

INDUSTRIAL R&D CONTINUED TO GROW SUBSTANTIALLY IN 2017

This document shows first estimates of territorial R&D funded by the business sector based on recent R&D and patent data from a representative sample of worldwide companies from the EU R&D Scoreboard (see the Annex)

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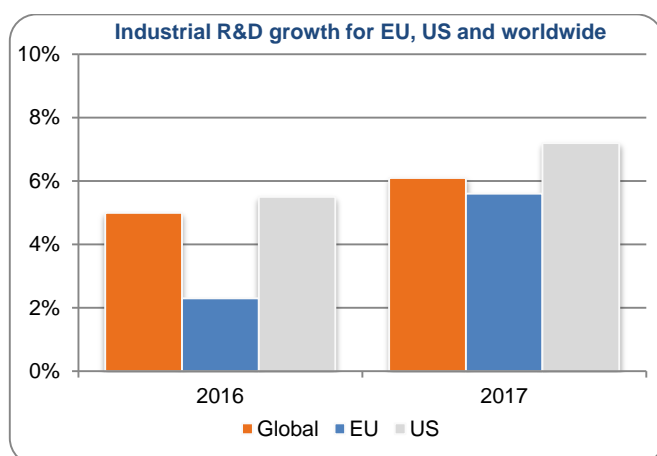
- R&D funded by the business sector increased in the EU by 5.6%, below the 6.1% global rate and the US R&D growth (7.2%).
- The worldwide growth of industrial R&D in 2017 is slightly higher than that recorded in 2016. This growth is largely driven by ICT and health industries.
- As in previous years, the industrial R&D growth in the EU is led by Germany, with France showing a stronger R&D increase compared to the previous year.
- In the EU, R&D inflows and outflows for Health industries were nearly equivalent in 2017 (€9.6bn versus €9.4bn) and showed a significant positive trend with respect to 2016.

1. Significant industrial R&D growth in 2017

The global R&D funded by the business enterprise sector (**BES-R&D**) increased by 6.1% in 2017 to €874bn, scoring a performance higher than that of the previous year (5.0%)ⁱ.

In the EU, the BES-R&D grew by 5.6% to €180bn, improving significantly the R&D growth rate recorded in 2016 (2.3%).

The BES-R&D in the US rose by 7.2% to €304bn, significantly higher than the R&D growth rate shown in 2016 (5.5%).



2. R&D growth driven by increases in ICT and health industries

The worldwide growth of industrial R&D in 2017 was driven by ICT producers (7.4%), ICT services (11.3%) and Health industries (6.7%). Globally, the Aerospace & Defence was the only sector showing a decline in R&D investment (-6.4%), see table 1 on the next page.

The EU showed a particularly good performance in ICT services where the BES-R&D increased at the significant rate of 12%, and in Automobiles (6.7%) and Health industries (6.5%). The lowest R&D performance in the EU was shown in Aerospace & Defence (-2.2%) and Chemicals (-1.4%).

In the US, investment in R&D continued to grow substantially in high-tech industries: ICT services (12.6%), ICT producers (8.7%) and Health industries (7.7%). The poorest performance in the US was recorded in Aerospace & Defence (-11.7%)ⁱⁱ and Industrials (-1.1%). In Automobiles the R&D growth in US (2.5%) continued to perform well below the EU (6.7%) and global (4.1%) rates.

Industrial Sector	Global (%)	EU (%)	US (%)
ICT services	11.3	12	12.6
ICT producers	7.4	5.2	8.7
Automobiles	4.1	6.7	2.5
Health industries	6.7	6.5	7.7
Aerospace & Defence	-6.4	-2.2	-11.7*
Industrials	2.4	3.3	-1.1
Chemicals	0.2	-1.4	4.6
Others	6.6	4.3	4.0

Table 1: Industrial R&D annual growth in 2017 for the EU, the US and worldwide.

* This negative figure is mostly due to an adjustment after the exceptionally high R&D costs reported in 2016 by the US leading company in this sector (see Endnote ii).

3. The largest EU countries sustained industrial R&D growth in 2017

In Germany, industrial R&D grew by 4.6% to about €63bn, showing the highest BES-R&D growth rate among the top EU countries. However, Germany's BES-R&D performance was lower than that of 2016 (3.1%).

In France BES-R&D recovered strongly from previous years' stagnation, recording an increase of 4% to €28bn (compared with 0.3% in 2016).

The BES-R&D in the UK grew modestly by 1.2% to €18.8bn, a growth rate considerably lower than that of 2016 (6.4%).

The performances of specific industries varied greatly in the top 3 EU countries:

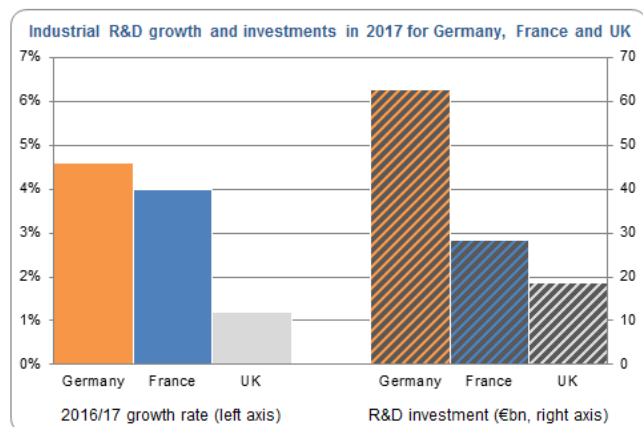
In Automobiles, the largest R&D sector in the EU, the BES-R&D growth was particularly high in France (12.4%) and relatively good in Germany (4.3%), while the UK showed a considerable decline in this sector (-20.4%).

Regarding Health industries, second EU's sector in terms of R&D investment, highest R&D growth was showed by Germany (7.8%) followed by the UK (6.9%) and France (3.6%).

The performance of ICT industries was particularly good in Germany (ICT services, 9.1% and ICT producers, 5.5%) and in France (ICT services, 7.3%).

As in 2016, the Aerospace & Defence sector continued to show contrasting R&D figures. The UK showed a BES-R&D increase of 6.7% while Germany and France recorded a decrease of 9.5% and 5.6% respectively.

The Industrials sector recovered from previous year's R&D decline, showing a significant increase in Germany (4.7%) and moderate increases in the UK and France (2.9% and 0.8% respectively).

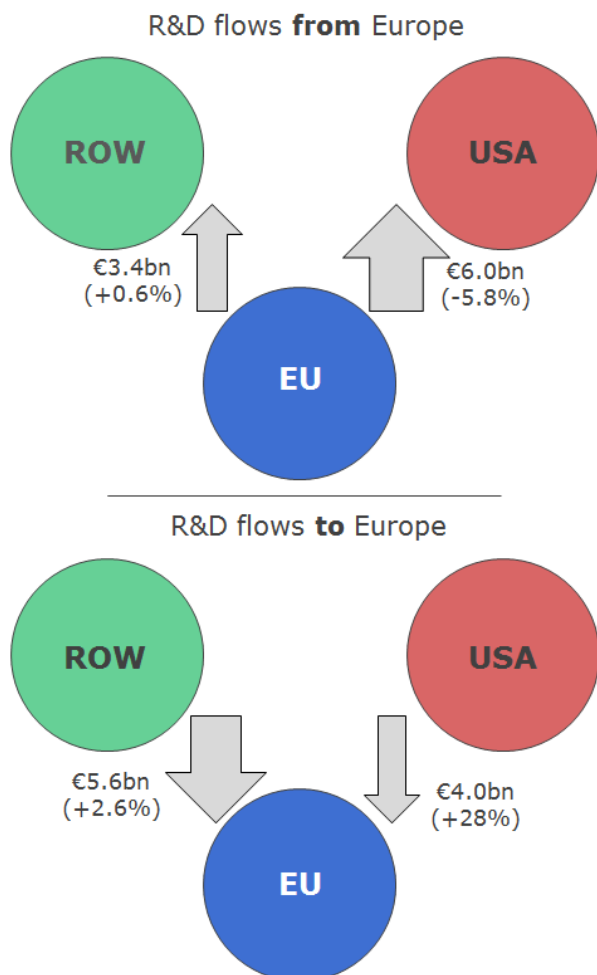


4. Cross-border R&D investment in Health industries

As shown in the 2016 edition of the [EU R&D Scoreboard](#), R&D flows across different economic areas can be estimated by reallocating R&D investments according to the patent activity of companies' affiliated inventors located abroad (see Annex).

In this section, we focus on the EU's R&D inflows and outflows with respect to the US and the rest of the world (ROW) for the Health industries.

In 2017, the EU's R&D inflow and outflow were practically equivalent (€9.6bn *versus* €9.4bn). Overall, the R&D inflow represented about 31% of the R&D of Health industries in the EU.



The R&D inflows and outflows are not symmetric. While the R&D flow from the EU to the US (€6bn) is larger than that to the rest of the world (€3.4bn), the

opposite holds true when considering the R&D flows to the EU. The EU attracts more R&D investment from the rest of the world (€5.6bn) as compared to the US (€4bn).

In 2017, the R&D inflows and outflows showed a positive dynamics for the EU: The R&D inflow increased more than the R&D outflow with respect to the rest of the world (+0.6% *versus* +2.6%) and much more with respect to the US (-5.8% *versus* +28%)ⁱⁱⁱ. It should be noted that the large increase of R&D flow from the US to the EU (+28%) is mainly due to the extraordinary increase of R&D figures from a large American company having strong patent activity in the EU (see Endnote iii).

Disclaimer

The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission. The numbers presented are estimations based on the methodology described below and may therefore differ from those on territorial business R&D expenditures (BES-R&D), which are produced by national statistical offices, Eurostat or the OECD.

Acknowledgements

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Read more

More information, including activities and publications, is available at:

- [Link to the methodology](#)
- <http://iri.jrc.ec.europa.eu/scoreboard17.html>
- <http://iri.jrc.ec.europa.eu/>
- <http://ec.europa.eu/research/>
- <https://ec.europa.eu/jrc>

Annex - Data sources and methodology

The 2017 estimates of R&D funded by the business enterprise sector (BES-R&D) are obtained correlating past territorial business R&D expenditures (BES-R&D: latest figures provided by Eurostat and OECD databases - July 2018) with R&D data from a representative sample of companies comprised in the EU R&D Scoreboard (<http://iri.jrc.ec.europa.eu/scoreboard.html>).

Company data applied, corresponding to the latest (2017) fiscal year, cover worldwide industrial R&D investments and main innovative industries, especially manufacturing and knowledge intensive services.

The main characteristics of the company data grouped by region/country and by industry are presented in tables A1, A2 and A4.

The correlation between BES-R&D and company data is improved by using patent data to characterise the international location of R&D activities of parent companies, allowing the estimation of cross-border R&D flows (see JRC Report "Estimating territorial business R&D expenditures using corporate R&D and patent data" (<http://iri.jrc.ec.europa.eu/other-reports.html>)).

An estimation of the average cost of each patented technology in terms of R&D improves the allocation of companies' R&D investments across countries.

For companies outside the Euro area, all currency amounts have been converted at the Euro exchange rates ruling at 31 December 2017.

Country	ISO code	unit/€
Australia	AUD	1.538
Brazil	BRL	3.967
Canada	CAD	1.51
Switzerland	CHF	1.170
China	CNY	7.809
Denmark	DKK	7.445
UK	GBP	0.888
Hungary	HUF	310.559
India	INR	76.687
Japan	JPY	135.318
S. Korea	KRW	1282.05
Saudi Arabia	SAR	4.497
Sweden	SEK	9.843
Taiwan	TWD	35.791
US	USD	1.199

Table A3: Euro exchange rates applied to companies based in different currency areas (as of 31 Dec 2017).

	EU	US	Asia	Other	Total
Number of companies	294	114	112	26	546
R&D in 2017 (€bn)	176	207	146	31	560

Table A1: Sample of top R&D companies extracted from the EU R&D Scoreboard dataset and applied to estimate the 2017 BES-R&D.

	Germany	France	UK
Number of companies	78	50	48
R&D in 2017 (€bn)	75	26	21
Country R&D share in the 2017 EU R&D Scoreboard (%)	94	92	80

Table A2: Breakdown of the sample of companies applied to estimate the 2017 BES-R&D for top EU countries.

Industrial Sector	Sector classification ICB 3&4 digits	Sample of companies, R&D in 2017 (€bn)	R&D share in the 2017 EU R&D Scoreboard (%)
ICT producers	Computer Hardware; Electronic Office Equipment; Semiconductors; Telecommunications Equipment; Electronic & Electrical Equipment	128.5	73.7
Health industries	Pharmaceuticals; Health-biotechnology; Health care equipment & services	128.3	79.5
ICT services	Computer Services; Internet; Software & Computer Services; Fixed Line Telecommunications; Mobile Telecommunications	78.9	80.3
Automobiles & other transport	Automobiles; Auto Parts; Commercial vehicles	115.1	90.4
Industrials	General Industrials; Industrial Engineering, Industrial Metals & Mining, Industrial Transportation	27.4	62.5
Aerospace & Defence	Aerospace; Defence	16.5	76.1
Chemicals	Chemicals	11.6	48.6
Other	Leisure Goods; Oil & Gas Producers; Banks and Financial Services; Construction & Materials; Food producers; etc.	53.8	54.2

Table A4: Sample of companies applied to estimate the 2017 BES-R&D grouped by industry.

Note: Industrial categories are a reduced (R&D focused) version of the ICB classification applied in the EU R&D Scoreboard.

Endnotes

ⁱ Please be aware of the effects of fluctuations of exchange rates when comparing 2016 and 2017 figures. All foreign currencies have been converted to Euros at the exchange rate of the year-end-closing (31.12.2017). For example, in this period the Euro has significantly appreciated by 14% against the US dollar (\$/€ from 1.05 to 1.199).

ⁱⁱ Most of the decrease of the Aerospace & defence sector in the US is explained by the R&D figures of Boeing. This company, accounting for about 40% of the sector R&D, reported extraordinary high R&D costs in 2016 (as stated in the company's annual report, due to "reclassification of \$1,235 million of 787 flight test aircraft costs to research and development and higher reach-forward losses on the 747 and KC-46A Tanker programs". As a result of this, Boeing's R&D figures in 2017 indicate a 33% drop with respect to 2016.

ⁱⁱⁱ The company Merck & Co., Inc., accounting for about 10% of the total R&D in the Health sector in the US, showed an R&D increase of 49% from 2016 to 2017. In fact, the R&D figures in 2016 were considerably reduced due to Merck's reported impairments of about \$3.6bn. The patent portfolio of this company is broadly internationalized, showing in particular strong patent activity in the EU.

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