

## TEN-YEAR EVOLUTION OF EU INDUSTRIAL R&D IN THE GLOBAL CONTEXT

### Key messages

- More than a quarter of the industrial investment in global R&D is made by EU companies.
- In the last decade EU companies have increased their specialisation in medium-tech sectors, with a significant R&D share increase in the Automobile sector and a decrease in the Aerospace & Defence sector.
- Industrial dynamics at company level provide insights into policy strategies to strengthen EU corporate R&D and to improve the competitiveness of innovation-driven industries.

### Introduction

Research and Development (R&D) and innovation in industry are expected to play a fundamental role in competitiveness and job creation in the European Union. A report<sup>1</sup> published recently by the European Commission compares the companies that invest the most in R&D worldwide and that represent more than 90% of global business R&D investment. This analysis is based on economic and financial data from the companies' income statements of their annual accounts. Collected and analysed over a period of more than 10 years, this information has served to inform European innovation and industrial policies on specific aspects such as promoting sector dynamics, targeting support to the growth of young innovative companies or supporting the technological transformation and modernisation of European industry.

### Evolution of industrial R&D investment

In the last 10 years the overall level of knowledge has risen considerably and economic competitiveness today depends largely on the scientific and technological competitive advantage. **Investment in R&D and innovation is vital for an economic and social system such as Europe's** with relatively high labour costs and scarce natural resources.

**Companies that bet on R&D turn out to be the most competitive** in the world market **and** those that **create the most jobs**. In absolute terms, in the last 10 years the EU companies that invested most in R&D showed the biggest increase in employment (see Figure 1 in the Annex).

**European companies<sup>2</sup> are responsible for more than a quarter (26%) of the industrial investment in R&D in the world.** They have managed to maintain this share of investment over the last 10 years, a period of time in which Industrial R&D global investment has grown by 50%.

In the same period, **US companies** have increased their share of total R&D investment worldwide (reinforcing their position as leaders), while the R&D share of Japanese companies has decreased (they invest about half the total R&D invested by their EU counterparts).

Companies from **emerging countries** show a greater increase in R&D investment (especially those from China and South Korea) even though their investment in R&D is still far from that of the EU and the US (see Figure 3 in the Annex).

<sup>1</sup> EU Industrial R&D investment Scoreboard  
<http://iri.jrc.ec.europa.eu/scoreboard17.html>

<sup>2</sup> A prominent role by German, British and French companies is observed in EU corporate R&D investment (see Figure 2 in the Annex).

## Industrial sectors of R&D specialisation

Over the **last decade European companies** *increased* their specialisation in medium-tech sectors (see Figure 1 and 3 in the Annex). Europe leads in the **Automobile & parts** sector (increasing the R&D shares from 36% to 44% in 10 years). It also specialises in **Health industries** (including equipment for health, pharmaceuticals and biotechnology where US companies largely dominate), **Aerospace & Defence** (where the EU lost ground in R&D shares over the 10 years), and in **ICT industries** (where EU companies underperform, especially in Software industries which are dominated by US companies).

Overall, **the R&D specialisation of European companies is very broad and more focused on sectors of medium and low technological intensity**, such as the Food retail sector, the Banking sector, and Utilities (Electricity, Gas).

Differently, companies from the **US** have increased specialisation and leadership in high-tech sectors, especially in ICT but also in Pharma, Biotechnology, and Aerospace & Defence. Companies from **Japan** have a varied R&D sector mix and have increased specialisation in medium-high-tech sectors such as the Chemical sector the Electronic equipment sector and the high-tech Leisure goods sector. The R&D specialisation for **Chinese companies** focuses on sectors related to infrastructure, energy and ICTs.

In sum, compared to their non-EU counterparts, EU companies outperform or perform comparably in size (of R&D and sales) and R&D intensity (ratio of R&D to net sales) for Aerospace & Defence, Automobiles and Pharmaceuticals. But in Biotechnology, Software and IT hardware the EU shows persistent weaknesses in most indicators. The EU gap in these three sectors has widened over the last 10 years (Figure 1 in the Annex).

## Cause of the EU R&D intensity gap

Despite the good R&D investment performance of the sample of EU companies, the gap with respect to their non-EU counterparts in R&D intensity has not been reduced. Evidence indicates that most of this gap is mainly due to structural factors linked to a specific sectoral composition and reflected in an insufficient number (and a smaller size) of leading innovative

companies in the EU in key high-tech sectors. This is particularly the case of ICT industries where EU companies invest much less in R&D than their counterparts, e.g. almost four times less than US companies (see Figure 3 in the Annex).

Additionally, the **EU is the world leader in the science underpinning emerging technologies, but not in turning these technologies into global businesses**; this difficulty reflects the lack of dynamism of the high-tech sector in the EU (European Commission, 2018a). Investment in these new sectors represents a **higher risk** but also a **greater potential profitability**.

## Solutions

The analysis of the evolution of industrial R&D over a decade sheds light on how to achieve a more positive R&D dynamic for the EU industry. As already put forward in our previous works, there are two main implications for policy.

The first is the need to leverage the capacity to create new innovative sectors and stimulate their growth, via targeted support to young technology-based companies. This process can be helped by establishing favourable conditions for the emergence and growth of companies and investments in **strategic and R&D-intensive sectors** of economic and social interest.

The second is to promote the capacity of traditional (and mature) **medium- and low-technology sectors to absorb new technologies**. Related examples are the adoption of ICT, but also of new materials, or a new way of improving products and services, such as the enormous potential that comes with the use of "Big Data". This would increase the competitiveness of the companies themselves and play a key role in favouring their participation in global innovation networks and innovative global value chains.

In addition, and of fundamental complementarity to fully enable the previous two policy undertakings, a third strategic pathway is the establishment of a medium- and long-term policy agenda that sets the conditions for a more dynamic and innovative EU industry. This agenda would include support for the following:

\* **Training (skills):** Most companies indicate that one of the key factors when deciding to invest in R&D in a country is the quality of (and not only availability of / access to) very qualified scientific and technical personnel (see Figure 4 in the Annex).

\* **Investment in basic research and use of R&D results:** This would increase the ability to develop new knowledge and to transfer technology ("from the laboratory to the market") and the entrepreneurial capacity to create and grow innovative companies.

\* **A more integrated EU market:** A well-integrated single market and better regulatory and market conditions conducive to innovation, business and industrial dynamics (markets to finance innovative investment, reduction of "red tape") allow for full exploitation of opportunities for business and for scientific and technological knowledge (see Figures 4 and 5 in the Annex). It would also help reduce corporate R&D investment gap between the northern EU countries and the southern ones. A fragmented and rigid European market hinders the timely scale-up of innovation and tends to lock in resources in uncompetitive and *zombie*<sup>3</sup> firms (European Commission, 2018a). The cost of no or little integration, which undermines the full exploitation of the potential of the EU internal market, is very high.

\* **Specific territorial needs to guarantee competitiveness and job creation** across the whole EU. On one hand, different patterns of structural change can be associated to specific technological dimensions. On the other, the choice of policy instruments may lead to differentiated impacts across economies, depending on their sector mix.

Changing an industrial model in the short term is not easy. The objective in the medium and long term is to increase the competitiveness of the EU economy that will need to be based on frontier scientific and technological knowledge (see Box 1 in the next page).

<sup>3</sup> Are those firms aged  $\geq 10$  years with an interest coverage ratio  $< 1$  over three consecutive years. The interest coverage ratio is a debt ratio and profitability ratio used to determine how easily a firm can pay interest on its outstanding debt.

## Conclusions

The empirical evidence indicates that the EU business sector is still strong in traditional medium-tech sectors, but losing ground in some of them.

Conversely, competing economies are much stronger in newer high-tech sectors and have maintained and even reinforced such strength. In fact, the EU shows an insufficient number of companies and a small number of global players in key sectors such as Biotechnology, Software and IT hardware.

On the other hand, evidence shows that the high-tech innovation-led competitiveness of some countries has benefitted from proactive industrial policies which have supported targeted sectors and markets. Clear examples are those of the USA, South Korea and China.

In this context, a promising undertaking is the recent proposal of "A renewed EU Industrial Policy Strategy" by the European Commission (2017b) to foster industrial competitiveness, innovation and technological leadership, supported by several instruments such as the European Horizon 2020<sup>4</sup> programme for research and innovation (and its follow-up). Likewise, this is the case of the "Renewed European Agenda for Research and Innovation" which also addresses the EU private investment *gap* in R&I (European Commission, 2018b).

Finally, company data analyses provide essential information to support policy-making to understand the specificity of industries (e.g. the heterogeneity of business models within sectors) and hence to design more effective industrial innovation policies.

### How to cite

Moncada-Paternò-Castello P. and H. Hernandez (2018) "Ten-year evolution of EU industrial R&D in the global context". JRC Policy Insights, European Commission. JRC112352; # 6. July, 2018.

<sup>4</sup> <http://ec.europa.eu/research/participants/portal/desktop/en/home.html>

## Box 1. Characteristics of the next wave of innovation

Europe has a unique opportunity to take the lead in the next wave of innovation. A wave that is no longer just about digital, but about the combination of digital and physical. In particular, it will:

- ▲ Be strongly linked to the basis of science and technology and data skills
- ▲ Require substantial and sustained investment by the public and private sectors in high-risk innovation (technology development, pilot manufacturing, etc.)
- ▲ Take place in highly regulated sectors (health, energy, financial services, etc.), so they depend on the quality of regulatory frameworks.

Source: European Commission, 2018b



## Read more

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

- <http://iri.jrc.ec.europa.eu/>
- <http://ec.europa.eu/research/>
- <https://ec.europa.eu/jrc>

## 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.*

## Bibliography

- Hernández, H., N. Grassano, A. Tuebke, L. Potters, S. Amoroso, M. Dosso, P. Gkotsis, and A. Vezzani (2017). The 2017 EU Industrial R&D Investment Scoreboard (No. JRC 108520). Joint Research Centre, Seville 2017. ([link](#))
- European Commission (2017a). European Innovation Scoreboard 2017. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. ISBN 978-92-79-67685-7, Brussels/Luxembourg, 2017 ([link](#))
- European Commission (2017b). Investing in a smart, innovative and sustainable Industry. A renewed EU Industrial Policy Strategy. COM(2017) 479 final ([link](#))
- European Commission (2018a) Science, Research and Innovation Performance of the EU 2018 - Strengthening the foundations for Europe's future. Directorate-General for Research and Innovation, ISBN 978-92-79-69745-6, 2018 ([link](#))
- European Commission (2018b) A renewed European Agenda for Research and Innovation - Europe's chance to shape its future, COM(2018) 306 final. ([link](#))
- Moncada Paternò Castello, P. (2017). Evolution of EU corporate R&D in the global economy: intensity gap, sectors' dynamics, specialisation and growth. Université Libre de Bruxelles, Brussels 2017 ([link](#)).
- Moncada-Paternò-Castello P., Coad A., Vezzani A. (2018). For a transformative industry & innovation strategy. JRC Science for Policy Insights, Industrial R&I -IRITEC briefs series - Issue # 5; No. JRC 110888 – European Commission. Seville (Spain), February 2018 ([link](#)).
- Potters, L.; Grassano, N. and Tübke, A.: The 2017 EU Survey on Industrial R&D Investment Trends; No. EUR 28871 EN; Joint Research Centre, Seville, 2017 ([link](#)).

## Acknowledgements

*These highlights have been published within the context of the Industrial Research, Innovation and Technology Analysis (IRITEC) project carried out by the European Commission's Joint Research Centre (Directorate B Growth & Innovation). The IRITEC project comprises two streams: one on the territorial dimension of technology analyses (KeyTec: Key Enabling and Emerging Technologies for Territorial development and Competitiveness) and one on improving the understanding of industrial R&D and Innovation in the EU (IRIMA II: Industrial Research and Innovation Monitoring and Analysis). The latter is carried out jointly with the Directorate General for Research - Directorate A, Policy Development and Coordination.*

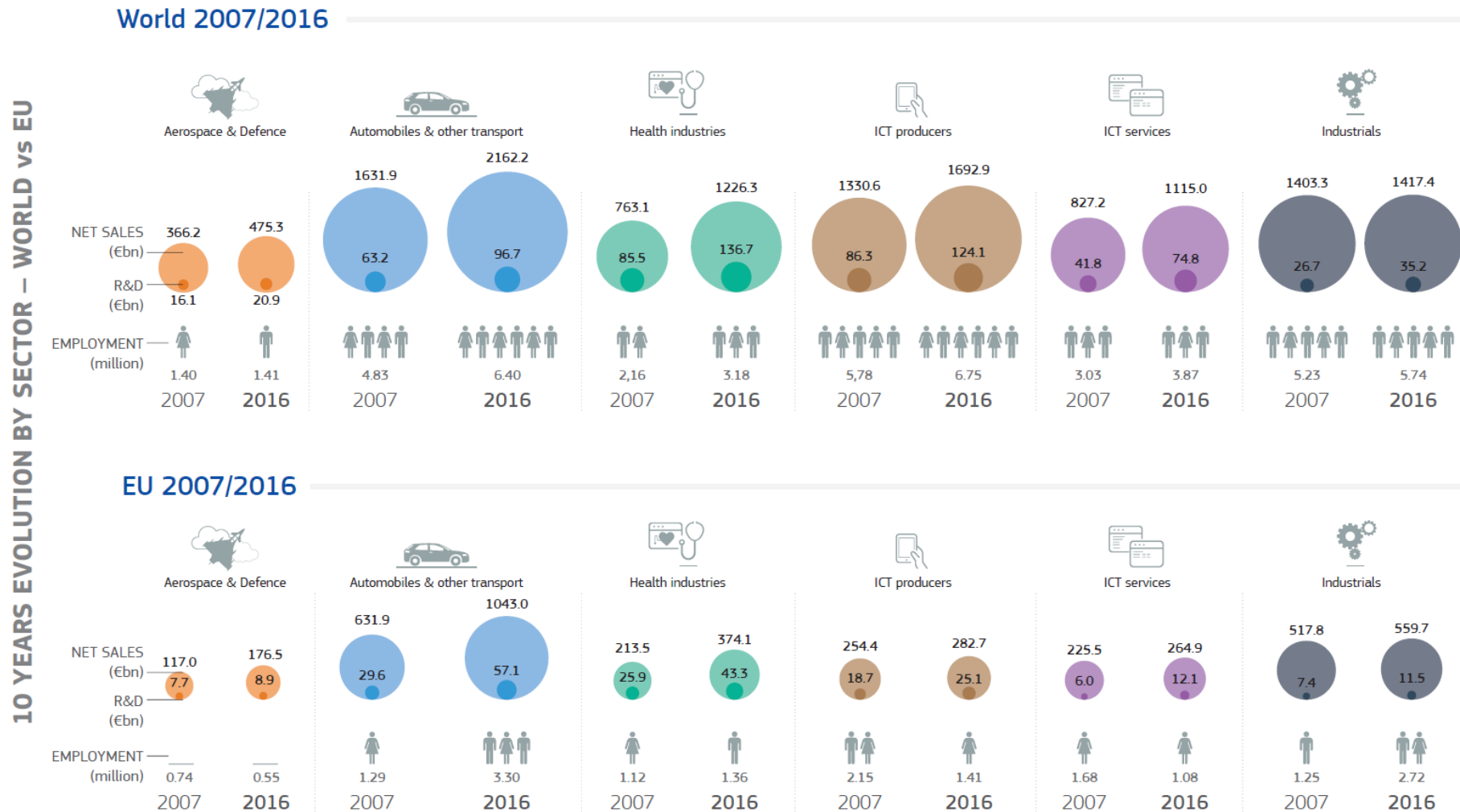
*The authors are grateful to Fernando Hervás, Roberto Martino and Alexander Tübke for their valuable review suggestions, as well as to Anna Atkinson for her appreciated English editing work (all from the European Commission).*

## Contact information for this document

Pietro Moncada-Paternò-Castello  
European Commission, Directorate General Joint Research Centre - Directorate Growth & Innovation, Territorial Development Unit  
[pietro.moncada-paterno-castello@ec.europa.eu](mailto:pietro.moncada-paterno-castello@ec.europa.eu)  
Edificio Expo - C/ Inca Garcilaso 3 - E-41092 Seville

# Annex

**Figure 1. 10 years evolution of top R&D investors; EU vs World (2007-2016)**

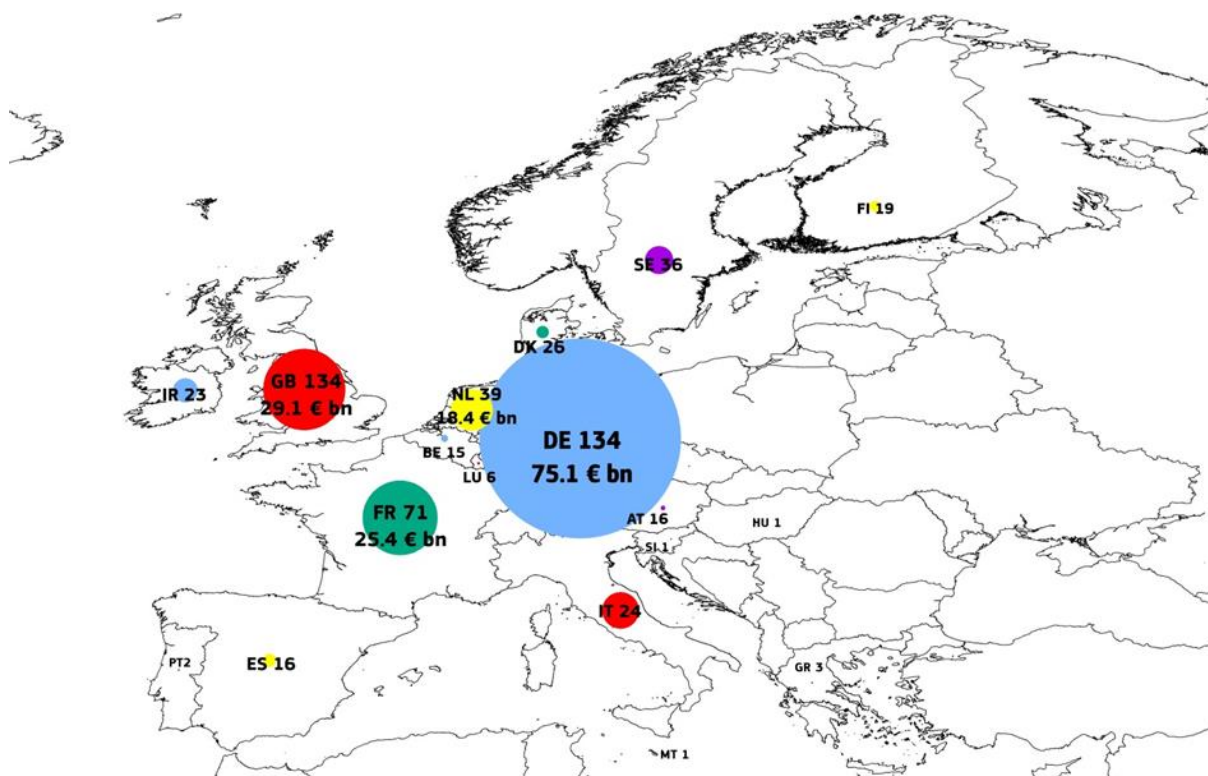


Note: The world figures include those of the EU.

Source: Hernandez et al. (2017) - European Commission, JRC/DG RTD.



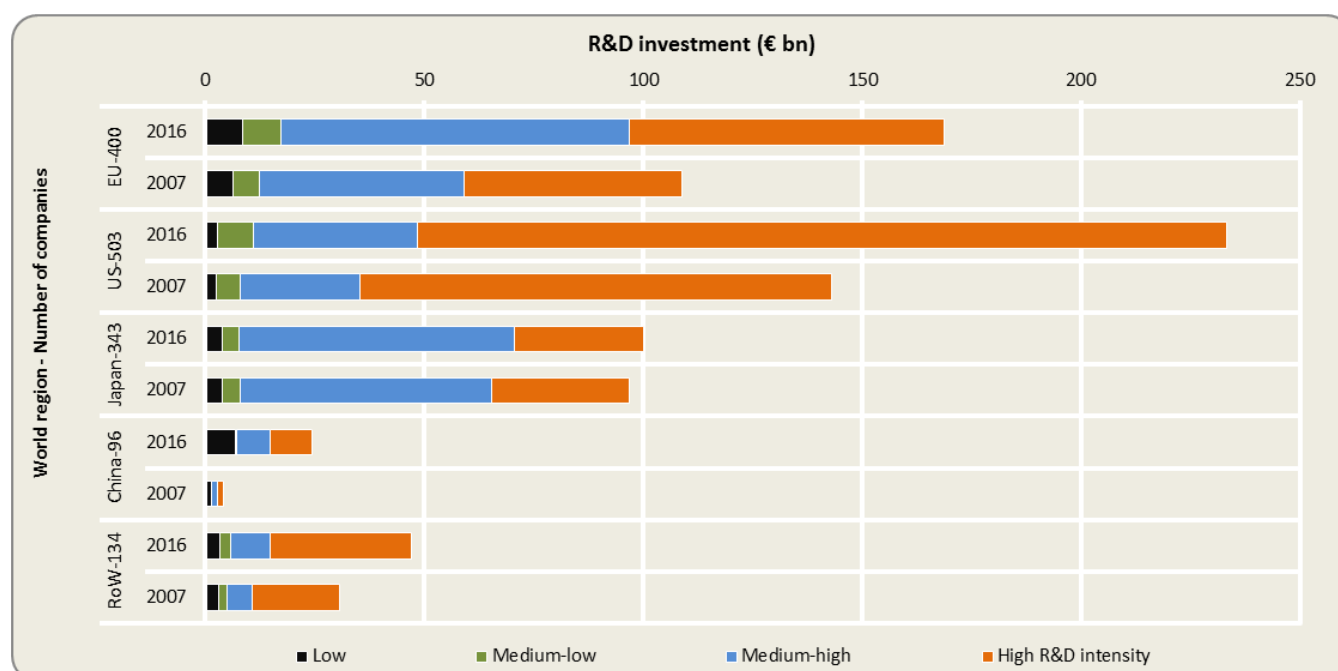
**Figure 2.** Distribution of the EU companies in the 2017 *Scoreboard* by headquarters country



Note: The number of companies is indicated beside the country code (the map only includes countries with at least 10 companies). R&D is represented with a bubble whose size is proportional to the R&D investment in 2016 in that country.

Source: Hernandez et al. (2017) - European Commission, JRC/DG RTD

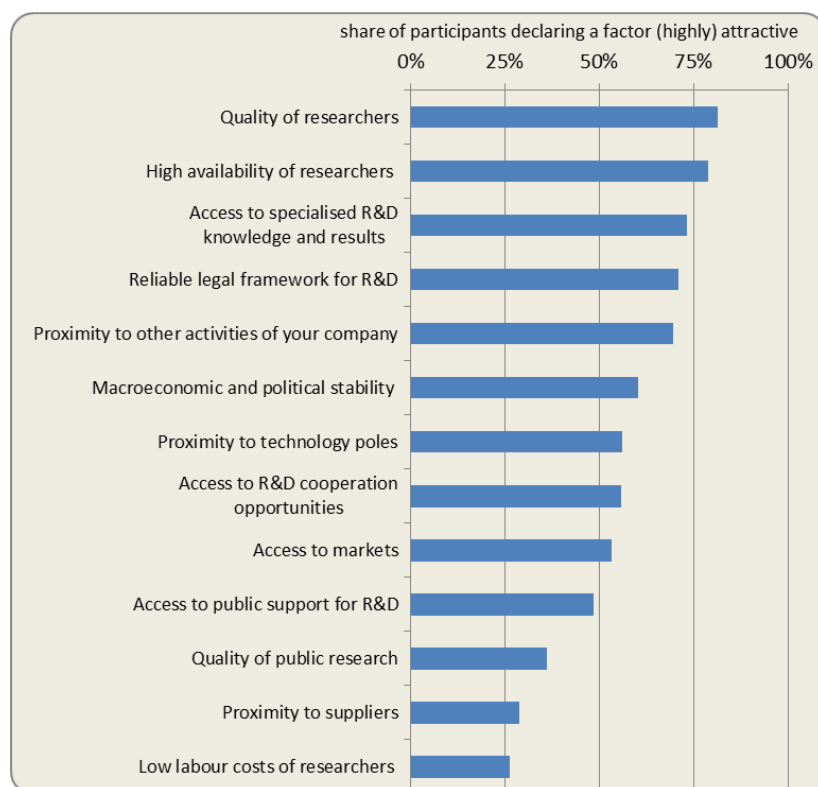
**Figure 3.** R&D investment in 2007 and 2016 by main region and sector group



Note: Figures displayed refer only to the 1476 companies for which data are available for all variables (R&D, Net Sales and Employment) and both years (2007 and 2016). "RoW" in the y axis means "Rest of the World".

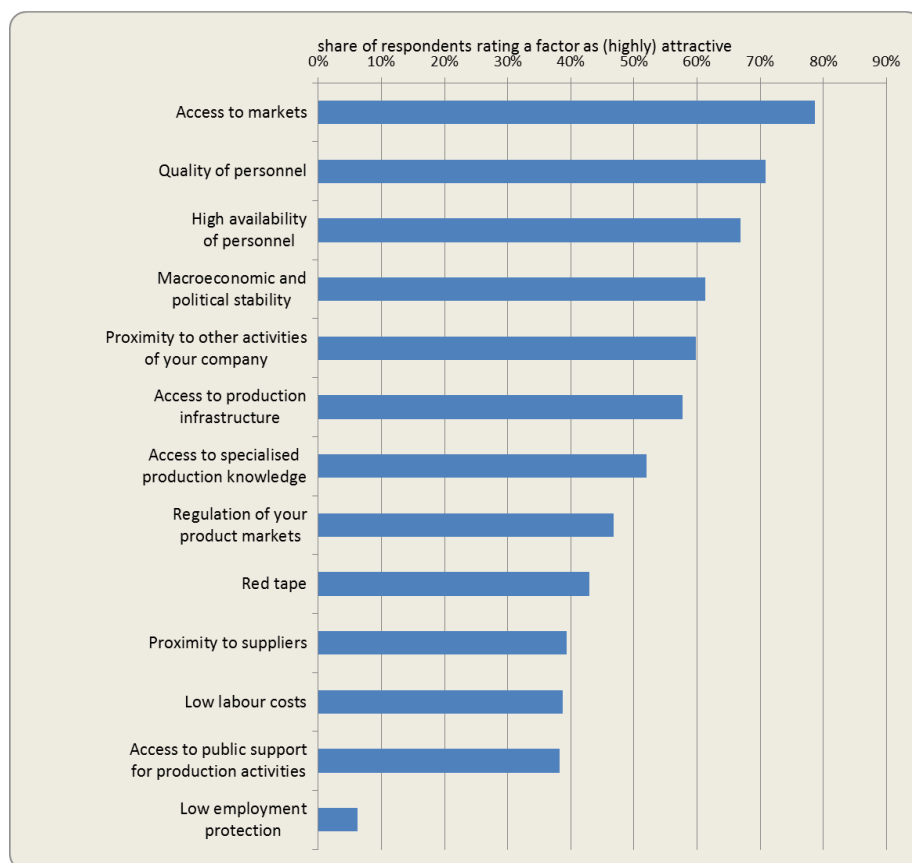
Source: Hernandez et al. (2017) - European Commission, JRC/DG RTD

**Figure 4. Factors of attractiveness for R&D location of top R&D investing firms (2017)**



Source: Potters et al. (2017) - European Commission, JRC/DG RTD

**Figure 5. Factors of attractiveness for production location of top R&D investing firms (2017)**



Source: Potters et al. (2017) - European Commission, JRC/DG RTD