European Commission

THE **2021** EU SURVEY ON INDUSTRIAL R&D INVESTMENT TRENDS

EUR 30988 EN

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Executive summary

Following the downturn in 2020, the top EU R&D investing Companies expect R&D to grow by 2.1% in the running financial year 2021. This means that the strong V-shaped recovery as expected last year is delayed by one year, with companies expected to further increase their by 5.9% in the year 2022.

However, the largest companies (with more than 50 000 employees) expect to decrease their R&D investments by 4.0% in 2021. Since these companies make up 36% of R&D in this subsample, this tempers the overall expectations. If we look at the three other size groups, the expected R&D growth for 2021 is 5.9%. For all other main financial indicators a strong increase is foreseen, with significant growth in 2021 for net sales (+5.7%), operating profits (+7.3%), capital expenditures (+7.5%) and R&D employees (+3.7%) and employees (+2.2%).

The respondent companies find it most relevant to invest, both capital and R&D, in Artificial Intelligence, Big Data and Robotization technologies for future competitiveness. This reinforces the finding of earlier surveys. Sustainable technologies – low emission, circular and other sustainable technologies – complete the top of the list of most relevant technologies for future competitiveness.

Digitalization, improving productivity and exploiting technological opportunities (technology push) are seen as the most important drivers. For digitalization it was the first time this driver was provided as a possible answer, while technology push and productivity improvements are traditionally among the highest rated drivers.

The COVID pandemic is the least relevant factors for companies to change R&D investments, together with the objective of maintaining R&D as a fixed proportion of net sales**.** The pandemic is a lowly rated driver across the board, but with the highest impact, not surprisingly, in the Health Industry.

EU companies locate about 70% of their R&D within the EU. This percentage has been constant since the start of the survey. Of the externalised R&D, the main locations are the rest of the world (largely South Korea and Taiwan) and the US, followed by India and China.

Respondents spend on average 26% of their capital expenditures and 33% of their R&D investments on improving climate and environmental performance. Especially energy companies invest a large proportion of their total capital and R&D investments in environmental performance.

One third of companies engage in one form or another of R&D collaboration. Of these collaborations 60% is done in the same country as the companies' main R&D location. Large companies and universities are the preferred partners in about half of the collaborations.

1 Introduction

The political sustainability framework in the EU is driven by the European Green Deal[1] and its aim to boost Europe´s competitiveness based on cutting edge innovation in a broad sense. The long-term goal of the new growth strategy is to make Europe the first carbon neutral continent by 2050. This entails the need for structural transformation and crosscutting policy support towards competitive sustainability. Compared to other regions, the EU policy focus of the Green Deal enabling industrial competitiveness and structural transformation is unique. Thus, EU companies and their R&D efforts will play a central role in the transition to a more environmentally friendly path while at the same time competing on a global level.

Since 2005 the EU Survey on Industrial R&D Investment Trends has provided insights on R&D strategies of top EU R&D corporate investors as listed in the EU R&D Scoreboard. These largest R&D investors key players of the innovation ecosystem and have a role to play in the digital and green transitions (so called twin transition). This survey aims at giving better insights into what current trends in industrial innovation and R&D investment fit into the ambitions of the European Green Deal.

This survey goes beyond publicly available data of R&D levels and trends and aims at better understanding location strategies, technological developments among different sectors and innovation collaboration of the largest R&D performers that are responsible for the bulk of private R&D in the EU.

Following the departure of the UK on 31 January 2020[2] in this report, the EU is understood as EU27 (i.e., without the UK), and whenever the UK is included for comparative purposes, EU28 or EU+UK will be referred to. Since the survey is directed at the top 1000 EU companies of the previous R&D Scoreboard[3], for this year's survey there were 720 EU companies and the survey was also sent to the 280 UK companies addressed which were in the EU1000 in 2020.

For the 76 EU27 companies, the response rate was 11% (76 respondents on 720 EU companies), which is close to the response rate in previous exercises (around 13-15%) and an increase of 34% with respect to last year's survey. Not surprisingly, just 3 of the UK companies responded. Furthermore, one US company and two Taiwanese companies also responded.

In total, the 76 responding EU companies invested a total of €36.6 bn in R&D in 2019, accounting for 20% of the R&D invested by the EU27 companies, which indicates that the respondents were amongst the larger R&D investors.

1.1 Company size

The average actual R&D investment in 2020 of this year's respondents is €488 million, with average net sales of €12.0 billion and average employees of around 34 000. The average R&D intensity (R&D over net sales) is 4.3%.

The corresponding averages for the EU27 720 firms in 2020 were €270.0 million R&D investment, €7.4 bn. of net sales and around 26 000 of employees. The average R&D intensity was 3.7%, which in contrast to the other indicators, is almost the same as the survey's subsample. Thus, the average EU Survey

[1] The European Green Deal. COM/2019/640 final. Brussels: European Commission. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN

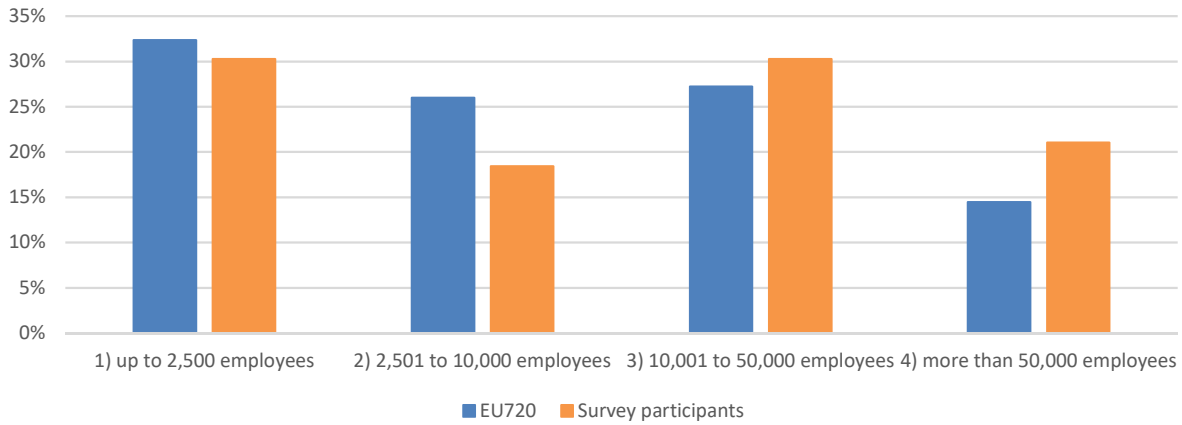
[2] https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:European_Union_(EU)

[3] See 2020 EU R&D Scoreboard.

respondent is bigger than the average EU27 720 firm. This skewedness towards the larger firms is in line with what we have seen in earlier surveys

This year's sample contains 4 SMEs with 250 or fewer employees. Applying the Eurostat distinction between small, medium and large companies[4] would classify almost all the sample companies as 'large' companies. As in earlier surveys, we classified companies according to four different size classes: 1) up to 2,500 employees; 2) 2,501 to 10,000 employees; 3) 10,001 to 50,000 employees; and 4) more than 50,000 employees. Figure 2 reports the distribution of the sample according to these four classes compared to the distribution of the full EU27 720 sample, confirming that the largest companies are overrepresented, while the smaller firms are (slightly) underrepresented.

Figure 1: Comparison by size of the 2020 EU Survey participants vs EU28 1000 from the 2019 EU R&D Scoreboard

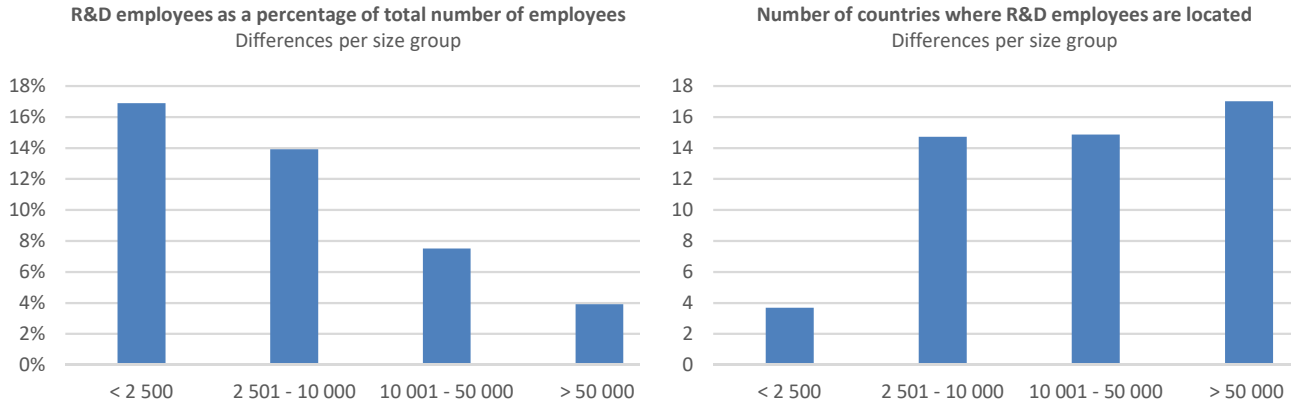


Note: The figure refers to 61 out of the 61 companies in the sample.
Source: European Commission, JRC/DG R&I.

According to the survey, the 76 EU firms employ around 2.5 million people worldwide, of which 8.4 % is R&D personnel, located on average in 8 different countries. Figure 3 breaks down these numbers by size. If we look at the R&D personnel as percentage of the total employees of the firm (Figure3, panel A), small companies are those with the highest percentage of R&D employees (17.0% - as last year) and this proportion decreases to 4% with the largest firms. This picture is consistent with the fact that small companies have higher R&D intensity than big companies, with R&D labour costs being a large portion of total R&D costs.

[4] Small enterprises (10 to 49 employees); medium-sized enterprises (50 to 249 employees); large enterprises (250 or more employees).

Figure 2: R&D employees and countries where they are located



Note: The figure refers to 60 (panel A) and 59 (panel B) out of the 61 companies in the sample for which data are available.
Source: European Commission, JRC/DG R&I.

The reverse is true when considering the number of countries where the R&D personnel is located. The bigger the company the higher the number (up to 17 countries for the largest companies), with a size barrier for the smallest companies that tend to be located in only few countries as we will see later.

1.2 Sector groups

Table 1 gives an overview of the number of companies and the total R&D investments per sector in the 2020 R&D Scoreboard (from which the respondents come) compared with the Survey participants. The sector representation is similar to earlier surveys.

Table 1 Sector representation

Sector	ICB 3 digit name of sectors with participants	Companies in the 2021 EU Survey (# and %)		Companies in the 2020 EU720 (# and %)		% of R&D in 2021 Survey	% of R&D in EU720
Aerospace & Defence	Aerospace & Defence	3	3.9	14	1.9	2.6	4.2
Automobiles & other transport	Automobiles & Parts Industrial Engineering	6	7.9	58	8.1	23.7	23.9
Chemicals	Chemicals	4	5.3	30	4.2	8.1	2.9
Health industries	Pharmaceuticals & Biotechnology	12	15.8	139	19.3	32.9	19.2
ICT producers	Electronic & Electrical Equipment Technology Hardware & Equipment	5	6.6	80	11.1	7.0	14.1
ICT services	Fixed Line Telecommunications Mobile Telecommunications Software & Computer Services	9	11.8	71	9.9	9.4	7.2
Industrials	General Industrials Industrial Engineering Industrial Metals & Mining	13	17.1	120	16.7	4.4	6.7
Others	Banks Construction & Materials Electricity Food Producers Forestry & Paper General Retailers Leisure Goods Mining Oil & Gas Producers Support Services	24	31.6	208	28.9	11.9	11.8
Total		76	100	720	100	100	100

Source: European Commission, JRC/DG R&I.

2 R&D investment expectations[5]

Without explicitly asking for the impact of the COVID pandemic on the companies' main financial indicators, we asked companies about their expectations, for calendar years, 2021 and 2022, on R&D, net sales, operating profit, number of (R&D) employees and capital expenditures. We asked specifically for expectations for the current financial year and the coming year to get a better impression of the impact of the COVID-19 pandemic. In this section, we present these indicators in more detail.

2.1 R&D forecasts

Companies expect R&D to grow by 2.1% in the running financial year 2021. As we saw last year, fewer companies responded to this question than previously: only 62% of the companies versus around 85% in earlier surveys. This might indicate the high uncertainty in quantifying these expectations. Of the responding companies, 14 per cent expect a decrease in R&D for 2021.

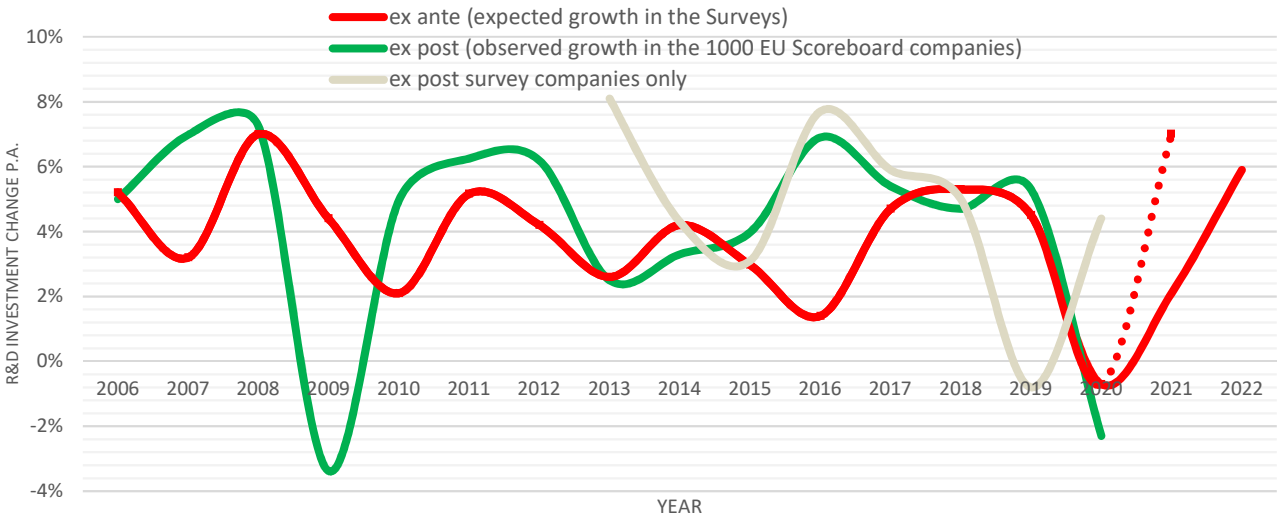
The expectations for 2022 are more positive with companies expecting to increase by 5.9%. The expected V-shaped recovery of last year (with R&D growth expectations of -0.7% for 2020 and 7.0% for 2021) is thus one year slower, but the outlook remains very positive. Only 50% of the companies provided an expectation for 2022 and of those only one company expects a decrease in R&D.

The comparison between expectations and actuals can be seen in Figure 3. For 2020 a decrease in R&D was foreseen, but the actual magnitude of this decrease was stronger (-2.3% vs -0.7%). The forecast for 2021 was been tempered in this year's survey: from 7.0% to 2.1%. The V-shape is still expected but the main rebound is now expected in 2022 rather than in 2021.

Looking at the comparison over time, in 12 out of 15 years, the predictions went in the same direction, although in 2009 the magnitude of the impact of the financial crisis was underestimated. In three of the 15 years, the forecast and actual R&D change went in opposite directions (2007, 2016 and 2017). 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 EU1000 companies in each Scoreboard, while the *ex ante* refers to the survey participants. It should be noted that *ex ante* R&D 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).

[5] At the time of the publication of this report (February 2022) consolidated figures for 2021 are not yet available for the companies in the sample. Hence presenting their expectations is still a valuable piece of information.

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 15 surveys (2006-2020).
The ex post series refers to the top 1 000 EU companies as published in the R&D Scoreboard for each of the years. This year, 47 companies replied to the R&D forecast question. The ex post survey only companies line refers to a comparison between the forecast of survey respondents with their actual change in R&D as reported in the EU R&D Scoreboard the year after. This could only be done for survey respondents from 2013 onwards due to a change in matching id's from the data provider.
Source: European Commission, JRC/DG R&I.

Among the responding companies, the largest companies (with more than 50 000 employees) expect to decrease their R&D investments by 4.0% in 2021, while the average expected increase is 2.0%. Since the largest companies make up 36% of R&D in this subsample, this tempers the overall expectations. In contrast, the other size groups expect R&D to grow in 2021 by 17.4% (less than 2 500 employees), 5.4% (between 2 500 and 10 000 employees) and 5.0% (between 10 000 and 50 000 employees). Although the numbers of respondents in some sectors is low and overall statements cannot be made, it does show that companies from the **Health Industries have the most positive expectations with a foreseen 11% R&D growth**, closely related to the ongoing pandemic and in line with last year.

2.2 Expectations for other key financial indicators

This year, we also asked companies to provide forecasts for other financial indicators: net sales, operating profit, capital expenditures and the number of employees and R&D employees. Since this survey is usually filled in by the manager of the R&D department, these expectations had a lower response rate than the R&D expectations, ranging between 40 and 50 per cent.

The respondents expect significant growth in 2021 for net sales (+5.7%), operating profits (+7.3%), capital expenditures (+7.5%), R&D employees (+3.7%) and employees (+2.2%). This indicates an expectation of recovery as these indicators were all negative in 2020. Also for 2022, albeit a lower response rate, the outlook remains very positive with high single digit growth rates.

This year, for the last time, we asked for the impact of Brexit on the R&D investments for 2021 and whether any relocations of R&D activity from the UK to the EU were foreseen. **While in earlier surveys the impact was significant, this year there is a broad-based expectation of no impact of Brexit, both on R&D investments and possible relocations of R&D activity.** No non-UK company indicated a relocation. The two UK companies responding to this question expect zero or minimal impact.

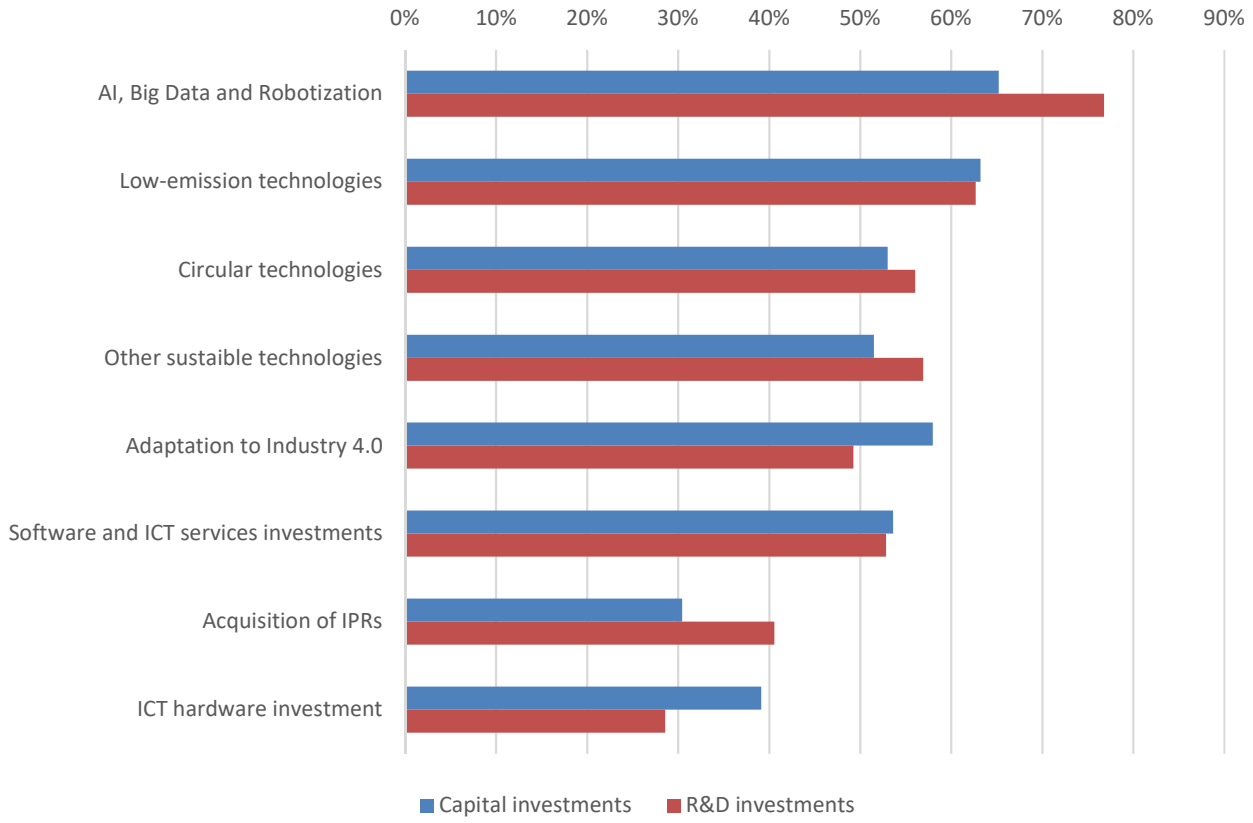
2.3 Technologies for future competitiveness

For the third year in a row, the survey asked the participants about the technologies that they deem relevant to remain competitive in the future, though this year with some additional detail. Instead of asking merely what technologies are the most relevant for future competitiveness, this year we ask how relevant are capital investments and R&D investments in these technologies to remain competitive.

As shown in Figure 4, **the participants find it most relevant to invest, both capital (65%) and R&D (77%), in Artificial Intelligence, Big Data and Robotization technologies for future competitiveness.** This is in line with earlier surveys where these technologies were also considered as important, however this importance seems to have increased. AI, Big Data and Robotization are the technologies in which R&D is seen as more important than CAPEX, likely related due to the more R&D personnel intensive character.

Sustainable technologies – low emission, circular and other sustainable technologies – complete the top of the list of most relevant technologies for future competitiveness. This year the basket of sustainable technologies was further specified into low emission technologies, circular technologies and any other sustainable technologies. For the first mentioned, CAPEX is considered more important than R&D, whereas the reverse applies for the other two, albeit the differences are small.

Figure 4: Proportion of firms identifying capital and R&D investments in different technologies as (highly) relevant to future competitiveness



Note: The figure refers to 73 out of the 77 companies in the sample.
Source: European Commission, JRC/DG R&I.

Adaptation to Industry 4.0 has lost some relevance compared to earlier surveys. Technologies related to I4.0 require more capital investments than R&D investments. Curiously in view of the challenge and opportunities presented by digitalisation, ICT related technologies are perceived as the least relevant technologies, with hardware investments on the bottom of the list. Nevertheless, these technologies are deemed as relevant by a larger proportion of the respondents compared to last year (50% vs. 30% last year). For ICT hardware especially capital investments are deemed relevant (almost 40%), while R&D investments are on par with last year. **In these sectors, it is noted that R&D is seen as more important than CAPEX investment in AI, Big Data and Robotization while CAPEX is more important for ICT Hardware.**

While the response rate does not allow full comparisons at sector and firm size level, some interesting patterns do appear in the data. **Both capital and R&D investments in sustainable technologies are mainly considered as (highly) relevant for companies from Chemicals and by ICT producers**. ICT producers focus more on capital investments than on R&D investments to obtain these technologies, while this is more balanced for companies from the Chemicals sector. Size is an important factor for investments in sustainable technologies; it is the **larger companies who focus on these investments, while the smaller companies indicate these investments as least relevant.**

Health Industries see both capital and R&D investments in sustainable technologies as the least relevant technologies for future competitiveness and also to a lesser extent than in other sectors. Health Industry companies however, compared to others, see IPR acquisition as a main investment to remain competitive. **IPR acquisition is mainly used by smaller companies in our sample**, while the largest firms make much less use of this.

Artificial Intelligence, Big Data and Robotization are considered as relevant by companies from all sectors. This was also found in the surveys of 2018 and 2019.

3 Drivers of R&D investment

As in earlier editions of the survey, participants were asked to rate the significance of potential drivers on the decision to invest in R&D. For these drivers, Figure 5 shows the percentage of companies that consider them (highly) relevant.

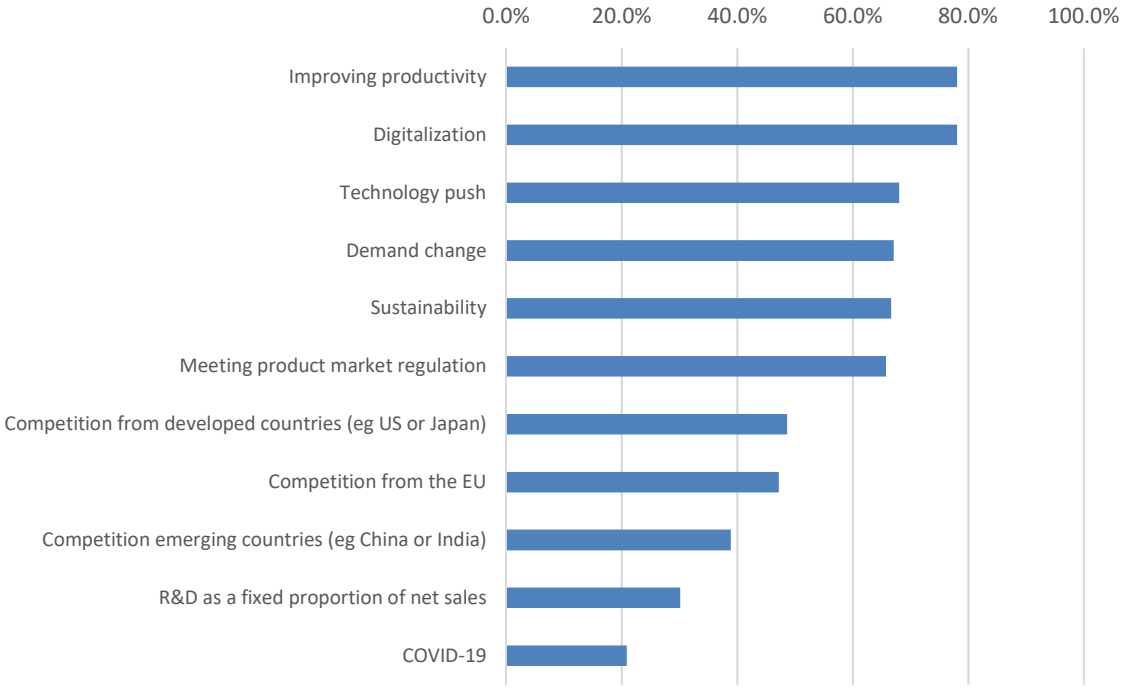
Surprisingly, while demand change remains one of the more important drivers, the number of companies considering this important has decreased from over 80% to 66%. This driver is traditionally among the highest rated ones, but this year's proportion is lower than other years.

Digitalization, improving productivity and exploiting technological opportunities (technology push) are the highest rated drivers. For the first time digitalization was provided as a driver for R&D. The answer might not be in line with the importance of ICT Software and ICT Hardware as key technologies for future competitiveness, as we saw in Section 2.3, although there are some differences in the questions. Technology push and productivity improvements are traditionally among the highest rated drivers.

The COVID pandemic and maintaining R&D as a fixed proportion of net sales are the least relevant factors for companies to change R&D investments. The pandemic is a lowly rated driver across the board, but with the highest impact, not surprisingly, in the Health Industry.

Competition as a driver for changing future R&D investments shows many similarities with earlier surveys. **Around 50% of the companies rating competition from developed countries and from the EU as (highly) relevant** and just below 40% of the companies indicating competition from emerging markets as so.

Figure 5: Proportion of participants indicating (high) impact of drivers of R&D investment changes



Note: The figure refers to 73 out of the 77 companies in the sample.
Source: European Commission, JRC/DG R&I.

3.1 Size effects

The largest companies are more sensitive to the drivers than the smaller companies and rate almost all drivers higher than the other size groups. This difference is most pronounced in the digitalization and is closely related to the importance of AI, Big Data and Robotization for future competitiveness as seen in section 2.4. Improving productivity is also rated higher by the larger companies than by smaller companies. This might be related to the fact that the smaller size group contains some companies that invest heavily in R&D and focus less on productivity than on technological breakthroughs and marketable innovations. This is shown in the average R&D intensity of the two smallest firm size groups with resp. 9.1% and 5.5% R&D intensity, while the largest groups, over 10 000 and 50 000 employees, have 2.8% and 4.0% R&D intensity respectively.

Competition from abroad as a driver is also perceived differently by large and small companies. The smallest size group rates competition from emerging countries (such as China and India) as much less relevant than the largest companies.

3.2 Sector effects

Where there is sufficient data, some interesting observations can be made on sectoral differences in the drivers' ratings.

Although companies from the Chemical Industry are not the largest in terms of number of employees (companies from Automobiles & other transport are), they have a wider geographical distribution of their R&D activities. They subsequently rate competition highest for all sectors as a driver to change R&D.

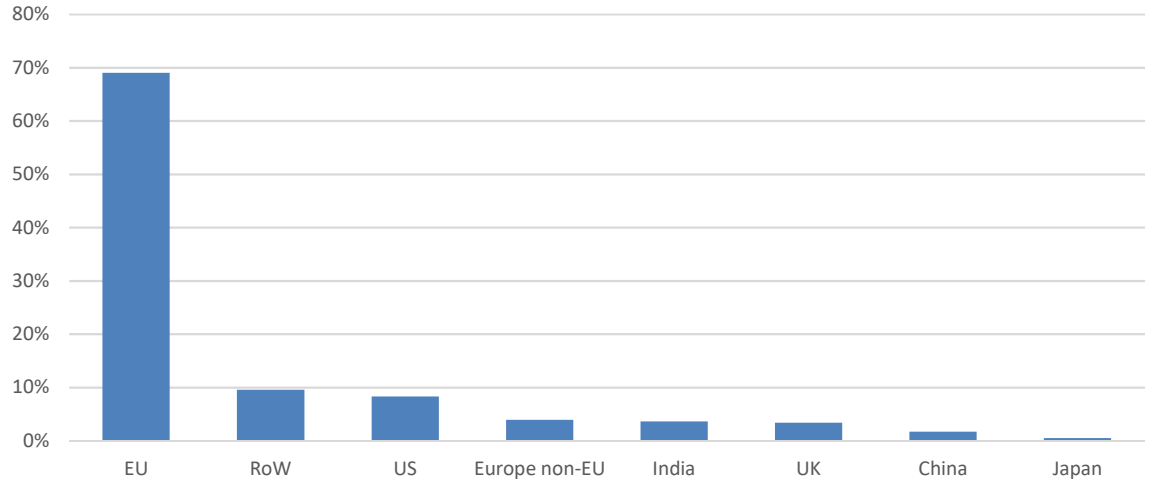
Companies from both the ICT services and the ICT producers sectors rate competition from developed non EU countries as very high, with competition from both EU and emerging markets as much lower. This indicates that especially the US (and Japan) is a very strong player in this market, but surprisingly emerging markets like China and India are still much less so (especially for ICT producers).

4 Global distribution of R&D activities – present and trends

4.1 Global R&D investments breakdown

Around 70% of R&D investments in 2020 was performed within the EU, which is similar to previous editions. This proportion has been quite stable for many years and does not show signs of offshoring to other regions. Although the distribution is similar to earlier surveys, there are some differences than can be likely related to the fact that around 15% of the participants did not provide a full geographical distribution of their R&D activities in 2020 and had to be discarded, which leaves us with 66 EU firms. Interestingly, companies perform a higher proportion of their R&D investments in India than in China, which is traditionally reversed.

Figure 6: Distribution of R&D activities per main country or region in 2020 (as a % of total R&D investments)



Note: The figure refers to 66 out of the 76 companies in the sample. RoW refers to Rest of the World: all countries that are not captured by EU, US or Asia – mainly Norway, Switzerland, countries from South America, Oceania and Russia.
Source: European Commission, JRC/DG R&I

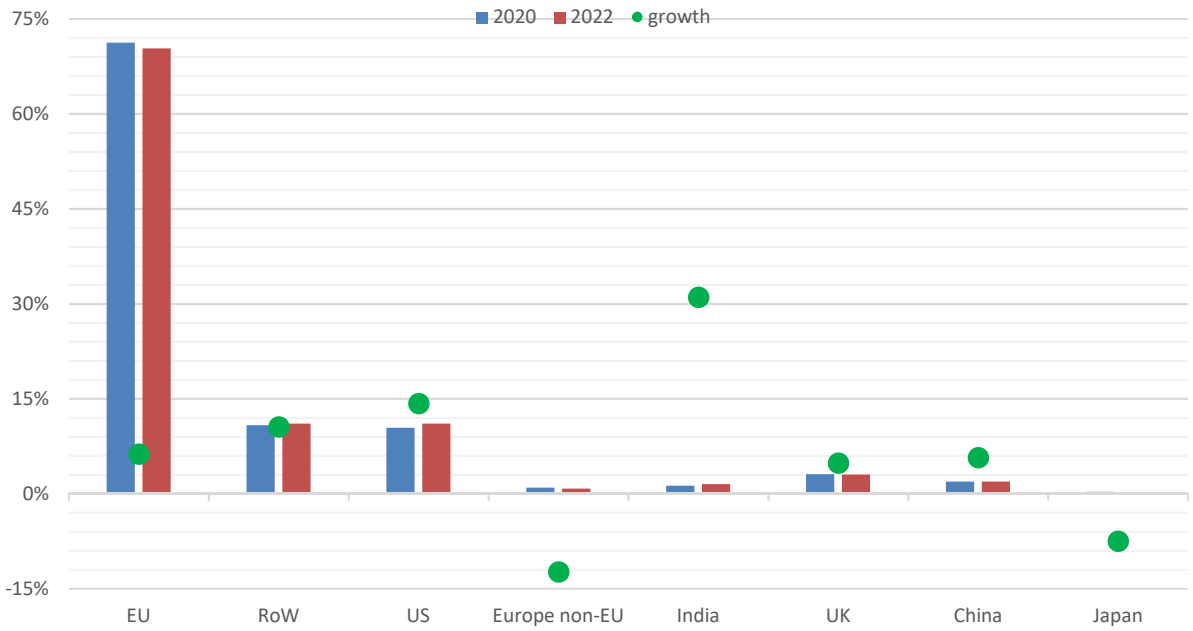
For the expected distribution in 2022: only 55 companies completed this question, or 72% of the companies, responsible for 30% of the participants' R&D investment but the overall distribution is expected to be similar, see Figure 7.

For the third year in a row, respondents expect to increase their R&D activities the most in India, similar to last year. Interestingly, this expected growth of 31.1% is due both to an increase in the actual proportion that companies indicated and the expected R&D growth of the EU companies that perform R&D in India but this is driven by few observations. R&D performed in China by EU firms shows again a lower, although still considerable, expected increase of 5.7%.

The expected decrease in the R&D performed in Japan by EU companies represents an ongoing trend. In 2010, EU companies performed around 3% of R&D in Japan and this has steadily decreased to now 1%, with negative expectations as can be seen in Figure 7. Non-EU European countries[6] also show an ongoing decreasing pattern for EU companies to perform R&D. With just 1% of R&D performed there, this finding comes from few observations.

[6] See http://en.wikipedia.org/wiki/List_of_sovereign_states_and_dependent_territories_in_Europe#Recognised_states

Figure 7: Expected annual changes in R&D investment in the next two years



Note: The figure refers to 55 out of the 76 companies in the sample. There are currently 27 EU Member States: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.
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).
Rest of World consists mainly of South Korea, Taiwan, Israel, Canada and Latin and Central America.
Source: European Commission, JRC/DG R&I.

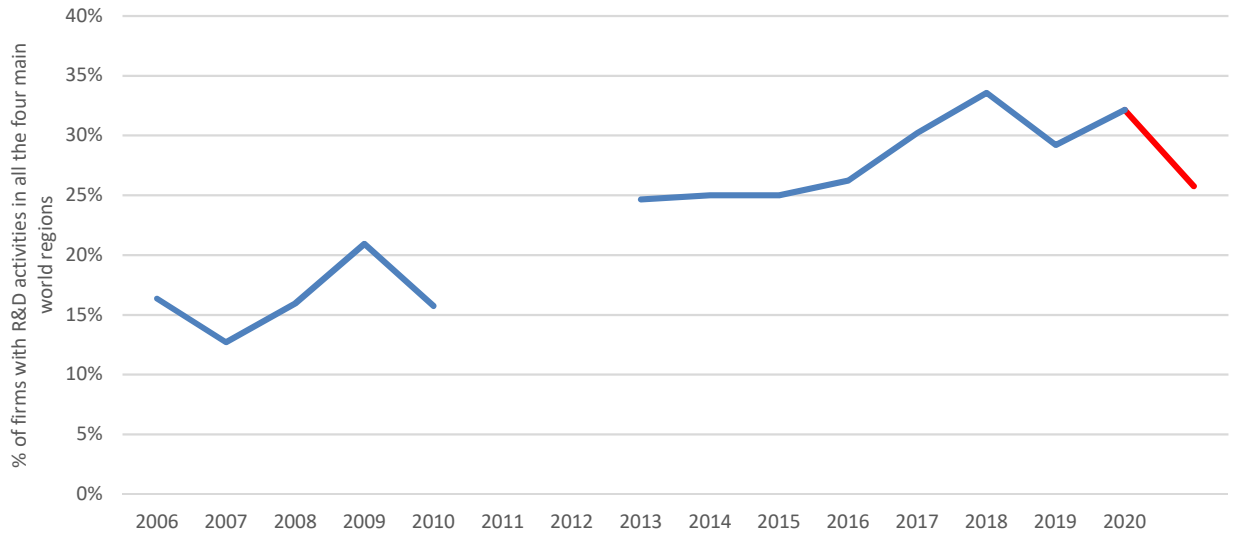
4.2 R&D – number of locations

Whereas the previous section described the geographical distribution of the R&D expenditure, this section looks at the number of regions in which the R&D takes place. For this question, a different breakdown of regions is used with notably all Asian countries considered as one and thus not part of the RoW group. One in five companies in this year's survey performs its R&D in only one country, which is less than in earlier years (with around one in seven). As in earlier years, one third of the firms do R&D in 10 or more countries. Here, a size effect plays an important role. **Only 5% of the smallest firms perform R&D in 10 or more countries, while 62% of the largest firms do so.** Only one of the 13 largest firms performs R&D in one country, while one third of the smallest firms do so.

On sector level, it shows that companies from the Chemicals and Industrials sectors distribute their R&D activities the most with an average of R&D locations in 18 and 16 countries respectively. Companies from the Automobiles & Other Transport locate their R&D on average in only 3 countries. As these companies are on average the largest in terms of number of employees, this is counter to the previously mentioned tendency.

One in four companies perform R&D in all four main economic regions[7] – this is slightly lower than the last years and the upward trend seems to have reversed to the 2016 level, as shown in Figure 8.

Figure 8: Global presence of top EU R&D performers, percentage of companies with R&D in all four main regions



Note: The figure refers to 66 out of the 77 companies in the sample. This question was not asked in 2011 and 2012.
Source: European Commission, JRC/DG R&I.

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

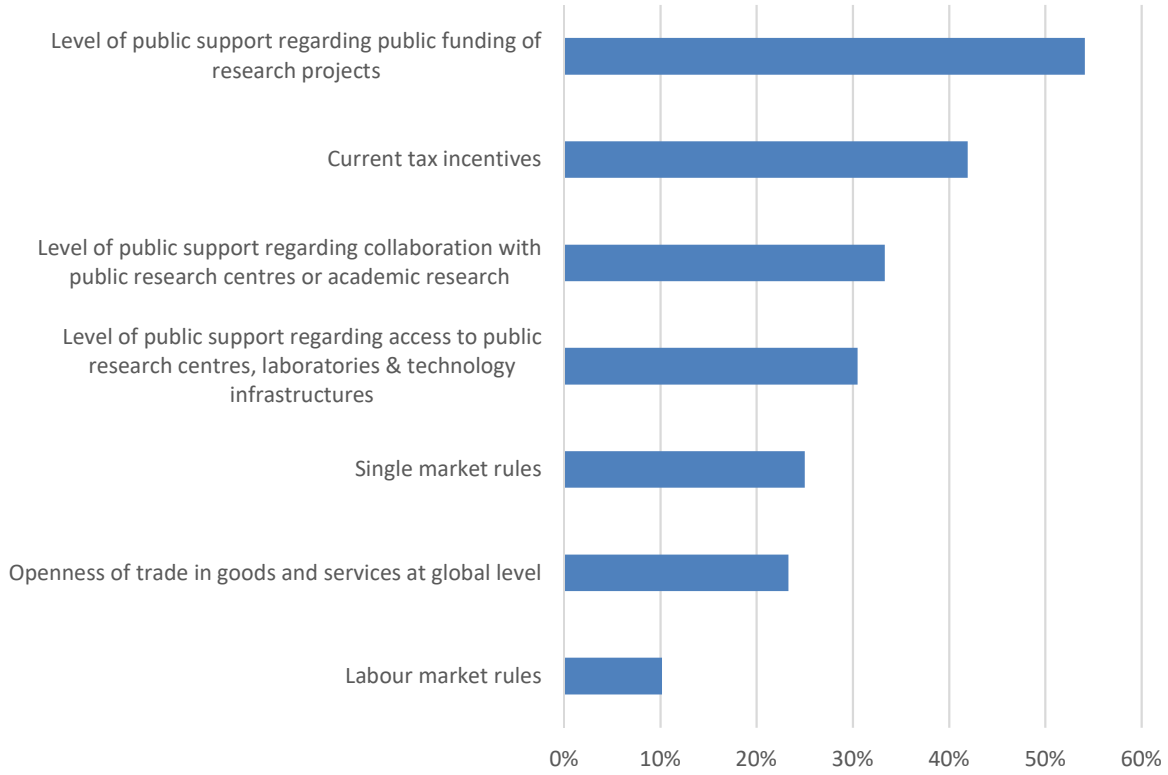
5 Sustainability

Among the European Commission priorities is the Green Deal[8] the aim of which is for Europe to be the first climate-neutral continent by becoming a modern, resource-efficient economy. It is accompanied by the Sustainable Europe Investment Plan[9], triggering €1 trillion investment over the next decade.

5.1 Key obstacles

We asked companies for the key obstacles that might hamper their investment in more sustainability related projects. The Figure 9 illustrates how these obstacles are perceived. .

Figure 9: Obstacles to invest in more sustainability related R&D projects



Note: The figure refers to 60 out of the 77 companies in the sample.
Source: European Commission, JRC/DG R&I.

The most significant obstacle and the only one rated as important by more than half of the respondents is the level of public support regarding public funding of research projects. Other types of public support, specifically related to access to public research centres, laboratories & technology infrastructures and collaboration with public research centres or academic research are not seen as significant obstacles The labour market rules do not form an important obstacle to undertake more sustainable investments, with only 10% of the respondents declaring this as (highly) important.

Exceptionally, Aerospace & defence and Health Industries are the sectors that rate the obstacles to sustainable investments the highest (with an average of 3.1 and 2.9 on a 5-point Likert scale ranging from [1] not relevant to [5] highly important, resp.), foreseeing a lack in openness of trade in

[8] See https://ec.europa.eu/info/strategy/priorities-2020-2024/european-green-deal_en
[9] See Sustainable Europe Investment Plan

goods and services at global level (likely due to the global character of the business) and current tax incentives. In contrast, companies from the Chemicals industry indicate a low importance to all obstacles (average of 1.6).

The size effect is rather small, with the largest companies rating the obstacles as most important and especially those related to public funding (tax incentives and public support for research and for collaboration with academic and public research).

As with other questions, we provided also free space to describe other possible obstacles. 12 respondents used this opportunity and half of these comments referred to the bureaucratic difficulty and administrative burden of dealing with public incentives, while four companies foresee technological obstacles related to the feasibility, costs or the available funding for these specific technologies.

5.2 EU Taxonomy for sustainable finance

From 2022, the EU taxonomy for sustainable activities will require large companies to disclose the proportion of activities aligned with the sustainability taxonomy. These activities include activities making a substantial contribution to climate change mitigation, climate change adaption, preservation of water and marine resources, circular economy, pollution prevention and control and/or preservation of biodiversity and healthy ecosystems, and not harming any of the others. We asked companies whether they report – either internally or by disclosing it publicly – R&D investments or intangibles related to the Taxonomy, or any other type of information.

Around 70% of the participants responded to the part on R&D investment, while 54% indicated whether the company reports on intangibles – no additional metrics related to the Taxonomy that companies are reporting were mentioned.

More than half (55%) of the respondents report both internally and publicly on Taxonomy related information on R&D – some of the companies provided links to their Sustainability reports. Of the respondents, 25% indicated that they only disclose Taxonomy related information on R&D publicly and 21% does so only internally. For intangibles, 18% of the respondents[10] both report internally and disclose this information. Internal reporting only is done by 14% and 20% respectively.

5.3 Taxonomy aligned activities

For each of the main financial indicators (turnover, operating expenditures, capital expenditures and R&D investments) participants were asked for the proportion of sustainable finance taxonomy-aligned activities for 2020 and to provide an estimate for 2022.

This turned out be a very difficult task for the participants, with only 11 companies (14%) providing figures for 2020 and only 9 (12%) providing an estimate for 2022, of which 4 companies provided 0% for all indicators and both years. Beside the low response rate, the range in estimates is very large, ranging from practically nothing (0.1%-3.0%) to the overwhelming majority 58%-100%) of either turnover or these expenditures.

[10] Respondents here refers to those companies that indicated at least public disclosure or internal reporting for R&D related to the Taxonomy.

5.4 Investments dedicated to improving climate and environmental performance

Respondents spend on average 26% of their capital expenditures and 33% of their R&D investments on improving climate and environmental performance. The companies with the highest levels of investment are typically active in climate and/or environmental undertakings, with in particular and not surprisingly energy companies investing a large proportion of their total capital and R&D investments in relation to environmental performance.

Companies tend to spend a greater proportion of their R&D on activities closer related to their own production process, while a greater proportion on capital expenditures is spent for mitigating external impacts. Circularity of production and reduction of emissions can count on about 60-80% higher relative R&D efforts than Capex efforts, while companies aim to obtain climate mitigation technologies and especially other sustainable technologies via capital expenditures rather than R&D efforts.

Table 2: Capex and R&D efforts to improve climate and environmental performance

	% of Capex	% of R&D
Climate mitigation and adaptation technologies (particularly CO2)	**48%**	**45%**
Circular industries (sustainable design, circularity of production, recycling)	**10%**	**18%**
Reduction of pollutant emissions	**8%**	**13%**
Other sustainable technologies (energy, water, soil, biodiversity etc.)	**33%**	**24%**

Note: The table refers to 21 out of the 77 companies in the sample.
Source: European Commission, JRC/DG R&I.

6 Investment and financing

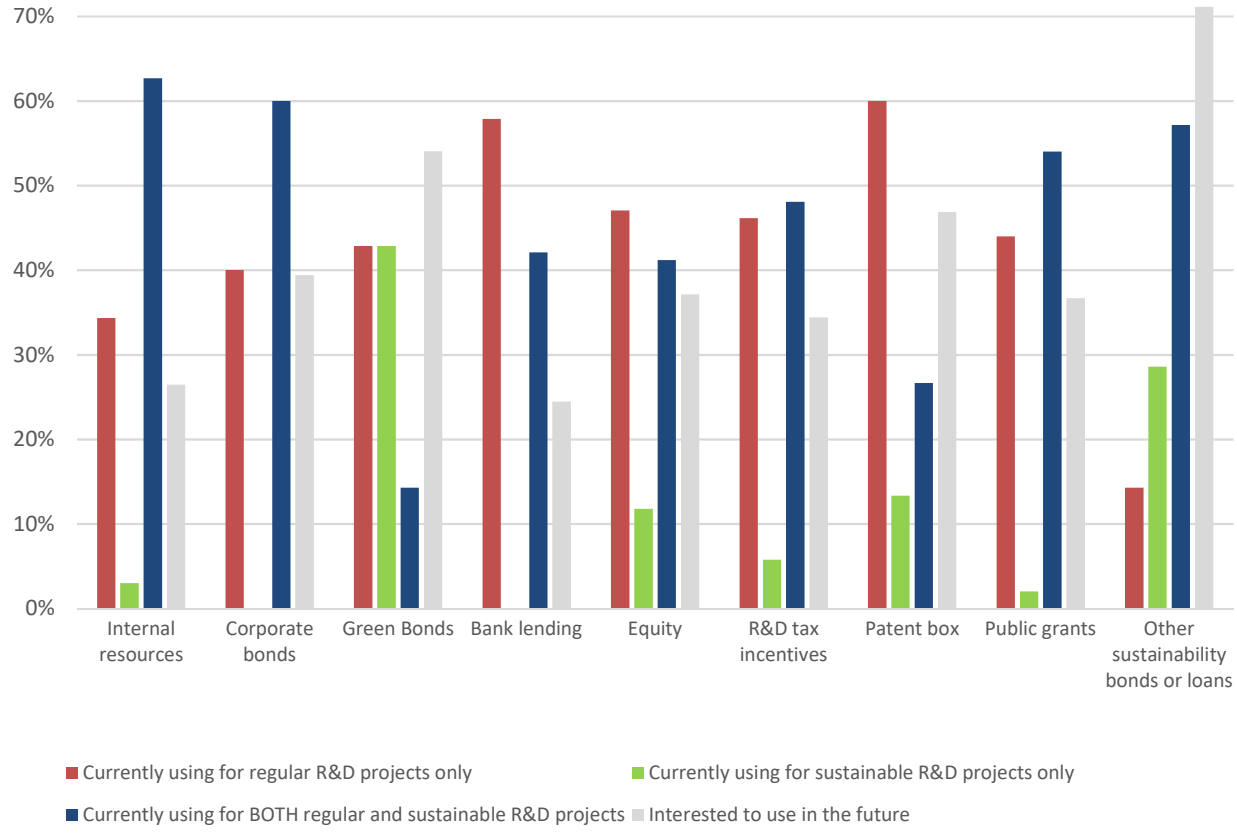
6.1 Financing instruments

Even more pronounced than last year, internal sources for financing R&D are used by almost all participants (except for one). This is understandable as they are the largest R&D performers of the EU. Over 60% of the companies that use internal sources do so for financing both regular and sustainable R&D projects (Figure 10).

R&D tax incentives and public grants are the second and third most used R&D financing sources, with 85% and 83% respectively using these for any regular and/or sustainable R&D projects. In contrast, corporate bonds and green bonds are the least widely used financing methods, although respectively 40% and 54% of the respondents are interested in using these instruments. Compared to last year, the use of equity is much higher (49% vs 22%) and is now more widely used than bank lending that is used by the same proportion of respondents as last year (42%).

Green bonds and other sustainability bonds and loans have are preferred for future R&D projects. The interest in Green Bonds has increased considerably with respect to last year (from 33% to 54%), while at the same time the use has increased considerably as well (from 7% to 19%). No data for comparison were collected last year on other sustainable bonds and loans.

Figure 10: Use of different sources of financing of R&D projects



Note: The figure refers to 68 out of the 76 companies in the sample.
Source: European Commission, JRC/DG R&I.

Patent boxes are a widely used tax incentive whereby profits are taxed at a lower rate where the revenue are allocated to patented technology. The figures show that **companies mainly use patent boxes for regular R&D projects only**, showing a low proportion of firms doing only sustainable projects or in combination with regular projects with this source of financing.

It is remarkable to see that financing instruments appear to be aimed at sustainable R&D projects – Green Bonds and other sustainable bonds and loans – also include a high proportion of firms using these as a source of financing for regular R&D projects, either in combination with or without regular R&D projects.

The use of Green Bonds is more widely used among all size groups with respect to last year, but it stays the least used financial instrument. This year not only the largest companies (with over 50 000 employees) make use of this instrument, but also the size groups medium size groups (between 2 500 and 10 000 and between 10 000 and 50 000 employees) make use of this instrument. Only companies from the smallest size class (less than 2 500 employees) do not use this source of financing, but they show the highest interest in using this instrument in the future, as in last year. The subset of the smallest companies does not make use of corporate bonds to finance either regular or sustainable R&D projects and is therefore the size group that uses the fewest number of financing instruments.

Companies from the Health Industry make use of the fewest R&D financing instruments and mainly rely on internal resources for regular R&D projects, but not for sustainable R&D projects. This is in line with earlier findings that companies in this sector see sustainable technologies of less importance for future competitiveness type of projects. Companies from the Chemicals industry rely on all financing resources, for both regular and sustainable R&D projects.

6.2 Public support programmes

Last year, in the separate COVID pandemic survey, we asked if measures as implemented by the EU27 Member States to support economic activity had been requested for and – in case so – received and if they amount received was as requested. This year, we repeated this exercise, but extended it to programmes that have been developed to support greenhouse gas emission reduction and circular economy undertakings.

Last year, 40% of the respondent to the COVID survey indicated that they had actually applied for some type of support. **This year, 46% indicated they had applied for at least one type of support**, although with a much lower response rate for this particular question than last year (37% vs 90%). Of these support measures, direct grants form 63% of all requests, while the other applied for support measures were subsidised public loans (26%), advance payments and safeguards for private loans (both 5%). Export credit insurance and state guarantee on commercial loans were not sought. 29% of the applications for support were not granted, while in 36% of applications less was received than applied for and in 36% the amount received was as applied for.

7 R&D collaboration

7.1 R&D collaboration

This year's survey addressed some questions on the nature of R&D collaboration between companies and the academia and other public research organisation in view of the Commission's review of a 2008 Communication on management of IP and knowledge transfer.[11] The question concerned the level of R&D performed in collaboration with other entities, the types of entities with which the companies collaborate, the mechanism of collaboration and the location of the collaborating partners.

Two thirds of the respondents do not use any form of collaboration for their R&D projects. One third of R&D activity is performed either in collaboration with one or more partners or is outsourced in which the financing partner performs no R&D itself.

The 23.2% of respondents that indicated being involved in collaborations were asked on the mechanism of these collaborations. **Public-private partnerships[12] (PPP – 61%) is by far the most widely used form of collaboration, followed by technology platforms[13] (11%) and other forms of open innovation schemes (10%).** In this latter case, companies were invited to specify further. Almost all comments referred to direct, private-private collaborations with contractual agreements, often with customers and/or private R&D labs.

Table 3: Forms of R&D collaboration

How does the R&D collaboration take place?	%
Public-private-partnerships	60.8
Technology platforms	11.2
Sharing of research facility	5.0
In a science park/innovation hub	8.4
Mobility of researchers and personnel:	1.4
Mobility of students	2.0
Involvement in training courses	1.1
Other forms of open innovation schemes	10.3
Total	100.0

Source: European Commission, JRC/DG R&I.

[11] Commission Recommendation of 10 April 2008 on the management of intellectual property in knowledge transfer activities and Code of Practice for universities and other public research organisations (notified under document number C(2008) 1329) (Text with EEA relevance) (OJ L 146 10.04.2008, p. 19, CELEX: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008H0416)

[12] Public-Private Partnerships (PPPs) are an important instrument under the current European Research and Innovation Programme, Horizon 2020 that enable interested industry and the European Union to work together in a partnership that is built on a seven year strategic roadmap.

[13] Technology Platforms are supported by the European Commission and bring together stakeholders to define medium- to long-term research and technological development objectives and lay down markers for achieving them. It is a forum that brings together industry, academia, policy makers and the wider society. These platforms focus on strategic fields – such as food, biotechnology, chemicals and nanotechnology – where Europe's future growth, competitiveness and sustainability depends on major technological advances.

In more than half of all R&D collaborations, the companies themselves perform R&D activities whereas for one third, collaborations is performed as contract research where one party pays and the other(s) perform R&D. Another type of collaboration, through paid consultancy services, is used in around 11% of the R&D collaborations, while licensing (either with or without prior R&D collaboration) is used only marginally. Companies from the Health industries are the only companies that on average use contract research in more than half of their R&D collaborations.

Table 4: Breakdown of types of R&D collaboration

What is the breakdown between different types of collaboration?	%
Collaborative research	**52.5**
Contract research (in which one party pays and the other performs):	**32.1**
Consultancy service provided to your company:	**10.5**
Licensing or sale of intellectual property right following prior collaboration:	**2.0**
Licensing or sale of intellectual property right without prior collaboration:	**2.8**
Total	**100.0**

Source: European Commission, JRC/DG R&I.

About half of the collaborations mainly take place with large firms (28.6%) and universities (22.5%), together responsible for more than half of all R&D collaborations. Collaborations with medium-sized firms and PROs/RTOs account for one third of collaborations. Start-ups and spin-offs are more attractive as R&D collaborators than micro-firms, most likely due to their innovative character.

Table 5: Partners in R&D collaboration

Of the collaborations, how much of this takes place in collaboration with:	%
Large firms	28.6
Universities	22.5
Medium-sized firms: < 250 employees and ≤ € 50 m turnover or ≤ € 43 m balance sheet total	15.5
Public Research Organisations (PROs) or Research & Technology Organisations (RTOs)	14.7
Small firms: < 50 employees and ≤ € 10 m turnover or balance sheet total	9.2
Start-ups: <5 years with innovative product/process	4.3
University spin-offs	2.9
Micro firms: < 10 employees, ≤ € 2 m turnover or balance sheet total	2.3
Total	**100**

Source: European Commission, JRC/DG R&I.

In line with earlier surveys, where we had asked companies for their main R&D locations, a **similar level (60%) of R&D collaborations is done in the same country as the companies' main R&D location**. Other locations are much less popular with other EU Member States (17%) the most preferred location.

Table 6: Location of R&D collaboration partners

How much of your these R&D collaborations were carried out with partners in:	%
In the country of your main R&D location	60.4
In other EU Member States	17.6
In the US	6.7
In the rest of the world	6.3
In the UK	3.5
In other European non-EU countries	2.4
In China	1.5
In India	1.1
In Japan	0.6
Total	**100.1**

Source: European Commission, JRC/DG R&I.

7.2 Firm size and sectoral differences

Considering the R&D performed extramural, the largest companies (>50 000 employees) perform the smallest proportion in-house (51.8% collaborating (20% with 1 partner, 16% with multiple partners) and outsource the largest proportion (13%). On sector level, Aerospace & Defence and Health industries are the sectors that do least of their R&D in-house (25% and 60% resp.), while companies from the Chemicals sector do most of their R&D completely in-house (95%).

Table 7: R&D collaborations detailed by firm size

	In-house (%)	In collaboration with 1 partner (%)	In collaboration with multiple partners (%)	Outsourced to third parties (%)
up to 2,500 employees	67.4	14.8	6.9	11.0
2,501 to 10,000 employees	69.0	7.8	14.2	9.1
10,001 to 50,000 employees	71.6	9.5	10.1	8.8
more than 50,000 employees	51.8	20.0	15.7	12.6

Source: European Commission, JRC/DG R&I.

How firms collaborate varies considerably by sector. While PPP is the preferred way in the Automobiles & other transport and Aerospace & Defence sectors (with 80% of R&D collaborations), the ICT producers and Chemicals industries are not using this mechanism at all. ICT producers rather prefer technology platforms, sharing of research facilities and innovation hubs[14] (for ICT producers), while Chemicals industries use almost exclusively other forms of open innovation, mainly through private partnerships with incubators and in alliance with customers. Effects on firm size are much less pronounced.

[14] Innovation hubs provide access to technical expertise and experimentation as well as the possibility to sandbox testing. As part of the Digital Europe Programme, the European Commission supports the European Digital Innovation Hubs (EDIHs) to help companies improve business/production processes, products, or services using digital technologies. They also provide innovation services, such as financing advice, training, and skills development that are needed for a successful digital transformation.

7.3 R&D collaboration with Research Organisations and Universities

Around 5% of total R&D is invested in collaborations with universities and about 1% with research organisations. Notwithstanding the relatively low share of collaborations with Research Organisations (specifically public research organisations and research & technology organisations) and universities has increased by 25% over the last 10 years.

Participants to the survey were asked to rate a list of barriers and drivers that they perceive when entering in R&D collaborations with Research Organisations and universities. **In general, companies rate the drivers as more important than the barriers to collaborate with these organisations.** The main barrier is the IP policy of the research partner with 50% of the respondents mentioning this as a (highly) important barrier.

The drivers for this specific form of R&D collaboration are – logically – somewhat different than general R&D drivers. Demand (market pull) here is not rated as the most important driver, but **technology push is mentioned as highly important by two third of the respondents.** This is because such R&D collaboration tends to focus on exploratory or more basic R&D. Improving the productivity, innovativeness or competitiveness (64%) is ranked second and market pull comes in third (60%).

Annex: Methodology

Background and Approach

The European Commission's Global Research and Innovation Analysis (GLORIA)[15] initiative serves to better understand industrial R&D and innovation in the EU from a corporate perspective 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 evidence to support policy making in the light of the Europe 2020 strategy[16] and the Investment Plan for Europe[17] initiative by monitoring, analysing and benchmarking the global industrial players in R&D, building on a 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 gathers 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[18], Eurostat[19] 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*[20], which is the flagship publication of the GLORIA project. The Scoreboard monitors and analyses company R&D investment trends and to serves 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 analyses trends ex-post based on the audited annual accounts of companies, whereas the Survey collects ex-ante information on future expectations and on rationales for decisions. The survey thus addresses location strategies, drivers and barriers to research and innovation activities, or perception of policy support measures with a questionnaire agreed between JRC B.3 and DG R&I.

For the 2021 Survey, the response period ran for 5 months: from 30 March 2021 (first emailing of the questionnaires) to 1 November 2021.

[15] See: http://iri.jrc.ec.europa.eu/.
[16] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF
[17] https://ec.europa.eu/info/investment-plan-europe_en
[18] https://op.europa.eu/en/publication-detail/-/publication/69e52157-2ba9-11e6-b616-01aa75ed71a1
[19] https://ec.europa.eu/eurostat/web/main/data/database
[20] 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 optimise response rates, the following measures were taken:

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,[21] 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.[22]

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.[23]

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

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

[22] 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.

[23] 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

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.

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.[24] 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",[25] based on the OECD "Frascati" manual,[26] and the definition used in the EU Industrial R&D Investment Scoreboards.

Table: 8: Distribution of responses by sector

Sector group	# responses R&D survey	# top 720 EU Scoreboard companies
Aerospace & Defence	3	14
Automobiles & other transport	6	58
Chemicals	4	30
Health Industries	12	139
ICT producers	5	80
ICT services	9	71
Industrials	13	120
Others	24	208

Source: European Commission, JRC/DG R&I.

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

Table 9: Distribution of the responses by home country of the company

Country	**# responses R&D Survey**
Germany	15
Spain	14
France	10
Italy	8
Austria	6
Finland	5
Sweden	5
Netherlands	4
Denmark	3
Portugal	2
Slovenia	1
Belgium	3
Ireland	1
Slovenia	1

Source: European Commission, JRC/DG R&I.

[24] See Annex B
[25] See http://www.iasplus.com/standard/ias38.htm
[26] 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

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