D LOCATION.
Note: The figure refers to 138 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

The quality and availability of researchers and the proximity of a company's other activities (e.g. production) are rated the most important factors for R&D location. Low labour costs for researchers are not an important factor of attractiveness for locating R&D activities. These findings are consistent with earlier surveys (Figure 23).

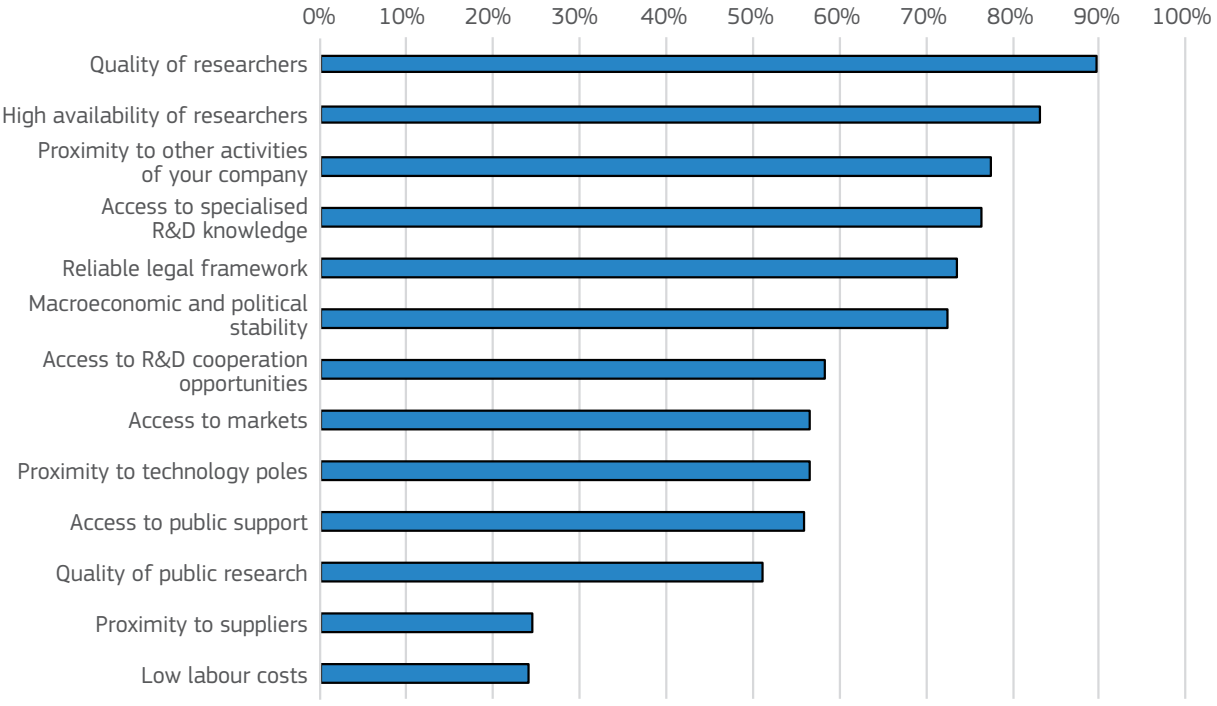

FIGURE 23: SHARE OF RESPONDENTS RATING A FACTOR AS (HIGHLY) ATTRACTIVE.
Note: The figure refers to 135 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

The proximity to other activities within the same company is much more important to companies with R&D activities in only one country (100% of these firms find this highly important) or a few countries (2-5 countries; 81%). This implies that the decision to perform R&D in another country is not so much limited by *external* factors, but is instead a deliberate company-specific decision.

The quality of researchers seems to be a decisive factor for firms with any kind of R&D strategy. Low labour cost gains importance as a factor as the number of country locations increases, but it remains one of the least important factors for locating R&D activities.

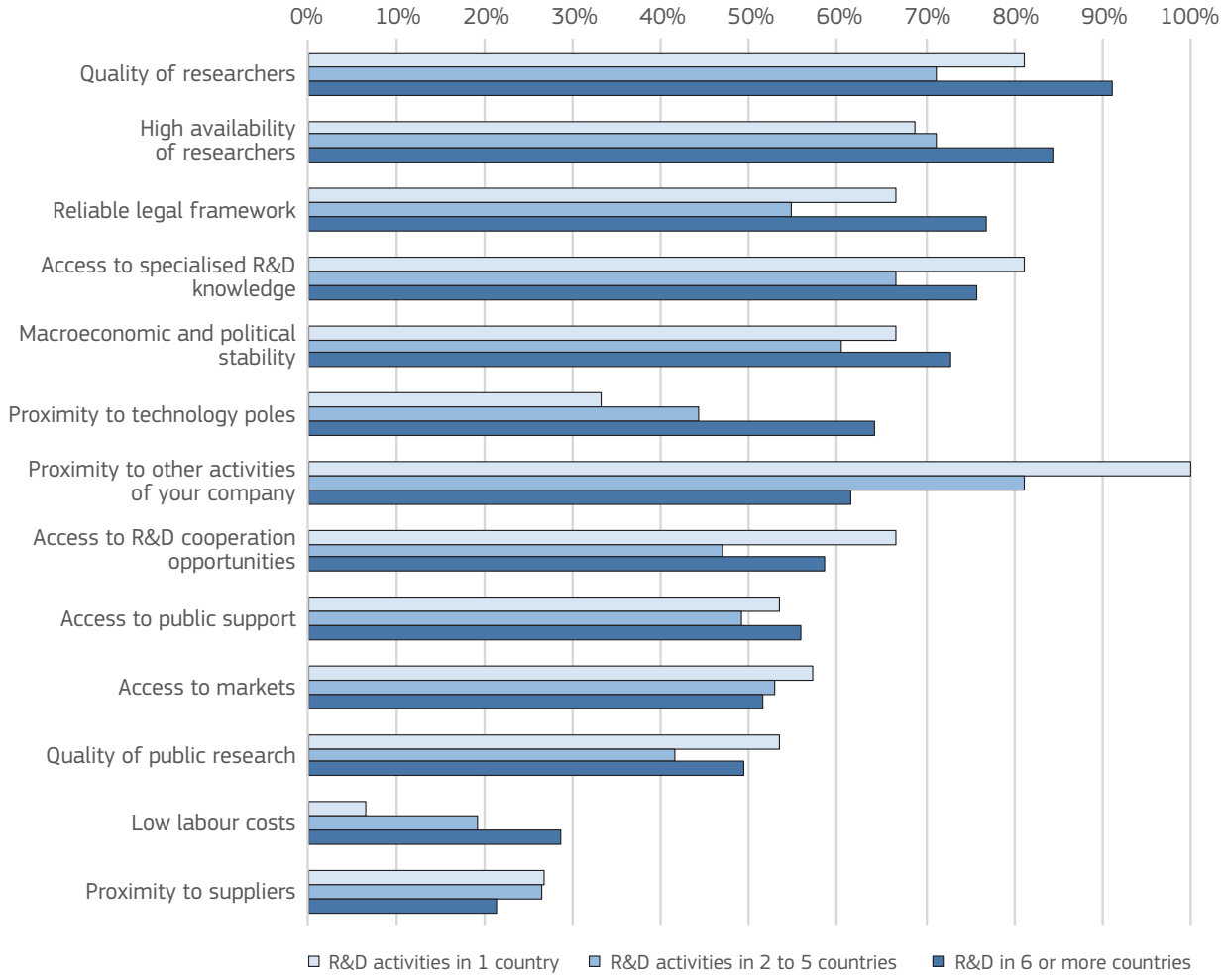

FIGURE 24: RATING OF R&D LOCATION FACTORS FOR DIFFERENT GEOGRAPHICAL STRATEGIES.
Note: The figure refers to 135 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

We will now look at the importance of factors of attractiveness, differentiating by geographical R&D strategy: *only in EU; R&D focus on US; and focus on China/India*. **Firms that perform R&D only in the EU rate the proximity to other activities within the company, and the quality of public research, as highly important for locating R&D activities.** This confirms that co-location with other activities within the companies is an important factor for firms when deciding where to locate R&D activities. The current EU policy emphasis on upgrading manufacturing capabilities with Industry 4.0 may prove valuable in the long term. EU firms also seem to value highly the quality of public research as performed in the EU, which underpins the importance of framework programmes as funded by the EU. Low labour costs and proximity to technology poles are rated as less important by *EU only firms*.

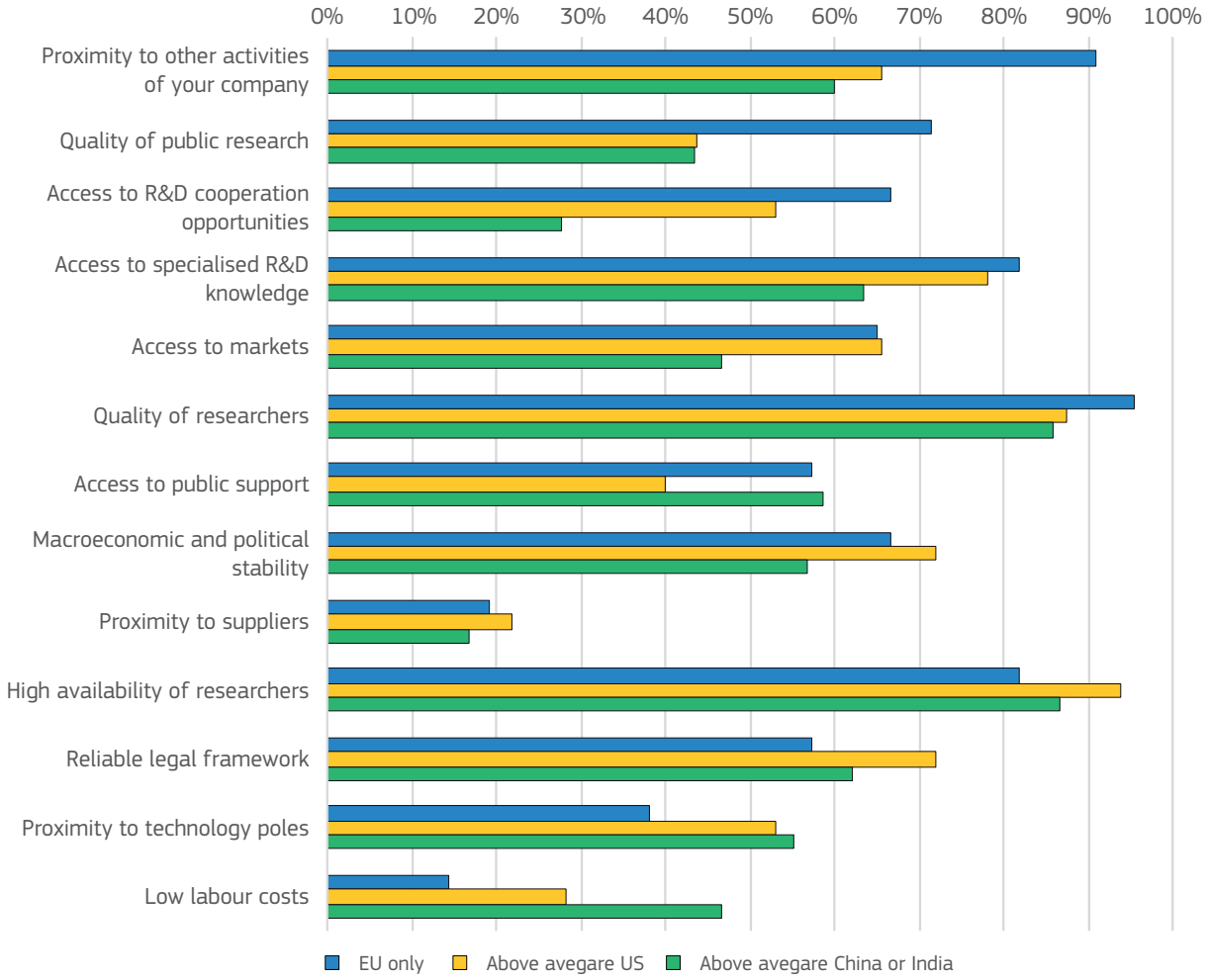

FIGURE 25: SHARE OF PARTICIPANTS THAT RATE A FACTOR AS (HIGHLY) ATTRACTIVE FOR R&D ACTIVITIES.
Note: The figure refers to 83 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

The quality of researchers is highly valued by firms with all three strategies. This implies that (some parts of) China and India have been successful in matching the level of EU and US researchers. This is further confirmed by the importance of proximity to technology poles, where the largest firms connect to the most important global technology hubs. EU firms are most likely already connected to the local (EU) hubs and look for global presence in US, China and India.

Access to markets is the least important R&D location factor for firms that focus their R&D strategy on China and India. While market access is typically considered a driver for location in BRICS countries, this does not seem to be an important driver for R&D activities by EU firms. However, as later shown in Figure 30, it is considered an important driver for the location of *production* activities.

A reliable legal framework is rated more highly as a location factor by firms with R&D in the US than by firms with R&D in China or India. This confirms the reputation of the legal framework in the US. Interestingly, a reliable legal framework is rated as less important by firms with R&D activities in the EU only. This may be due to a selection bias: our analysis deals with EU firms only and locating activities within the EU is therefore less of a concern for these firms.

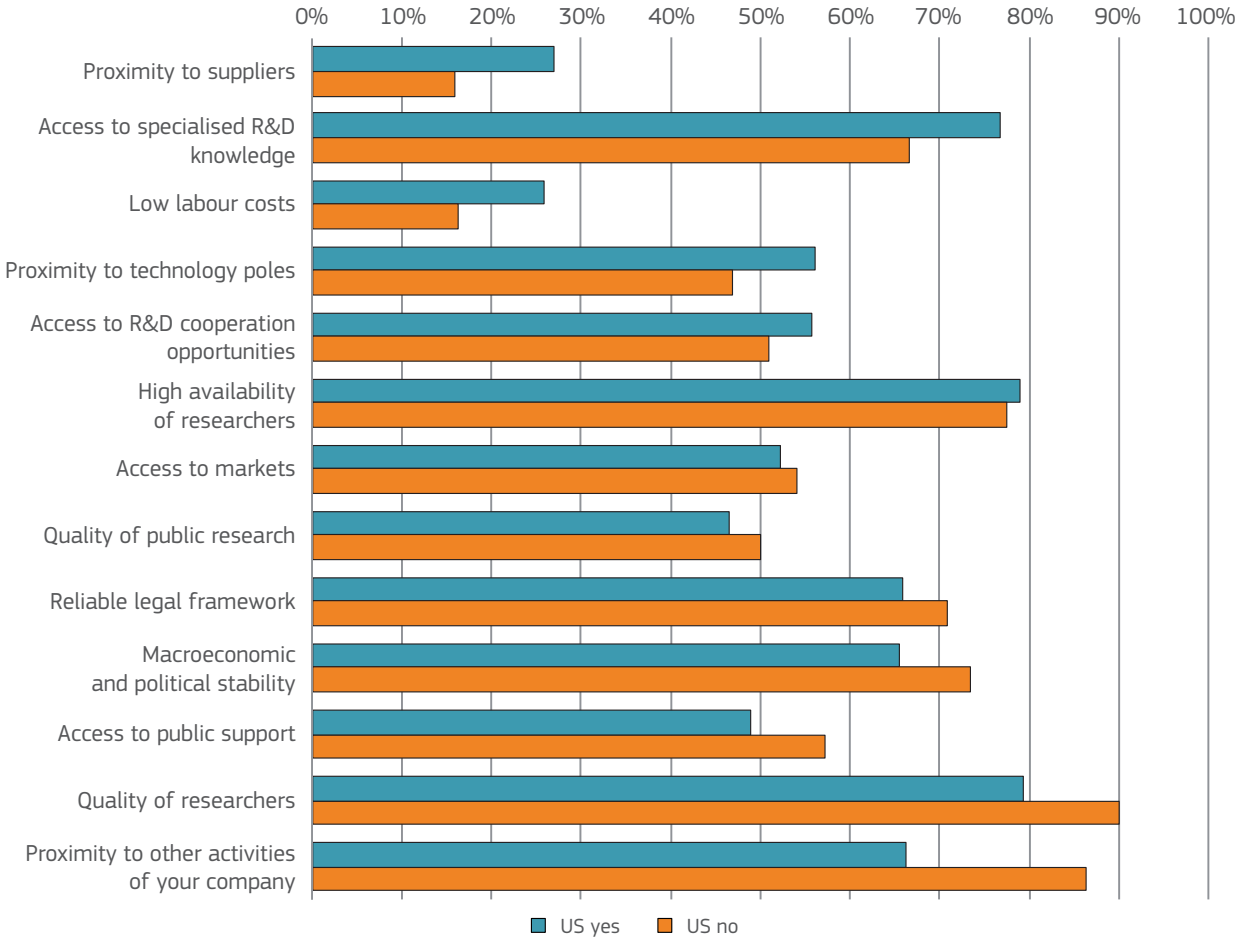

FIGURE 26: SHARE OF PARTICIPANTS THAT RATE A FACTOR AS (HIGHLY) ATTRACTIVE.
Note: The figure refers to 138 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

Figure 26 compares responses from companies that have R&D activities in the US with those that do not. We find that proximity to suppliers and access to specialised R&D knowledge are rated much more highly by firms that perform R&D in the US than by those that do not. Surprisingly, firms that perform R&D in the US do rate low labour costs as more important, although still low in comparison to many other factors.

Figure 27 shows the same analysis as for the US, but comparing companies that have R&D activities in China or India with those that do not. **As in last year's survey, low labour costs are still rated much more highly as a location factor by firms that perfom R&D in China or India than by firms that do not.** This confirms that, although in general labour cost is not an important location factor, it is much more important for firms that have decided to perform R&D in China. As last year, companies that perform R&D in China value the proximity of technology poles more highly in locating R&D activities. China has significant technology poles in Shenzhen and Zhongguancun district in Beijing (mainly for ICT production – also the largest sector as shown in Figure 6).

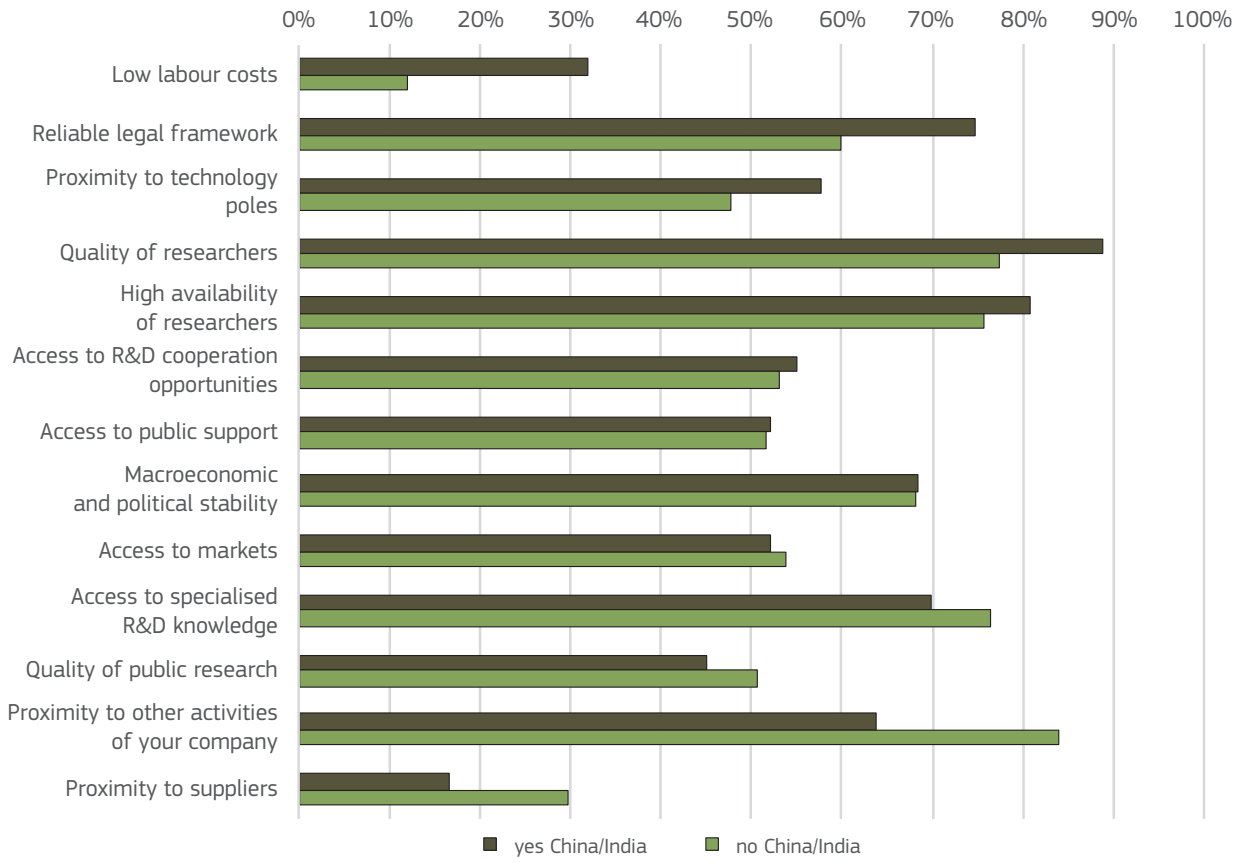

FIGURE 27: SHARE OF PARTICIPANTS THAT RATE A FACTOR AS (HIGHLY) ATTRACTIVE.
Note: The figure refers to 139 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

7.2 | Production location

Production activities are geographically more dispersed than R&D activities: only 10% of the firms concentrate their production in one country (compared with 17% for R&D). We do not have data on the number of countries in which firms perform production activities, but 79% of the firms do so in at least three countries (78% in last year's survey), compared to 65% for R&D.

Although production is more dispersed, there is an important historical factor in the location of production activities: 71% of the participating firms have their main production activities in the same country as the headquarters, while 82% have their top three production activities in the same country as the headquarters. Looking at production,[31] 42% is performed in the main production location: 44% for companies that produce mainly in the same country as the headquarters, versus 36% for those that produce mainly elsewhere (compared to 58% vs. 51% for R&D activities).

The top production locations are similar to the top R&D locations, with Germany and France the main locations within the EU. The US and China are by far the most popular locations outside the EU. These figures are very similar to last year's survey.

[31] Calculated by taking top one location as a proportion of net sales (taken from the 2017 R&D Scoreboard).

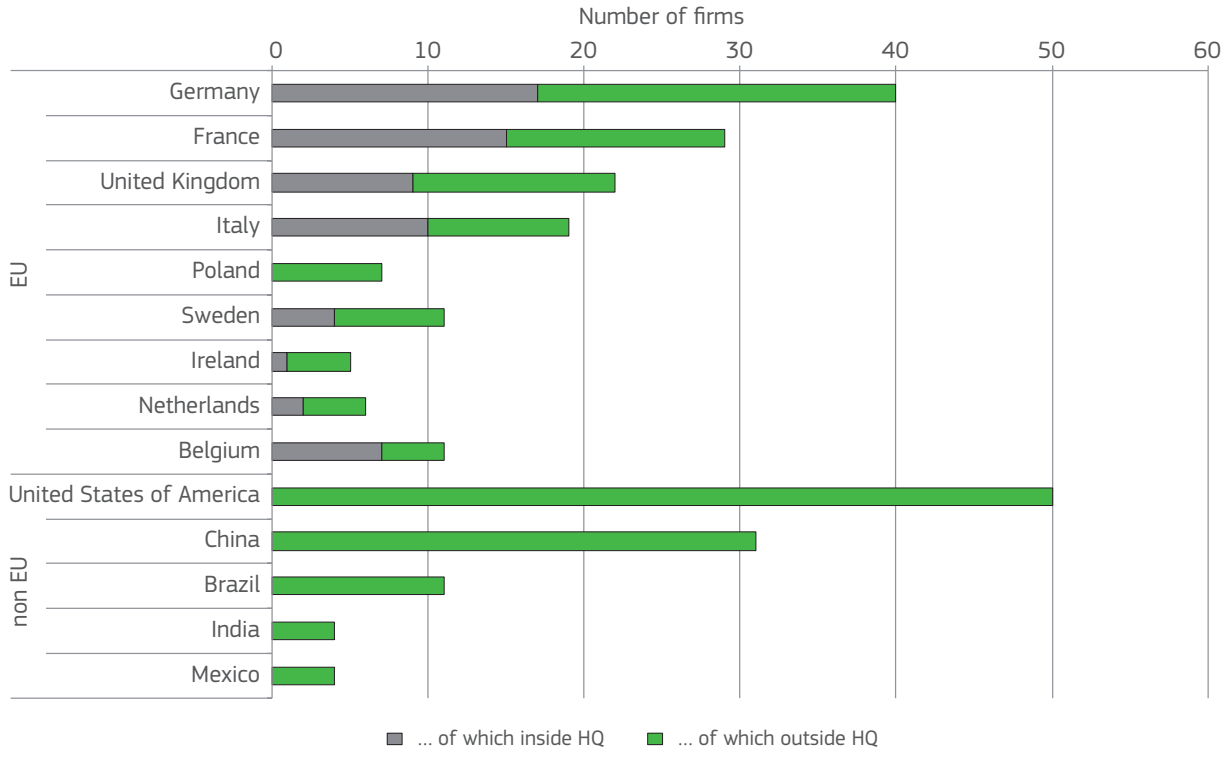

FIGURE 28: NUMBER OF MENTIONS AS A TOP THREE PRODUCTION LOCATION.
Note: The figure refers to 125 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

Consistent with earlier surveys, the factors most often rated as (highly) attractive by firms are access to markets, quality and availability of personnel and macroeconomic stability. Low employment protection is not considered an important factor of attractiveness.

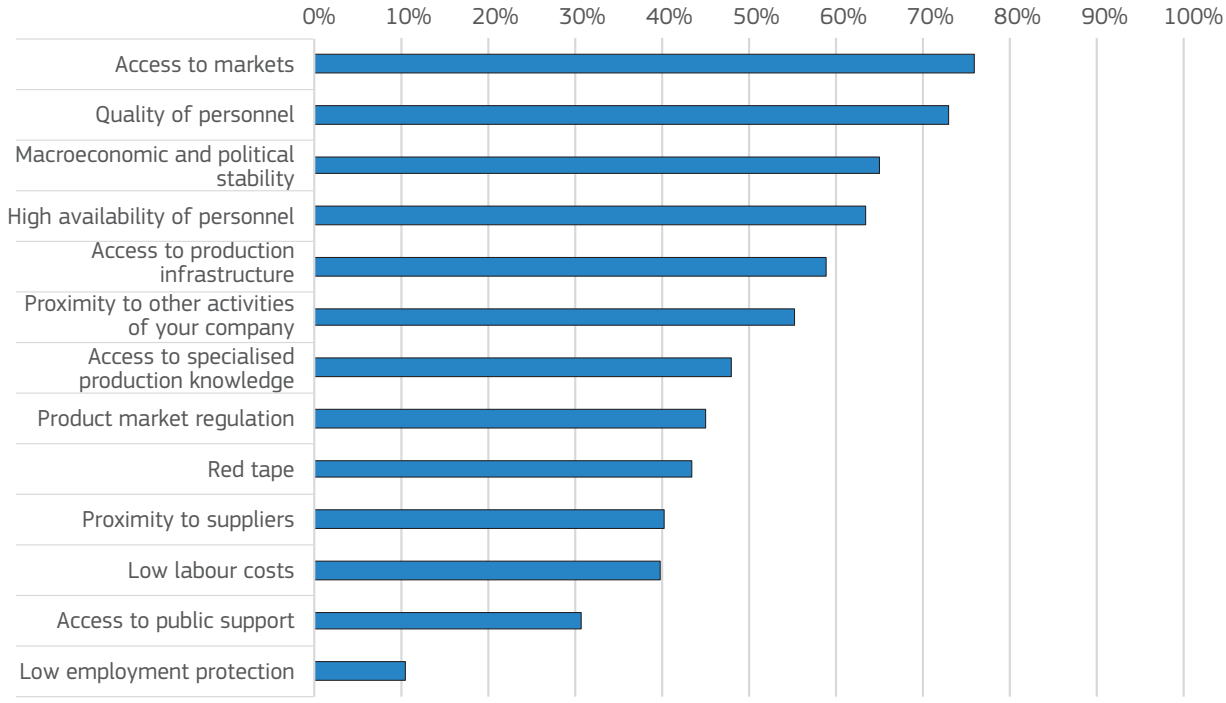

FIGURE 29: PROPORTION OF RESPONDENTS RATING A FACTOR AS (HIGHLY) ATTRACTIVE.
Note: The figure refers to 125 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

How do firms rate production locations? There are clear differences depending on the firm's R&D strategy, as shown in the following graph comparing firms that perform R&D in the EU with firms whose R&D strategies focus either on the US, or on China or India.[32]

For EU only firms, the most highly rated production location factors are macroeconomic stability, access to production infrastructure and quality of personnel – although the latter factor is rated even more highly by firms with R&D strategies outside the EU. Co-location of production with other activities within the firm is rated most highly by firms that perform R&D only in the EU. This indicates that, for these EU only firms, production and R&D activities cannot be easily disentangled and are concentrated in a few locations.

For firms with R&D strategies focused on China, the most highly rated *production location* factors are access to market and the quality of (production) personnel. Firms with R&D strategies focused on the US rate proximity to suppliers higher than firms with EU only R&D, which indicates that the US has the best co-location environment.

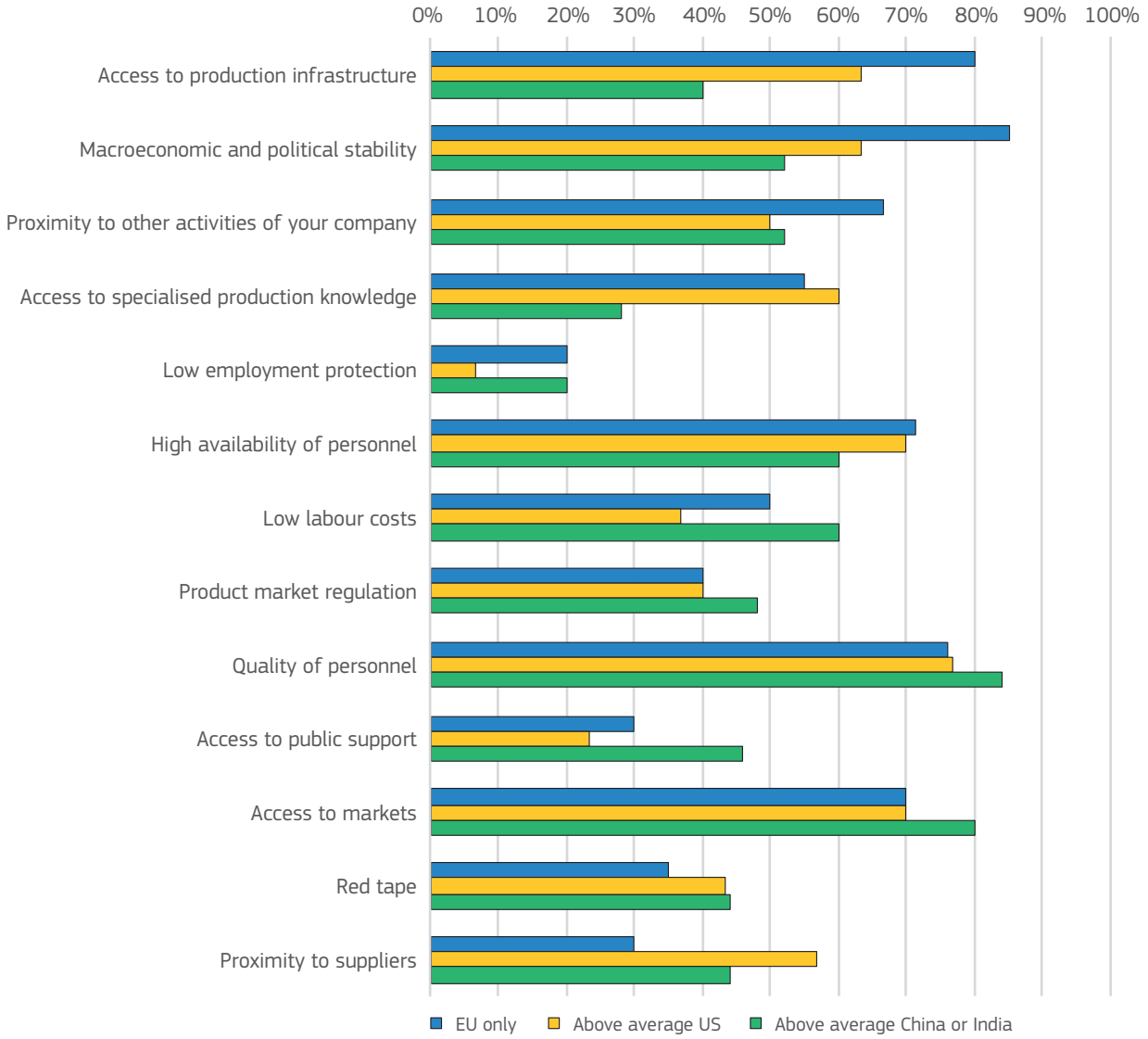

FIGURE 30: PROPORTION OF PARTICIPANTS THAT RATE A FACTOR AS (HIGHLY) ATTRACTIVE FOR PRODUCTION.
Note: The figure refers to 75 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

[32] Firms with above average R&D activities in the US (more than 14.3%) or China (>6.8%) or India (>5.2%).

Looking instead at production strategies, we only have data for the main (top three) production locations. We are interested to see how differently firms rate location factors depending on whether or not they produce in the US (or in China or India).

Firms with a main production location in the US value proximity to suppliers, access to specialised production infrastructure and access to markets more highly than firms not producing in the US. Figure 31 shows this for the US, in order of the gap in rating. This is consistent with last year's survey.

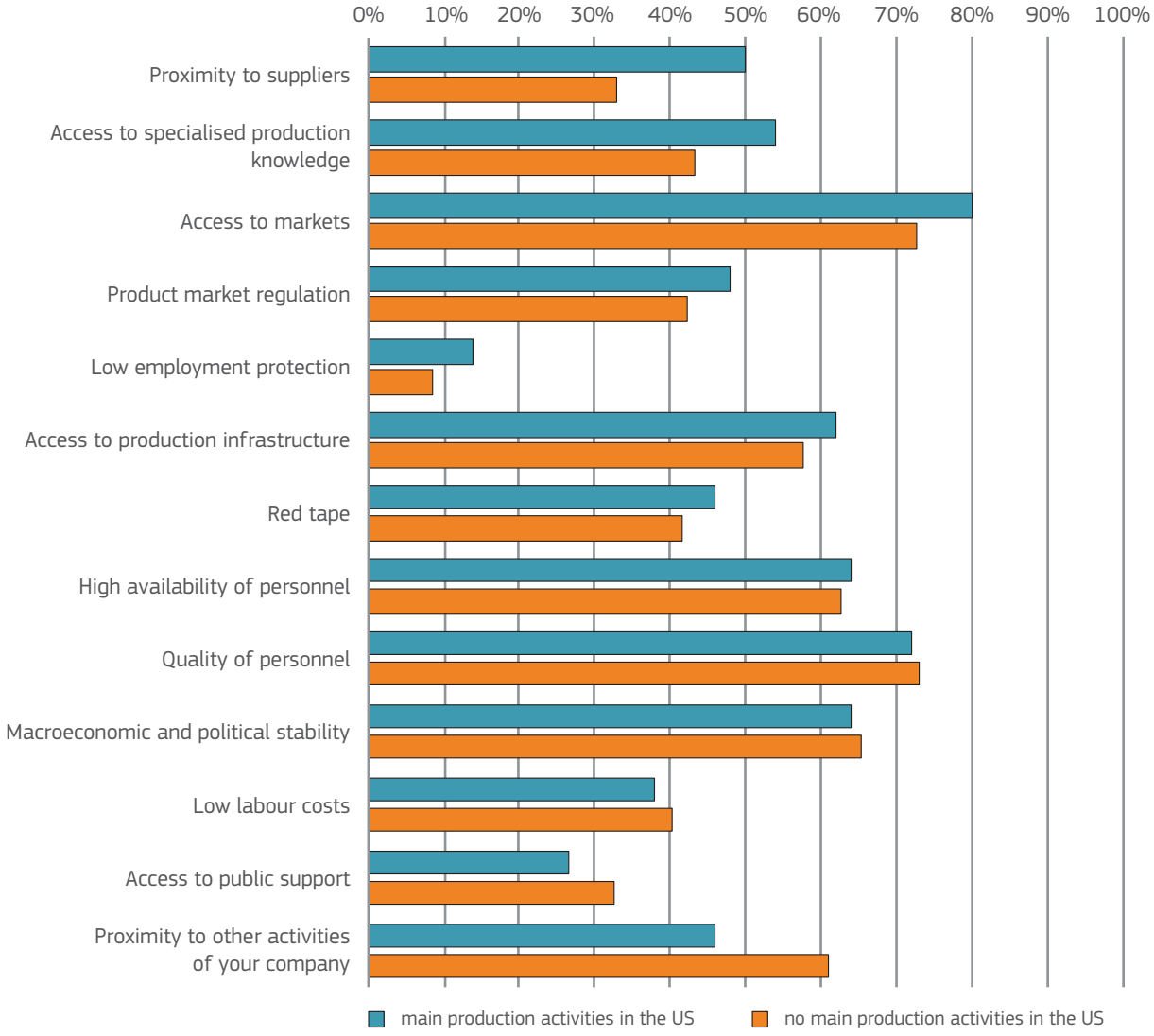

FIGURE 31: PROPORTION OF PARTICIPANTS THAT RATE A FACTOR AS (HIGHLY) ATTRACTIVE.
Note: The figure refers to 124 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

Figure 32 provides a similar analysis, but comparing companies that have a main production location in China or India with those that do not. **We can clearly see the difference in how firms producing in China or India rate low labour costs.** This is in stark contrast with the whole sample of companies, where only 40% of the participants rate low labour cost as an important production location factor (the third least important factor). We can safely say that firms locate main production activities in China or India to lower costs.

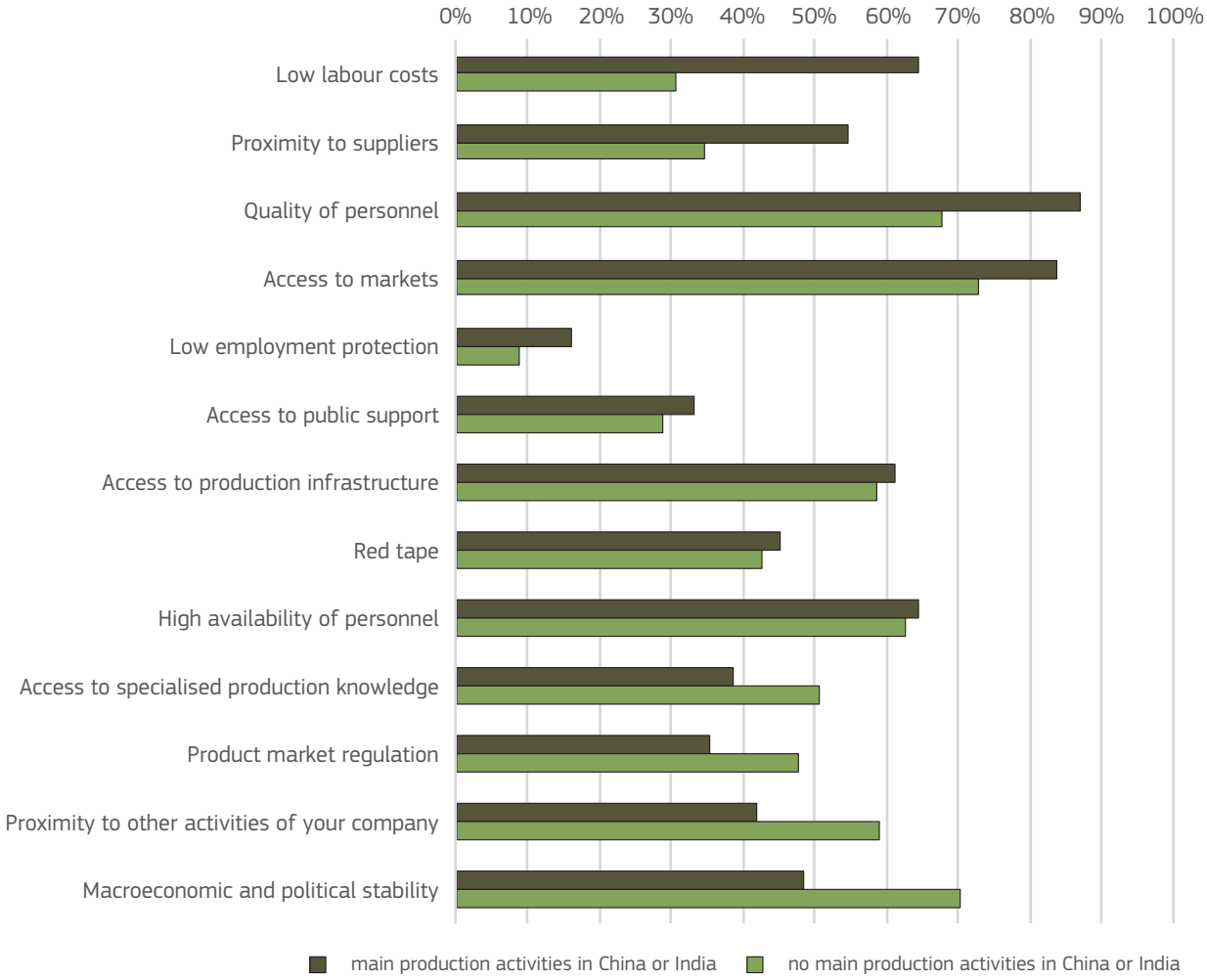

FIGURE 32: SHARE OF PARTICIPANTS THAT RATE A FACTOR AS (HIGHLY) ATTRACTIVE.
Note: The figure refers to 124 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

India is gaining strength as a popular R&D location and is now second after the US. China, Brazil, Italy and Russia remain the countries most mentioned as a production location, as in last year's survey.

Country	Difference in number of mentions as a production or R&D location	
China	11	more frequently mentioned as production location
Brazil	5	
Italy	3	
Russia	3	
Canada	4	more frequently mentioned as R&D location
Germany	5	
India	8	
US	11	

TABLE 5: POPULAR R&D AND PRODUCTION LOCATIONS.
Note: The figure refers to 132 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

8

STRUCTURAL REFORMS **FOR R&D**

8 Structural reforms for R&D

We asked our respondents about the potential impact of a series of structural reforms on their R&D activities. We asked them to rate, on a scale from 1 (low potential) to 5 (very high potential), a set of 17 structural reforms grouped into seven different categories.[33] For each of the proposed structural reforms, the percentage of companies considering it to have a high (4) or very high (5) potential impact is reported in Figure 33.

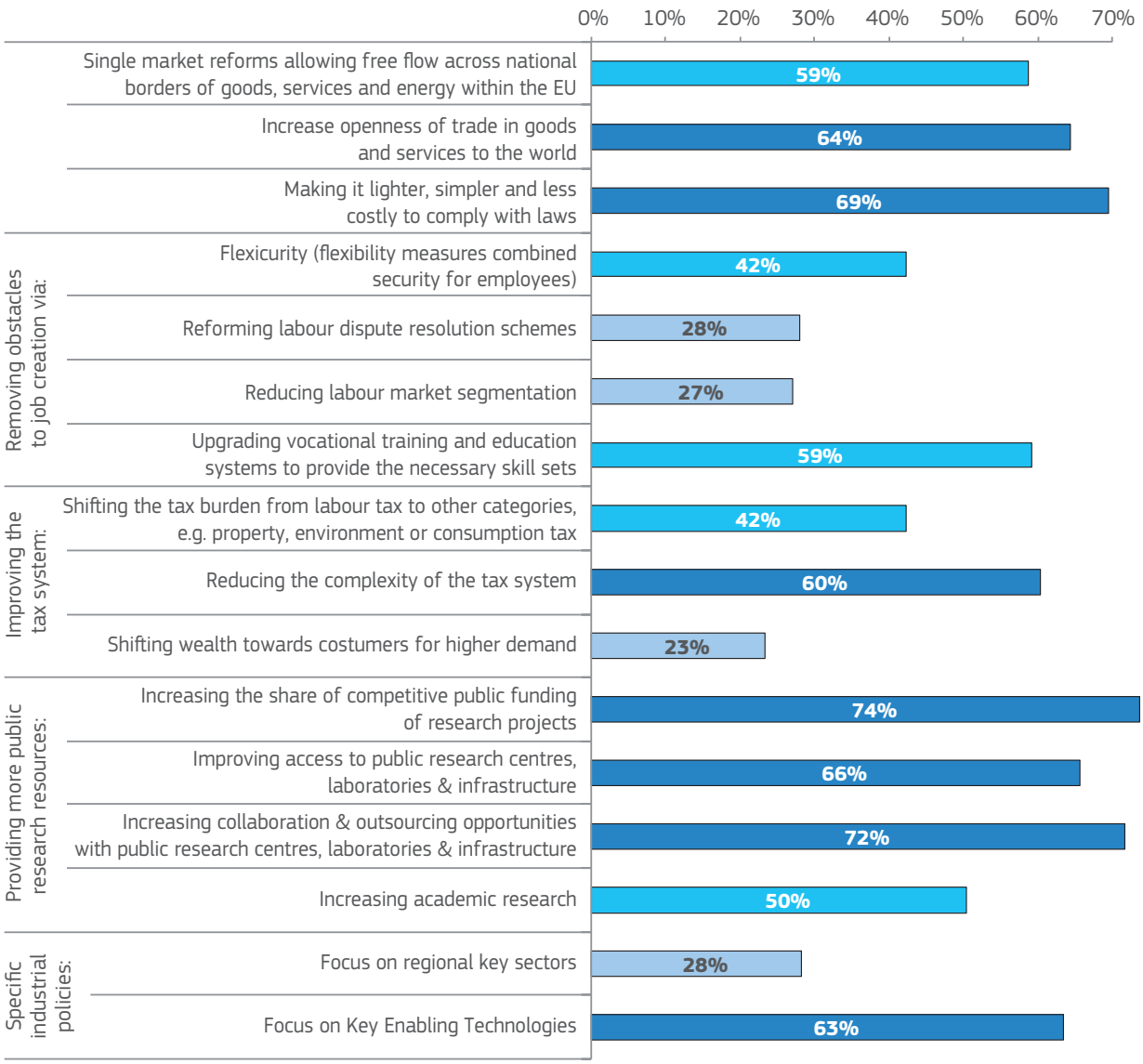

FIGURE 33: POTENTIAL OF STRUCTURAL REFORMS FOR INCREASING R&D AND INNOVATION.
Note: The figure refers to 132 out of the 142 companies in the sample.
Source: European Commission JRC-B (2018).

The reforms rated highest in terms of their potential impact on companies' R&D and innovative activities are those in the category of 'Providing more public research resources'. This is in line both with findings about the type of R&D performed by the companies in the survey (see section 4) and with what has consistently been reported in previous surveys.

A strong picture emerges as to how the companies consider public authorities should act in this area. They clearly see public action as a complement to their own

[33] (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.

activities, calling on public authorities to fund research projects (74%), increase public-private cooperation (72%) and invest in vocational training (59%). They do not specifically call for less regulation, but for it to be simplified - both in general (69%) and in terms of the tax system (60%). Our respondents consider that increased openness of trade would have high potential impact (64%). On the other hand, reducing the segmentation of the labour market (27%) or reforming labour dispute resolution schemes (28%) are considered to have relatively low potential impact.

In terms of specific industrial policies, the companies express a clear preference for a focus on key enabling technologies (63%) rather than regional key sectors (28%re. This is not surprising given the multinational nature of the companies in our sample.

The general patterns described above also hold true when looking at the data disaggregated by sector (Table 6). However, some sector preferences emerge. The ICT producers and ICT services sectors seem more prone to push for simpler regulation (both in general and in taxation), while the Automobile and Other Transport, Health Industries and Industrials advocate strongly in favour of public research and public-private partnerships.

		Automobiles & other transport	Health industries	ICT producers	ICT services	Industrials
Single market reforms	Single market reforms allowing free flow across national borders of goods, services and energy within the EU	58.3%	66.7%	53.8%	58.3%	68.0%
Comply with regulation	Increase openness of trade in goods and services to the world	66.7%	71.4%	76.9%	66.7%	68.0%
	Making it lighter, simpler and less costly to comply with laws	69.2%	72.7%	76.9%	75.0%	60.0%
Removing obstacles to job creation via:	Flexicurity (flexibility measures combined security for employees)	45.5%	57.1%	53.8%	54.5%	40.0%
	Reforming labour dispute resolution schemes	36.4%	47.6%	38.5%	27.3%	24.0%
	Reducing labour market segmentation	20.0%	52.4%	25.0%	36.4%	37.5%
	Upgrading vocational training and education systems to provide the necessary skill sets	58.3%	66.7%	53.8%	63.6%	52.0%
Improving the tax system:	Shifting the tax burden from labour tax to other categories, e.g. property, environment or consumption tax	18.2%	52.4%	41.7%	58.3%	44.0%
	Reducing the complexity of the tax system	27.3%	63.6%	75.0%	81.8%	64.0%
	Shifting wealth towards costumers for higher demand	22.2%	40.0%	16.7%	36.4%	20.0%
Providing more public research resources:	Increasing the share of competitive public funding of research projects	54.5%	68.2%	69.2%	66.7%	84.0%
	Improving access to public research centres, laboratories & infrastructure	72.7%	77.3%	46.2%	36.4%	68.0%
	Increasing collaboration & outsourcing opportunities with public research centres, laboratories & infrastructure	72.7%	76.2%	61.5%	45.5%	76.0%
	Increasing academic research	36.4%	71.4%	46.2%	25.0%	52.0%
Specific industrial policies:	Focus on regional key sectors	54.5%	25.0%	30.8%	18.2%	16.0%
	Focus on Key Enabling Technologies	63.6%	70.0%	58.3%	58.3%	66.7%

TABLE 6: POTENTIAL OF STRUCTURAL REFORMS TO INCREASE R&D AND INNOVATION, BY SECTOR.
Note: The table refers to 132 out of the 142 companies in the sample. Automobile and other transport (13), Health Industries (23), ICT producers (13), ICT services (12) Industrials (25), Aerospace and Defence (not reported) (3), Chemicals (not reported) (7), Others (not reported) (36).
Source: European Commission JRC-B (2018).

ANNEXES

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

Annex A: Methodology

Background and Approach

The European Commission's Global Research and Innovation Analysis (GLORIA)[34] initiative serves to better understand industrial R&D and innovation in the EU and to identify medium and long-term policy implications. GLORIA 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 objective of this project is to generate science based evidence to support policy making in the light of the Europe 2020 strategy and the Investment Plan for Europe initiative by monitoring, analysing and benchmarking the global industrial players in R&D, following the mandate given by Member States of actions to be implemented by the European Commission since 2003. These companies are responsible for very large shares of Europe's total business R&D investments and their global flows.

The present GLORIA surveys tackles 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*[35], which is the main publication of the GLORIA project. 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 1 000 European companies. Also, a web-interface and email contacts are made available 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 2018 Survey, the response period ran for three months: from 10 March 2018 (mailing of the questionnaires) to 15 June 2018.

[34] See: http://iri.jrc.ec.europa.eu/.

[35] 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 during 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 full colour figures and tables 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,[36] where a pdf 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.[37]

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.[38]

One-year growth is simple growth over the previous year, expressed as a percentage: 1yr 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: 2yr 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.

[36] See: https://ec.europa.eu/eusurvey/.

[37] The response rate of the present survey is 16.2%. This is slightly lower compared to the 18.5% of last year due to a two-week shorter response period. The responsiveness per day has been very steady over the past five surveys.

[38] 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.[39] 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",[40] based on the OECD "Frascati" manual,[41] and the definition used in the EU Industrial R&D Investment Scoreboards.

Composition of the Responses

The 148 responses were classified according to the ICB classification.[42] 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	# EU top 1000 Scoreboard companies	response rate	share of R&D
Aerospace & Defence	3	24	13%	27%
Automobiles & other transport	14	64	22%	40%
Chemicals	8	42	19%	57%
Health Industries	24	191	13%	35%
ICT producers	15	110	14%	43%
ICT services	15	129	12%	42%
Industrials	26	154	17%	24%
Others	37	286	13%	18%

TABLE 7: DISTRIBUTION OF THE RESPONSES BY SECTORS.
Source: European Commission JRC-B (2016).

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	22	49.7%
France	20	15.1%
UK	17	4.4%
Finland	15	0.9%
Spain	14	6.8%
Italy	13	4.2%
Belgium	10	2.8%
Netherlands	10	4.1%
Sweden	8	7.7%

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 (2016).

[39] See Annex B.

[40] See http://www.iasplus.com/standard/ias38.htm.

[41] 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.

[42] ICB, or the Industry Classification Benchmark, as owned and published by FTSE International (see: http://www.icbenchmark.com/docs/ICB_StructureSheet_120104.pdf).

Annex B: Questionnaire

SURVEY ON BUSINESS R&D INVESTMENT

We would very much appreciate your response by **27 April 2018**, **preferably by using the online questionnaire** at:

europa.eu/rd-survey-2018

Alternatively, you may return this completed form by e-mail (lesley.potters@ec.europa.eu), fax (+34.95.448.83.26), or post[43].

The information in your response will be treated as strictly **confidential**. It will only be used within this study and in an aggregated form. The European Commission is committed to the protection and privacy of data[44].

We will automatically inform you of the results of the survey once they are available (for that purpose, please ensure that you have provided your e-mail address below).

Name of the company you are responding for: _____

Its primary sectors of activity: _____

Your name: _____

Job title: _____

E-mail: _____

Phone number: _____

The European Commission may follow up this survey with short interviews to clarify major trends revealed in the analysis. If you *do not* wish to be contacted for this purpose, please **tick here** ☐.

DEFINITION OF R&D INVESTMENT

For the purposes of this questionnaire, **'R&D investment' is the total amount of R&D financed by your company** (as typically reported in its accounts). It does not include R&D financed from public sources.

[43] European Commission, JRC Directorate B – Growth and Innovation, Attn.: Lesley Potters, Edificio Expo, Calle Inca Garcilaso 3, E-41092 Seville, Spain, Tel.: +34 954 48.05.81.

[44] See the Privacy Statement on the last page.

A. Corporate background

1. **Number of employees in your company in the past year (2017)?**

   Around _____ (FTE[45]).

2. **How many employees have worked on R&D in the company in the past year (2017)?**

   About _____ (FTE[3]).

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 (2017)?**

   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): _____ %

   Total 100 %

6. **At what average rate do you expect the company to change its overall R&D investment over the next two years (2018 and 2019)?**

   About _____ % per annum.

[45] 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.

C. R&D drivers

7. **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	☐	☐	☐	☐	☐
(b) Exploiting technological opportunities (technology push)	☐	☐	☐	☐	☐
(c) Maintaining R&D as a fixed proportion of net sales	☐	☐	☐	☐	☐
(d) Competition from companies located in:					
(d1) the European Union	☐	☐	☐	☐	☐
(d2) other developed countries, e.g. the US or Japan	☐	☐	☐	☐	☐
(d3) emerging countries, e.g. China or India	☐	☐	☐	☐	☐
(e) Improving the company's productivity	☐	☐	☐	☐	☐
(f) Meeting product market regulation and other legal frameworks	☐	☐	☐	☐	☐
(g) Other (please specify):	☐	☐	☐	☐	☐

D. R&D location strategy

8. **Please estimate the distribution of your company's in-house R&D activity among the following world areas in the past year (2017) and two years later (2019)?**

Distribution in 2017	R&D carried out:	**Expected** distribution in 2019
%	in the European Union[46]	%
%	In the United Kingdom	%
%	in other non-EU European countries[47]	%
%	in the US	%
%	in Japan	%
%	in China	%
%	in India	%
%	in the Rest of the World	%

9. **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. _____ _____% of total R&D	2. _____ _____%	3. _____ _____%

[46] 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.

[47] 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).

10. **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	☐	☐	☐	☐	☐
(b) High availability of researchers	☐	☐	☐	☐	☐
(c) Quality of researchers	☐	☐	☐	☐	☐
(d) Low labour costs of researchers	☐	☐	☐	☐	☐
(e) Access to specialised R&D knowledge and results	☐	☐	☐	☐	☐
(f) Quality of public research	☐	☐	☐	☐	☐
(g) Reliable legal framework for R&D, e.g. Intellectual Property Rights	☐	☐	☐	☐	☐
(h) Macroeconomic and political stability	☐	☐	☐	☐	☐
(i) Proximity to technology poles[48] and incubators[49]	☐	☐	☐	☐	☐
(j) Proximity to other activities of your company	☐	☐	☐	☐	☐
(k) Proximity to suppliers	☐	☐	☐	☐	☐
(l) Access to R&D cooperation opportunities	☐	☐	☐	☐	☐
(m) Access to public support for R&D	☐	☐	☐	☐	☐
(n) Other (please specify):	☐	☐	☐	☐	☐

E. Production location strategy

11. **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. _____
_____% of total production	_____%	_____%

12. **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	☐	☐	☐	☐	☐
(b) High availability of personnel	☐	☐	☐	☐	☐
(c) Quality of personnel	☐	☐	☐	☐	☐
(d) Low labour costs of personnel	☐	☐	☐	☐	☐
(e) Low employment protection[50] of production personnel	☐	☐	☐	☐	☐
(f) Access to specialised production knowledge and results	☐	☐	☐	☐	☐
(g) Macroeconomic and political stability	☐	☐	☐	☐	☐
(h) Proximity to other activities of your company	☐	☐	☐	☐	☐
(i) Proximity to suppliers	☐	☐	☐	☐	☐
(j) Access to production infrastructure	☐	☐	☐	☐	☐
(k) Access to public support for production activities	☐	☐	☐	☐	☐
(l) Regulation (environmental legislation, red tape…)	☐	☐	☐	☐	☐
(m) Regulation of your product markets	☐	☐	☐	☐	☐
(n) Other (please specify):	☐	☐	☐	☐	☐

[48] "Technology poles" are areas where R&D active companies, institutions and universitites are concentrated.
[49] "Incubators" are structures that support innovative startup companies in order to increase their survival rates.
[50] Referring both to regulations concerning hiring (e.g. rules favouring the disadvantaged, for using temporary or fixed-term contracts, training) and firing (e.g. redundancy procedures, prenotification, severance payments, collective dismissals and short-time work), see the OECD Employment Outlook (10.1787/empl_outlook-2013-6-en).

F. Non-R&D innovation activities[51]

13. **How important are the following non-R&D innovation activities for your company's innovation output?**

	Not important				Highly important
	1	2	3	4	5
(a) Market research for innovations	☐	☐	☐	☐	☐
(b) Training of staff for innovative activities	☐	☐	☐	☐	☐
(c) Market introduction of innovations	☐	☐	☐	☐	☐
(d) Organisational innovations	☐	☐	☐	☐	☐
(e) Form and appearance design of new products	☐	☐	☐	☐	☐
(f) Acquisition of licenses and other knowledge	☐	☐	☐	☐	☐
(g) other (please specify):	☐	☐	☐	☐	☐

14. **How much does your company spend on innovation activities that fall outside the R&D definition, so called non-R&D innovation expenditures?**

About € _____ million.

15. **Research is often turned into scientific publications. How relevant are the following motivations for your company to allow employees to contribute to scientific publications?** *Please rate on a scale from 1 (irrelevant) to 5 (highly relevant).*

	Irrelevant				Highly relevant
	1	2	3	4	5
(a) Accessing external knowledge and resources	☐	☐	☐	☐	☐
(b) Attracting, recruiting, and retaining researchers	☐	☐	☐	☐	☐
(c) Signaling and building reputation	☐	☐	☐	☐	☐
(d) Supporting IP strategies	☐	☐	☐	☐	☐
(e) Supporting marketing and commercialization strategies	☐	☐	☐	☐	☐
(f) Other (please specify):	☐	☐	☐	☐	☐

[51] Innovation is the introduction of new or significantly improved products, services, or processes.

G. Structural reforms supporting R&D and innovation

16. **The European Commission is pushing for important structural reforms.[52] In this context, what potential do the following initiatives have for *increasing* your company's R&D and innovation 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 within the EU	☐	☐	☐	☐	☐
(b) Increase openness of trade in goods and services to the world	☐	☐	☐	☐	☐
(c) Making it lighter, simpler and less costly to comply with laws	☐	☐	☐	☐	☐
(d) Removing obstacles to job creation via:					
(d1) flexicurity (flexibility measures combined security for employees)	☐	☐	☐	☐	☐
(d2) reforming labour dispute resolution schemes	☐	☐	☐	☐	☐
(d3) reducing labour market segmentation	☐	☐	☐	☐	☐
(d4) upgrading vocational training and education systems to provide the necessary skill sets	☐	☐	☐	☐	☐
(e) Improving the tax system:					
(e1) shifting the tax burden from labour tax to other categories, e.g. property, environment or consumption tax	☐	☐	☐	☐	☐
(e2) reducing the complexity of the tax system	☐	☐	☐	☐	☐
(e3) shifting wealth towards costumers for higher demand	☐	☐	☐	☐	☐
(f) Providing more public research resources:					
(f1) increasing the share of competitive public funding of research projects	☐	☐	☐	☐	☐
(f2) improving access to public research centres, laboratories & infrastructure	☐	☐	☐	☐	☐
(f3) increasing collaboration & outsourcing opportunities with public research centres, laboratories & infrastructure	☐	☐	☐	☐	☐
(f4) increasing academic research	☐	☐	☐	☐	☐
(g) Specific industrial policies:					
(g1) focus on regional key sectors	☐	☐	☐	☐	☐
(g2) focus on Key Enabling Technologies	☐	☐	☐	☐	☐

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!

[52] See: "The 2017 Annual Growth Survey": https://ec.europa.eu/info/sites/info/files/2017-european-semester-annual-growth-survey_en_0.pdf.

Privacy Statement

The *2018 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 *2018 EU Industrial R&D Investment Scoreboard*.

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