



**8th IRIMA WORKSHOP
INDUSTRIAL RESEARCH AND INNOVATION
MONITORING AND ANALYSIS**

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Corporate R&D and Innovation Value Chains: Implications for EU Territorial Policy

SUMMARY REPORT

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Objective of the workshop

This workshop was part of the Industrial Research and Innovation Monitoring and Analysis II (IRIMA II) project,³ under Work Package 3 which aims to better understand how corporate R&D and innovation activities and networks operate as part of Global Value Chains⁴ (GVCs). The workshop focused on the global R&D and innovation Value Chains (GIVCs) - *whereby firms increasingly break up their knowledge generation, R&D and innovation activities across international networks of actors and places in order to create and bring innovations into the market.*

The key issues discussed between academics, policymakers and industry representatives focussed on the following questions:

1. What are the patterns and rationales underlying the decisions of firms to **further break up (or not) their corporate R&D and innovation processes into sub-functions or activities** across international networks of actors and places?
2. How do these patterns of knowledge and technology sourcing and generation **relate to the broader GVCs and production-related networks?**

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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 See: <http://iri.jrc.ec.europa.eu/home/> The activity is undertaken jointly by the Directorate General for Research and Innovation (DG RTD.A; see: <http://ec.europa.eu/research/index.cfm?lg=en>) and the DG Joint Research Centre, Directorate B Growth & Innovation (DG JRC-B; see: <https://ec.europa.eu/jrc/en/science-area/innovation-and-growth>).

⁴ It refers to the increasing geographical fragmentation (at worldwide scale) of the full range of activities that firms engage in to bring a product to the market, from conception to final use (i.e. including design, production, marketing, logistics, distribution and support to customers). See also Global Value chain Initiative at <https://globalvaluechains.org/concept-tools>

3. Which differences can be observed **across industries and between the manufacturing and services sectors**?
4. How do these dynamics **interact with and impact on the economic, industrial and technological systems** within and across European territories?
5. How should the current **territorial policies be adapted** to respond to these corporate trends? How can policies **promote at the same time the place-based development of innovation capabilities and the upgrade of the EU industry** in the global value chains and innovation networks?

Román Arjona Gracia (DG RTD A.4) opened the workshop stressing the importance of achieving a better understanding of the complexity of innovation dynamics and the interplay between their global and local dimensions. He underlined the need to focus on framework conditions, non-R&D innovation (intangibles) and firm's behaviour within and across GVCs worldwide. Fernando Hervás Soriano (DG JRC B.3) briefly presented the role of the DG Joint Research Centre (JRC) in collecting evidence for policy support. In this framework, IRIMA provides sound contributions to the analysis of the evolution of industrial structures, the role of public R&D and the location choices of companies.

Key Note Speech: MNEs' innovation investments: regional trajectories and firm-specific behaviours

The day was kicked off with a keynote speech by Simona Iammarino (LSE, UK) on Multinational Enterprises' (MNEs') investment in innovation on her recent work with Comotti and Crescenzi (2017), and Gagliardi (2017). She stated that the organisation of MNEs has undergone significant geographical changes over the past decades due to globalisation. This has increased their role in shaping innovation ecosystems and location patterns, with North-South and core vs. periphery patterns emerged increasingly sharp in Europe. The presentation showed descriptively that **the dispersion of MNE innovative activities across national borders goes hand in hand with an increased concentration within these borders**, where innovation gathers in fewer regions (as suggested by evidence on the concentration of Foreign Direct Investment (FDI) and intramural R&D in the EU Member States). In addition, MNE location choices of their innovative operations *vis à vis* other activities (i.e. Headquarters, Sales, Production activities, Logistic & Distribution) are highly spatially concentrated for **both** inward and outward FDI. This regional dimension of connectivity, and the implications for territorial inequality, have so far received scant attention in both academic and policy circles.

The presentation then zoomed on the micro-level of the firm, looking at the relationship between firm innovative behaviour (MNEs vs. domestic firms) and the perception of market risk. The main results pointed to a strong heterogeneity in firms' behaviour: **whereas single domestic firms tend to reduce their innovative efforts in presence of market risk, a positive relationship between perceived risk and investment in innovation emerges for**

MNEs. Such a relationship is also mediated by the characteristics of the external environment, i.e. the regional system where firms are located.

The results of this research have some specific policy implications. It suggests that **innovation policy measures cannot be captured in fixed outcome measures** (e.g. the 3% R&D investment target) across territories. They should be better integrated with other development-oriented policies, at the same time considering spatial differences and appreciating innovation as a complex process with the aim of supporting the ‘right’ innovation for the ‘right’ place. For less developed regions, this may translate into supporting capacity building and institutional change in the first step. In the second step, the policy incentives can then be linked to R&D investment in order to active internationalisation of firms in potential innovation hubs. This could then go together with encouraging cross-country skill flows and social and institutional openness across all regions.

The lively discussion after the presentation gave some interesting insights. Industry representatives stressed the need for their organisations to constantly search for growth and organisational efficiency. These companies constantly revise their shape and engage in Mergers & Acquisitions (M&A) activity to access knowledge and capabilities, and spin-off segments that are not core in their strategies. Especially in pharmaceuticals and other technology- or knowledge- intensive sectors, the development cycles for new products and technologies are much longer than those of organisational change. Therefore, **larger MNEs are more likely to acquire knowledge-intensive firms than invest in R&D beyond 5-10 years to maturity.** These knowledge-intensive firms are often startups and from very specific locations where the knowledge is found, such as Silicon Valley. This leads to a constant organisational change of MNEs where acquisition of knowledge-intensive firms goes together with outsourcing of high risk and spin-off of non-core businesses, so these companies become vertically disintegrated. The second session of the Workshop went into this aspect more in depth.

Some comments were also provided on the scarcity of data, particularly at comparative level, and further implications of the presented research.

Session I. the break-up of corporate R&D and innovation activities

The Workshop continued with a presentation of the Global Value Chain project currently undertaken by IDEA and VDI on behalf of the European Commission. Els van de Velde (IDEA) provided early insights from two case studies (both from the semiconductors sector) The study focuses on the organizational and geographical features of firms’ Global Innovation Value Chains. These case studies indicate, once again, the importance of **firm-specific GVC drivers.** While company A has its R&D centres internationalised but concentrated in few sites, company B has many more and smaller branches.

The decision on where to locate R&D is sometimes completely independent from the actual location. **An important location decision driver is a specific technology.** Company A acquired an US company because of its technology. It was decided to maintain the existing R&D centre in the US. The maintenance of the R&D activities in the US leads to R&D augmenting activities in Europe for company A.

Co-location of production and innovation activities is once again supported by studies: this is confirmed by many presentations and feedback from the audience. Company B locates basic R&D and innovation in the EU and US, while more applied research is outside these areas, mainly for market considerations. Foreign R&D is often co-located with production in semiconductors.

Governments can play an important role in country attractiveness and framework conditions. One of the main fears that foreign R&D&I activities lead to the hollowing-out of domestic activities is not supported by these case studies. Instead, **foreign innovation activities may lead to domestic increases in innovation activities.**

Petros Gkotsis (JRC.B3) presented an exploratory approach to estimate the regional R&D expenditures (BERD statistics as provided by Eurostat) exploiting the R&D and patent (REGPAT) data of Scoreboard companies. For this purpose, it was assumed that the distributions of patents are proportional to the R&D investments and that R&D is contemporaneous to the production of patents. The estimation of regional business R&D suggests that **EU headquartered companies contribute about 80% of the EU's territorial business R&D. Eurostat's BERD data and the estimator are highly correlated,** especially for the EU (0.99). This methodological approach yields relevant potential to characterise the location of companies' innovation activities worldwide, and for designing better targeted innovation policies, differentiated by sector and region.

Session II. Interdependencies and differences in GVCs and GIVCs

This second session focused on cross-functional interdependencies in the global value chain. The research by Inge Ivarsson and Claes Göran Alvstam (University of Gothenburg) focused on the Swedish manufacturing sector and the importance of the co-location of R&D and manufacturing at the sub-activity level.

Co-location of research activities with production seems to be the rule: a large majority of the foreign R&D units of the investigated sample of companies are located close to other corporate activities, especially production. New R&D sites are mainly opened for new technologies – closely linked to M&A decisions. Most foreign units are dedicated rather to development than research.

The second presentation by Koen De Backer (OECD) initiated with a semantic discussion on the use of different terminologies of GVCs, Global Innovation Networks (GINs), offshoring, and outsourcing. While relevant for academic conceptual debates, these different terminologies may not add much to the understanding of the actual industrial dynamics.

De Backer's analyses centred on global cities as places where GINs and GVCs are concentrated. This makes the links between these cities more crucial: it was confirmed that distance is not dead, and different time zones do matter. He reiterated the importance of collocation by stating that the **prior offshored production has a pull effect on R&D offshoring, but only once the decision to offshore R&D is taken.**

Evidence by patent data suggests that GINs have been on the rise in the last decades, but currently show stagnation, mainly reflecting the increasing weight of Asia, and especially China. Trade is an important factor of co-invention within GINs: more intensive trading goes together with more intensive co-invention, and countries that do not trade also show a lower propensity to co-invent.

The activities of GVCs are captured by trade and Value Added data. **GVCs are much more extensive and pervasive than GINs.** Regarding the links between GVCs and GINs, while there is a positive effect of engaging in trade on being involved in innovation cooperation, this is not necessarily the other way around. GINs may lead to GVC upgrading, but there is no evidence that the attraction of R&D activities is enough to upscale GINs to GVCs. As the offshoring of manufacturing today may lead to the erosion of R&D capability, it is important for regions that a critical mass of production is nurtured. Once again in the discussion, there is complementarity between trade and innovation policies⁵: being part of a GIN is not enough. More research is needed to capture the interdependencies between GINs and GVCs and their economic benefits.

Bernhard Dachs (AIT) then presented the results of a study on global value chains and the internationalisation of BERD. The R&D expenditures in the EU, as reported to national statistical offices, indicate an increasing weight of foreign affiliates' R&D. Offshoring is however not the main mode of expansion for R&D, but offshored R&D is rather complementing or expanding the home-base. **The EU is an attractive R&D location for non-EU firms,** in particular for US firms that have increased their R&D expenditures in the EU since the 1990s.

There seems to be a **recovery from the 2008 crisis in terms of internationalisation,** which is picking up again in the most recent years. The results also underline the role of **UK as a hub for non-EU firms in Europe;** the importance of private R&D for integration into wider innovation networks; and the strong link between knowledge and location-specific aspects and collocation. The main outcome is that, although there is evidence of recovery, certain indicators, such as FDI flows, remain lower than the pre-crisis levels and R&D is highly concentrated, performed mainly in high income countries and regions.

Session III. Policy insights for IVCs and local innovation systems

Paulina Ramirez (Birmingham Business School) opened the third session by presenting the main policy challenges for national and local innovation systems due to the impacts of GVCs.

⁵ This point has also been underlined in the Keynote presentation by Simona Iammarino.

Contract Research Organisations (CROs) play an important role in the fragmentation of the discovery process and the organisational disintegration of pharmaceutical companies. Subcontracting in this sector covers both routine R&D tasks to more complex, full programmes. The breakup of the corporate Value Chains has been pushed by the larger MNEs to reduce costs, thus producing a decoupling of organisational and territorial aspects. This can weaken the science and technology base of national/regional innovation systems. CROs are relatively young companies and provide opportunities for corporate research that would otherwise have been discontinued; the main point here is that CROs are under great efficiency pressure which compromises the consolidation of knowledge. After a couple of decades, since they are gaining weight in the pharmaceutical sector, some CROs are taking greater risks upscaling their innovative behaviour.

Regarding the territorial dimension, an important aspect is that there is a clear shift to the world east in the pharmaceuticals sector, which is not picked-up in official statistics. Companies from China provide increasing shares of value added and employment in the sector.

One of the main policy implications of this work is that regions have to ask themselves **which activities should be kept and provide added value to the regional economy and knowledge base.** While some industries are more modular than others, both simple and complex tasks are outsourced in the pharma sector depending on the understanding of the whole Value Chain. Policies like patent boxes may seem successful at first sight, but disregard that the company benefitting from a patent box in a Member State may completely outsource the work and only attribute the patent to itself, so that employment and innovative capacities are built up elsewhere. **The main challenge for policy is to integrate these trends and build activities that lead to learning upgrading and building of know-how and linkages with industry and education.**

René Belderbos (KU Leuven, Maastricht University, UNU-MERIT) provided insight on how **MNEs concentrate their investments in global cities:** metropolitan areas such as New York, Shanghai, Singapore, etc. – **with a rising trend in Asian cities.** Only 90 metropolitan areas in the world are responsible for about half of innovative activity. These global cities are characterised by offering an attractive environment for global expatriate talent, and thus a high diversification in terms of knowledge production. They also offer at the same time knowledge connectedness (depth) and the knowledge connectivity (breadth).

Companies choose these global cities that serve as innovation hubs with a presence of strong institutions, universities and private firms. As **not only the local knowledge base is decisive for firms, but also linkages to other countries and cities are of high importance,** local and regional policies may support such links. Examples on the importance of single individuals and teams as knowledge hubs were given, so policies should focus on the attractiveness and mobility of research scientists, which is crucial in this respect (e.g. specific visa and tax reductions for highly qualified expats).

Alexander Tübke (JRC.B3) then presented the results of the EU R&D Investment Survey regarding GVCs and policy conclusions. The responding companies' expectations for R&D investment for the next three years show the ongoing participation of European companies in the global economy with higher growth rates outside the EU than inside. **Path-dependency is an important factor in the location of R&D activities:** 83% of the companies mention the home-base as the main R&D location. However, internationalisation is a widespread phenomenon amongst the top investors. Almost two-thirds of the Survey participants perform R&D in at least three different countries, while only 12% carries out R&D in a single country. Also, two-thirds of the companies declare to have R&D activities in the three main macro-regions (North-America, EU and Asia).

The Survey confirms few features that were also underlined by the different speakers: companies tend to concentrate R&D activities in fewer locations than production activities: 34% of the companies perform R&D in 1 or 2 locations, while for production this is only 17%. There is certainly **an overlap of locating R&D and production activities:** 75% of the companies in the Survey perform the highest share of their R&D at the site where also the main production activities are located. The Survey shows that this holds across the sector groups.

Within the surveyed sample, the automobiles & parts sector remains a large employer for highly-skilled workers in the EU. The sectors aerospace & defence, chemicals, oil & gas producers are characterised by a high share of R&D employees on total employees, probably due to the combination of highly specialised technical activities with development or laboratory activities, and are therefore key in creating high-skilled employment.

According to the Survey, and in line with a huge academic literature, the **type of R&D undertaken varies by sector.** The automobiles & parts companies spend almost 80% in technology development, followed by 10% in software development. The technology hardware & equipment companies also have a high proportion of technology development (55%) but instead spend 10% in management on R&D projects and, surprisingly, not in software development. The profile of the pharmaceuticals & biotechnology companies is much different: almost 60% of their R&D is spent on market launch (which presumably includes very costly clinical testing and regulatory approval activities) and only 20% on technology development.

A main policy implication from this year's Survey, as in earlier Surveys, is the **low importance of labour costs for deciding the location of R&D (and sometimes also for production activities)**, depending on the industry technological characteristics. Companies attach much more value to **high availability of personnel and knowledge**, access to (economically and politically stable) markets and proximity to other activities within the company. In combination with the fact that market pull is the most important driver for future R&D investments, this shows the importance of a healthy economy for attracting R&D and production activities.

Round table discussion

During the round table discussion, three main topics were touched upon by the participants:

Analytical focus, semantics and needs for additional evidence:

The round table discussion started by reiterating how **the scientific analyses presented are prisoners of classifications and categorisation**. The presentations showed the frontier of current research on the internationalisation of innovation. Indeed, the most common data sources (patent data, WIPO, FDI, BvD Orbis, financial accounts and official national statistics) were covered. Many results coincide, e.g. the observation of increasing internationalisation, the shift to Asia, the importance of the regional knowledge and skills base, the blurring of corporate and institutional borders, the concentration in few cities/regions and the increased networking.

Industrial associations underlined that the analytical focus, semantics and categories may be well suited for the purpose of scientific analysis. Yet, in current industrial dynamics, corporate research is more and more cross-categorical and cannot be captured by standard economic indicators and classifications (e.g. Value Added in services). Companies do not fall into categorisations as they sell integrated systems and services and experiences.

From a policy perspective, this calls upon a conceptual revision of the non-linearity of GVCs, underlining the need for additional evidence. Organisational dynamics such as M&A activity and lab openings or closures are not captured systematically by data at the company level, unless they reach a larger size. At the same time, companies face red-tape and financial reporting obligations, so firms have no incentive to generate scientific or policy relevant data. Furthermore, medium-sized and smaller firms obviously have much less reporting capacity than the very large ones.

Industry feedback:

Some important insights came from the representatives of industrial associations (IA) – the automotive and pharmaceutical sectors and – as company representative – Philips.

Underlining the differences of companies' perspectives, the IAs' representatives mention that **companies may first try to exploit what is there and only think about the location options further downstream within a range of other factors**. Despite the fundamental differences, the industry representatives recognised the substantial efforts put into the analyses of GVCs over the past decades and found that the above results well describe the situation and how it evolved over time. Therefore, they stressed the relevance to access such type of analyses.

For the Automotive sector, **basic R&D** forms a small but crucial part of total innovation. Since companies buy basic R&D by acquiring companies, together with the Pharmaceutical

sector, **the industry representatives ask for "pockets" of excellence for basic R&D.** Furthermore, the industry perceives that the majority of Universities and public research institutions is not sufficiently open to cooperation. While the top institutions have a long-standing history of successful public-private collaboration, they feel that a large part of the other institutions do not have sufficient incentives to open-up and explore collaboration with the private sector.

Also, **there is need for more stable policy and regulatory environment**, specifically referring to clarity on Brexit (as this becomes an investment question and the UK is the main hub for US FDI) as well as on trade policies and national policies.

It was also confirmed again that **market and technological opportunities drive firms' R&D locations.** On the other hand, Jan van der Biesen (Philips) shared the experience that R&D labs are usually not relocated, as otherwise R&D teams are broken apart and innovativeness suffers. R&D relocation is therefore only done in exceptional cases, e.g. refocussing or removal to places where specific knowledge or markets exist.

A recent trend is that many companies reduce basic research activities and look instead for cooperation with universities for this specific type of knowledge. However, at the same time, **countries reduce university funding and do not sufficiently incentivise collaboration with the private sector.** Due to reduced public funding, universities are limiting their non-applied, basic research activities. **On the longer term, this might erode the innovation capacities of the EU Member States:** when companies do not find the required knowledge, they will go and find it somewhere else. Hence, a good public-private partnership is important for keeping knowledge where it was created.

Complementary policy messages⁶:

- There is a need for **more and better evidence and data describing GVCs.** Policymakers realize that they play a big role in sharing information and data with the private sector;
- There is **complementarity between both inward and outward internationalisation and collaboration for innovation**, and policy options to foster such complementarity must be based on understanding GVCs and companies;
- The **completion and growth of the EU's internal Single Market** is key for retaining and nurturing the firms' production and R&D activities;
- R&D is needed as a driver for productivity, employment and growth at a global level, although this does not necessarily apply to each region/city at different level of economic and technological development. Supporting R&D and innovation must be **broad and well-embedded into regional strengths** in order to attract companies, invest abroad or upgrade GVCs;
- The companies' search for talents and skills, which can often only be found in certain places around the world, provides a policy option across geography.

⁶ A Science for Policy report with more extensive policy implications is forthcoming in 2017.

- In today's context, basic research is often considered as a highly resource-consuming activity with none or low expected returns in the short or medium terms. Differently, from more applied R&D activities, the basic research has suffered from streamlined agendas in both the public and the private sector. However, these trends neglect the key role of such activities, not only in fueling future science-based innovations but also with respect to their importance for the progress and development of many contemporaneous technological breakthroughs. This suggests that **actions to promote basic research activities**, for instance with the **creation of pockets of excellence for basic R&D**, should be considered as essential seeds for future innovations and growth.