



J R C T E C H N I C A L R E P O R T S

THIRD WORKSHOP INDUSTRIAL RESEARCH AND INNOVATION MONITORING AND ANALYSIS (IRIMA)

SUMMARY REPORT

INTERNATIONALISATION OF CORPORATE RESEARCH AND DEVELOPMENT AND INNOVATION

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Corporate Research and Development and Innovation (R&D&I) activities have become increasingly integrated in global production and innovation networks. While the internationalisation of corporate R&D&I is not new, its speed and extent have increased in recent years in response to increased global competition, technological change, and the availability and costs of skills.

The increasing internationalisation of corporate R&D&I has implications for the European Union's future economic growth plus research and innovation. Global innovation networks lead to a larger base of knowledge and technologies and contribute to matching the demand for innovation and supply of science and technology. Innovative enterprises integrated in global production and innovation networks are likely to drive the European innovation-based growth in the next decade.

This third workshop of the Industrial Research and Innovation Monitoring and Analysis (IRIMA) project³ addressed recent evidence on the internationalisation of corporate R&D&I and its impact on productivity. Key research findings from IRIMA and invited external experts were discussed in two sessions (on Firm Level Evidence from the Top R&D Investors and on Cross-Country Analysis and Case Studies). A Policy Panel discussion on the implications of the internationalisation of corporate R&D&I for the Europe 2020 strategy concluded the workshop. The Agenda and List of Participants is given in Annex 1.

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² 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.

³ IRIMA's overall aim is to support the implementation of the 3% R&D investment intensity target enshrined in the Europe 2020 strategy. More information, including reports of the previous two workshops, is available at <http://iri.jrc.ec.europa.eu/seminars.html>.

Xabier Goenaga-Beldarraín welcomed the participants and presented the IRIMA workshop as part of the wider activities of the Knowledge for Growth unit at the JRC in supporting key policy areas related to the Europe 2020 strategy, such as research and innovation, industrial policy and the implementation of smart specialisation as a guiding principle for the use of the new generation of European Structural and Investment Funds. The workshop participants introduced themselves via a tour de table. There were some 40 participants, with around one third each from academia (universities and research institutes), the Commission (DGs JRC, RTD, ENTR, ECFIN, REGIO) and other international institutions (ECB, EIB, OECD).

SESSION 1 - FIRM LEVEL EVIDENCE FROM THE TOP R&D INVESTORS

This session looked at the recent empirical evidence on the internationalisation of corporate R&D and innovation and its impact on productivity, drawn from the analysis of firm-level microdata and more particularly from world top R&D investing companies.

Patrick Brenier, who chaired this Session, presented DG RTD's policy perspective. The first signs of economic growth and increased fiscal margins in Member States provide an opportunity to the public sector to support and leverage growth enhancing investments. Particularly important in this context are measures which promote business R&D investments as a mean to gradually renew Europe's industrial fabric and to increase its competitiveness and capacity to create employment. Given that large multinationals cater for more than 80% of world total business R&D investment, monitoring and assessing their investment trends and performance can be particularly revealing and informative to policymakers. The evidence showing the increasing proportion of R&D investments outside Europe by EU based companies indicates a need for policies which makes the EU a more attractive place for corporate R&D&I activities.

Fernando Hervás ([link](#)) presented the IRIMA project and highlighted key relevant evidence from the research output produced by the research team.

Iulia Siedschlag ([link](#)) highlighted the research context and policy relevance of the workshop. Further, she highlighted key research and policy issues to be discussed at the workshop. In addition, she summarised evidence and policy implications on determinants of the location choice of R&D activities by multinational enterprises in Europe. The research results identify proximity to existing R&D foreign affiliates and the quality of the knowledge base of regions as the main factors driving inward international investment in R&D in the European Union. This evidence highlights the importance of policies aimed to improve the quality of skills and strengthen the research and innovation capacities of regions.

Alexander Tübke ([link](#)) presented evidence from the 2013 EU Survey on Industrial R&D Investment on the attractiveness of European Union's countries to inward foreign R&D investment as well as drivers of outward investment in R&D.

These main contributions were presented in the background note ([link](#)) circulated to participants prior to the workshop.

Michele Cincera ([link](#)) showed the results of a study analysing the diversification and productivity growth in large European R&D companies in the light of internationalisation. The main results indicate a positive impact from internationalisation on corporate R&D productivity, especially in the US, while a negative impact for the firm's industrial diversification is found.

Davide Castellani ([link](#)) presented an empirical analysis carried-out using a sample of the EU Industrial R&D Scoreboard, including information on subsidiaries (2.800 parent companies and more than 200.000 subsidiaries of these firms in 2012). The purpose was to investigate to what extent the patterns of investments in R&D, the degree of multinationality and industrial diversification correlate with firm productivity and (technical) efficiency, and how they help explain the productivity and efficiency gap of EU firms. On the link between multinationality (measured through several indicators constructed on the basis of subsidiaries) and R&D and productivity (noting that strict causality cannot be inferred from the results) the following results have been obtained:

- The degree of multinationality of a firm has a positive correlation with the firm R&D investments and a negative correlation with its productivity. This may reveal that while multinationality creates incentives to invest in R&D, it creates organizational complexity that may dampen productivity.
- This pattern appears to be particularly the case in the Medium-High R&D and Low/Medium-Low R&D, which is consistent with the idea that in such industries the learning opportunities are more limited, so the organisational costs may outweigh the benefits from internationalisation.
- At the same time, multinationality boosts the productivity effect of investments in R&D, by enabling firms to reap higher benefits from international operations, possibly allowing them to absorb more knowledge from foreign markets.
- When taking into account the number of subsidiaries and the degree of multinationality, the productivity lead of EU firms with respect to the rest of the world disappears.
- EU firms have the lowest propensity to invest in R&D, for all industrial sectors.
- Industrial concentration has no significant correlation with firm productivity, but it is positively correlated with R&D intensity.
- A firm exploring activities in different sectors abroad will have a higher incentive to invest in R&D. This is consistent with the idea that these firms need to put substantial efforts into leveraging learning opportunities stemming from international activities. However, these efforts may end up increasing organisational costs, and thus lowering productivity.

The discussants (**Laura Resmini, Elena Huergo, Bernard Dachs, Michele Cincera and Maria Dolores Añón Higón**) offered a number of methodological suggestions, e.g. assess the robustness of the results by using quantile regression, which can be more appropriate to account for the presence of outliers especially in the measures of multinationality; and address the endogeneity of multinationality with respect to R&D and productivity. Whilst the lack of information on the stock of subsidiaries before 2012 prevents the application of any type of panel econometric technique, or to use past values of multinationality indicators as instruments, one can however exploit the relatively long series of data on past R&D, productivity and other firm characteristics and use them, even in a cross-sectional setting, as instruments to mitigate the endogeneity of the multinationality indicators. The results should also always take into account the fact that the sample is, by definition, biased towards the large R&D spenders. Therefore, comparison with aggregate statistics or with representative sample can be problematic and care should be exercised when extrapolating the results.

Various discussants also suggested investigating the heterogeneity of EU countries further. For example, trying different groupings of EU countries and highlighting the 'core' countries from the more peripheral ones. Related to this, there were a couple of comments on the impact of institutional/external factors, such as introducing country-specific characteristics as independent variables using the OECD measures of product and labour market regulation or the World Bank's Doing Business indicators.

SESSION 2 – CROSS-COUNTRY ANALYSIS AND CASE STUDIES

This session looked at recent empirical evidence on the internationalisation of R&D&I, based on country and sector specific analyses.

Francisco Caballero Sanz, as Chair of this session, underlined the enormous challenge faced by policymakers when designing industrial policies for changes to the structural nature of EU industry and directed towards attracting more businesses with the ultimate objective of increasing employment. More data and empirical evidence are thus needed to support policy development for this. In this respect, the results shown in the IRIMA surveys indicating that policy measures such as, for example, subsidies, tax credits, were not deemed as important by investing companies as the size of the market or the access to knowledge were considered to be very relevant.

Bernhard Dachs ([link](#)) presented an analysis of the impact of the economic and financial crisis as reflected in Business Enterprise Research and Development (BERD) statistics. The share of foreign firms as a proportion of total corporate R&D decreased in a majority of countries during the crisis and the

relative level of internationalisation did not recover in the analysed period (2009-2011). However, the global distribution of BERD did not change much. Both the trends in inward BERD, as well as the outward investments of, for example, US companies, showed a remarkable stability in the country mix. The relationship between the US and the EU with respect to R&D investment location⁴ is still strong after the crisis, while other OECD and non-OECD countries are gaining share in the total global flows of international R&D&I investments. The rise of Asian countries in the share of these international R&D&I investment flows (both as host and home countries) is slow and did not accelerate during the crisis. It was stressed that, while the decrease in internationalisation due to the crisis is considered a bad sign, due to the likely reduction of spillovers and slow-down of structural change, governments of host countries can do little to prevent this. The underlying changes in global aggregate demand and expectations are exogenous to the host country and special incentives directed at foreign firms have little impact and can conflict with EU competition law.

Elena Huergo ([link](#)) presented a study on the relationship between domestic and international outsourcing and companies' innovativeness, carried-out on a sample of more than 10.000 companies extracted from the Spanish sample in the Community Innovation Survey (CIS). The study found that international outsourcing had a positive and significant effect only on process innovation, whereas national outsourcing increases all types of firms' innovativeness (product and process innovation and the probability to innovate).

Paulina Ramirez ([link](#)) gave an overview of a sector specific study on outsourcing and offshoring of R&D in the pharmaceutical industry. The study focused on a value-chain analysis of pharmaceutical companies and contract research organisations based on interviews with the appropriate decision makers. While that sector has traditionally been very R&D intensive and historically an area of European strength, there is now a crisis of productivity. Despite significant increases in R&D expenditure, the number of new chemical entities discovered is stagnating. Thus, pharmaceutical companies are living on past discoveries which are increasingly difficult to sell to governments and health insurance companies, whilst they are not getting the breakthroughs for future growth. The main bottleneck here is the lack of scientific knowledge about causes of more complex diseases.

In this context, large companies outsource 40-50% of the whole value chain and, depending on the corporate policy, any part of it. This reduces risk (as molecules used to create new medicines are bought in at a later stage of development), as well as costs (as many tasks are outsourced to lower cost countries or universities). Collaborations with academia and biotech companies are thus now becoming central to the on-going product development work of big pharmaceutical companies. In this complex environment, pharmaceutical R&D locations are concentrated in key areas close to centres of scientific knowledge, where academic alliances are taking place, and large R&D labs located close to manufacturing facilities are being closed. All parts of the discovery process that require judgement, creativity and cannot be articulated in a Standard Operating Procedure (SOP) are kept in-house. Routine R&D activities, such as toxicology, drug metabolism and formulation, are outsourced. As a result, R&D becomes a more variable cost. In many cases, research teams are laid-off, tasks are outsourced and the same personnel are then sub-contracted at cheaper rates. In this way, pharmaceutical companies are losing part of their cumulative knowledge base and the national R&D base and industrial knowledge is weakened. In a global context, this also puts European/US contract research organisations under significant pressure from Chinese and Indian ones.

The study underlines the importance of public investment in basic science as this is the main obstacle in R&D productivity in this industry. Firms want support for basic, blue-sky research. It is also key to foster knowledge sharing in areas where lack of scientific knowledge is blocking technological progress. Workforce skills development needs to be emphasised, together with institutional systems that support new firm formation and experimentation with new business models (e.g. finance, science incubators).

⁴ Evidence shows that bilateral EU-US R&D internationalisation plays a prominent role in this respect, accounting for about two thirds of all R&D expenditure of foreign-owned firms in both regions. See: "Internationalisation of business investments in R&D and analysis of their economic impact", European Commission, 2012: http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=other-studies

Industry representatives participating in the study considered that policymakers should be wary of policies that focus on IPR to stimulate innovation, e.g. 'patent-box'. This is because contract research organisations do not own the IPR but they are doing the R&D and contributing in significant ways to innovation. Policy measures would therefore need to see industry as a dynamic eco-system with different types of firms with different needs. For Europe, there is the danger of prolonged 'austerity,' increasing the shift of R&D to China as a future dynamic market.

POLICY PANEL - EVIDENCE-BASED POLICY IMPLICATIONS FOR EUROPE 2020

This panel considered the policy relevance of the empirical results presented in the previous sessions as well as the relevance of the planned IRIMA research agenda on this topic (circulated in advance in the workshop background document⁵).

Frédérique Sachwald highlighted a number of evidence gaps in relation to the internationalisation of corporate R&D to inform research and innovation policies. First, policymaking would benefit from a more extensive descriptive analysis of the data on top R&D investors collected by the IRIMA project. Second, while it is widely recognised that human capital is an important factor for attracting investment in R&D, there is little evidence about the specific skills that are demanded. Third, further analysis is needed to provide evidence on the effects of R&D tax credits on the choice of location by multinational companies. Fourth, while the importance of concentrating R&D activities to generate positive knowledge spillovers is widely acknowledged, little is known about the mechanisms and best policy instruments to achieve an optimal agglomeration of R&D activities. Finally, to better understand the drivers of the internationalisation of R&D, more evidence is needed on R&D activities sourced internationally.

Mariagrazia Squicciarini focused on the policy implications from increased global interdependencies. The importance of cross-border spillovers which require a rethinking of policymaking at national and European levels was highlighted. With respect to evidence gaps to inform research and innovation policies, the need to analyse the effects of fiscal policies, such as R&D tax credits on incumbent R&D investors versus start-ups, was considered necessary. To fill these gaps, ongoing projects at the OECD consider the impacts of patent boxes on R&D investment. Additional analysis has provided evidence on the role of knowledge-based capital in generating productivity growth. An important issue to be considered is financing R&D&I. Both the intensive and extensive margins of R&D&I should be analysed as the implications for policy differ.

Patrick Brenier noted the importance of evidence on both inward and outward international investment in R&D. The sector-level analysis, such as the one on offshoring of R&D in the pharmaceutical industry discussed at this workshop, was considered to be particularly relevant.

⁵ See: <http://iri.jrc.ec.europa.eu/documents/10180/247186/3rd%20IRIMA%20Workshop%20Background%20Note>

ANNEX 1:
AGENDA AND LIST OF PARTICIPANTS



**THIRD IRIMA WORKSHOP
INDUSTRIAL RESEARCH AND INNOVATION
MONITORING AND ANALYSIS**

Internationalisation of Corporate R&D and Innovation

Agenda

5th June 2014

Brussels,
CLUB de la
FONDATION UNIVERSITAIRE
Rue d' Egmont 11, B - 1000

09h00 – 09h15 **WELCOME**
Xabier Goenaga, Head of Unit DG JRC.J.2

09h15 – 11h00 **INTERNATIONALISATION OF CORPORATE R&D AND INNOVATION:
FIRM LEVEL EVIDENCE FROM THE TOP R&D INVESTORS**
Chair: Patrick Brenier, Deputy Head of Unit DG RTD.A.4

**Internationalisation of Corporate R&D and Innovation: Research
and Policy Issues**

Fernando Hervás, Iulia Siedschlag, Alexander Tübke, DG JRC.J.2

**Globalisation, Industrial Diversification and Productivity Growth in
Large European R&D Companies**

Michele Cincera, Free University Brussels

Multinationality, R&D, and Productivity

Davide Castellani, University of Perugia

Discussants: *Laura Resmini*, University Luigi Bocconi Milan, *Elena Huergo*,
Complutense University of Madrid, *Bernard Dachs*, Austrian Institute of
Technology, *Michele Cincera*, Free University Brussels, *Maria Dolores Añón
Higón*, University of Valencia

Open Discussion

Concluding Remarks and Policy Implications



11h00 – 11h15 **COFFEE BREAK**

11h15 – 13h00 **INTERNATIONALISATION OF CORPORATE R&D, INNOVATION AND PRODUCTIVITY : CROSS-COUNTRY ANALYSIS AND CASE STUDIES**

Chair: *Francisco Caballero Sanz*, Head of Unit DG ENTR.A.4

R&D Internationalisation and the Global Financial Crisis

Bernhard Dachs, Austrian Institute of Technology

The Effects of International and Domestic R&D Outsourcing for Firm Innovation: Evidence from Spain

Elena Huergo, Complutense University of Madrid

Outsourcing and Offshoring of R&D in the Pharmaceutical Industry: Evidence and Policy Implications from a Global Value Chain Analysis

Paulina Ramirez, University of Birmingham

Discussants: *Tanja Tanayama*, European Investment Bank,

João Amador, Central Bank of Portugal, *Liza Jabbour*, University of Birmingham, *Maria Luisa Mancusi*, Catholic University Milan

Open Discussion

Concluding Remarks and Policy Implications

13h00 – 13h30 **INTERNATIONALISATION OF CORPORATE R&D AND INNOVATION EVIDENCE – BASED POLICY IMPLICATIONS FOR EUROPE 2020**

Chair: *Xabier Goenaga*, Head of Unit DG JRC.J.2

Frédérique Sachwald, Innovation for Growth – i4g, High Level Economic Policy Expert Group

Mariagrazia Squicciarini, Head of Unit, Science and Technology Directorate, OECD

Patrick Brenier, Deputy Head of Unit DG RTD.A.4

13h30 – 14h30 **LUNCH**



JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

Serving society
Stimulating innovation
Supporting legislation