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R&D AND INNOVATION ACROSS GLOBAL VALUE CHAINS: INSIGHTS FOR EU TERRITORIAL INNOVATION POLICY

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Key messages

- Firms organise innovation activities across a wider range of geographically dispersed and specialized units, as compared to previous decades. Moreover corporate innovation processes are broken up into ever finer stages and tasks at the global scale.
- The global dispersion of R&D and innovation activities occurs at a higher pace and goes hand in hand with a stronger regional polarization. Yet, corporate R&D remains a domestic activity, although functional and industry-specific patterns can be observed.
- The increased internationalisation of R&D and innovation activities does not imply the hollowing-out of domestic ones. Foreign innovation activities may actually support domestic increases in innovation.
- The internal and external connections of national and regional systems matter for their innovation performance. The quality of the regional learning and innovation systems is important to attract "relevant activities or segments" of the GVC. On the other hand, better connecting regions to the global innovation networks is important for local growth and employment.
- The extent to which firms co-locate production and innovation activities depends on industry, product and process-specificities.
- Evidence is needed on how R&D and innovation activities are sliced and diced across GVCs, on how these global corporate dynamics interact with national and regional innovation systems and on how they impact on local growth and employment.

The issue

The organisation of Multinational Enterprises' innovation activities along Global Value Chains (GVCs) has important implications for EU territorial innovation policies. The effective participation of EU firms into GVCs will depend on their ability to leverage local know-how, R&D and innovation capabilities and their connection with international knowledge and innovation networks.

The present brief addresses these topics and sheds new light on the development of global R&D and innovation value chains[1] *in which 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.* A crucial element for effective policies is to understand how the industrial actors organise and decide the location of their R&D and innovation activities and how these are connected to local and global innovation networks and systems[2].

This policy brief builds upon the recent evidence presented and discussed during the 8th IRIMA[3] workshop on "Corporate R&D and Innovation Value Chains: Implications for EU territorial policies". It offers relevant directions to think about the challenges faced by policymakers in supporting the connection of EU territories and industries to global innovation value chains, and promoting activities in segments of high added-value.

[1] Further referred to as global innovation value chains

[2] See Liu et al (2013) for more insights on Global Innovation Networks (GINs). The internationalisation of corporate R&D and innovation has been well documented by earlier works, for instance Iammarino and McCann (2013), Dunning and Lundan (2009), OECD (2008) and also studied under the IRIMA project – Moncada et al (2013), EU Scoreboards and EU Surveys (European Commission, various years) - .

[3] The 8th IRIMA workshop took place on March 8th 2017 in Brussels, Belgium. The background note, presentations and summary report are available at http://iri.jrc.ec.europa.eu/workshops.html

Definition

The concept of (global) value chains 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

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By an ever faster and deeper restructuring of their organisational and innovation modes and practices, the boundaries of Multinational Enterprises (MNEs) are becoming blurred. These companies constantly revise their shape, engaging in Mergers & Acquisitions (M&A) activity to access knowledge and capabilities, and spinning-off segments that are not core in their strategies. For instance, MNEs may favour the acquisition of knowledge-intensive or highly specialized firms rather than investing in high-risk and long-term internal R&D projects. The acquired targets are often start-ups firms with an advanced knowledge-base from specific locations, such as Silicon Valley, but increasingly so in Asia[4]. A typical example is in the pharmaceuticals sector, where the development cycles for new products and technologies can span over decades with few prospects for short or medium term expected returns. Recent evidence suggests that firms located in China, founded less than 20 years ago, have substantially increased their international shares of value added and employment in the pharmaceuticals sector. Besides important population effects (age and size), these trends may relate to several factors[5] including reforms of the healthcare system and a proactive industrial policy support for pharmaceuticals (large) companies, the expansion of healthcare spending and the internal market (rural and sub-urban areas), strategic diversification away from the manufacture of generics, the growth of international corporate partnership as well as the attractiveness of China as a top option for conducting of R&D activities by MNEs.

These new trends in the international division of labour in the pharmaceutical sector go together with the outsourcing of more knowledge-intensive activities and high risk business segments to Contract Research Organisations (CROs). Sometimes, entire non-core businesses units are externalised via spin-offs to these CROs. These increasingly contribute to the fragmentation of the discovery process and the organisational disintegration of pharmaceutical companies. Subcontracting to these CROs covers both routine R&D tasks and more complex, full programmes. In other words, there are signs that the global sourcing extends towards upstream and more knowledge-intensive activities.

A broad policy implication of the finer breaking up of innovation processes is that territories or regions have new opportunities for attracting some of these high value-added activities linked to global innovation value chains into their territories. This requires policies aiming at reinforcing their local knowledge base, investing in intangible assets (e.g. innovative properties and economic competencies) and creating favourable conditions for attracting and expanding the activities generating local growth and employment. These local or regional policies should be conceived as interdependent and complementary to national ones in order to avoid duplicating efforts, better identify and exploit regional specific strengths and to maximise the synergies with the local knowledge base and assets.

The global dispersion of R&D and innovation activities occurs at a higher pace and goes hand in hand with a stronger regional polarization. Yet, corporate R&D remains a domestic activity, although functional (e.g. research, development, design vs. other corporate activities) and industry-specific patterns can be observed.

The increased dispersion of MNEs' innovative activities across national borders comes with a higher concentration within regions or a handful of high-income locations (city-regions). Often these are metropolitan areas such as such as New York, Shanghai, Singapore, national and regional capital cities, with a rising trend for Asian cities. Indeed, only few metropolitan areas in OECD countries account for about half of innovative activity.[6] These global cities offer an attractive environment for global talent and

[4] Earlier evidence for the electronics industry is discussed by Ernst (2009)

[5] For more details on the main trends in China pharmaceuticals industry see *The next phase: Opportunities in China's pharmaceuticals market*, accessible at https://www2.deloitte.com/ch/en/pages/life-sciences-and-healthcare/articles/opportunities-in-chinas-pharmaceutical-markets.html

[6] See Belderbos et al (2016) who exploit the Financial Times' fDI database to analyse 5000 greenfield foreign direct investment projects in R&D, design and testing activities (OECD project "Global R&D location and decision")

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doing business, as well as a strong potential for diversification in terms of knowledge production. Noteworthy evidence presented also underlines the historical role of the UK as a hub for non-EU firms in Europe.

While the home base still appears as the main location for their R&D and innovation activities[7], internationalisation is a widespread phenomenon amongst the large R&D-investing companies. Among the 157 firms surveyed, two thirds perform R&D in at least three different countries and declare to have R&D activities in the three main regions (North-America, the EU and Asia).

These trends indicate that geographical concentration of R&D and innovation activities still prevails, although internationalization occurs at a higher pace and shows a strong polarization across few places, simultaneously. This poses a big challenge for regions to benefit from the opportunities offered by the changing geography of corporate innovation processes. Although R&D investment is often seen a driver of productivity, growth and employment, this is mainly so for core regions but not necessarily for all regions**.** Policies targeting exclusively R&D investments may thus not be appropriate for certain (especially peripheral) places or territories. These would need additional and targeted efforts focusing on the creation of new spaces and niches for activities favouring local socio-economic development and building on their existing knowledge and assets. National and regional strategies for Smart Specialisation, developed in the context of the European Cohesion policy, can be instrumental in this respect.

The increased internationalisation of R&D and innovation activities does not imply the hollowing-out of domestic ones. Foreign innovation activities may actually support domestic increases in innovation.

The internationalisation of R&D investments from global top R&D investors is not a zero sum game: offshored R&D may complement or expand the home-base activities. Although EU firms are more internationalized, the EU is still an attractive R&D (offshore) location for non-EU firms, in particular for US firms that have increased their R&D expenditures in the EU since the 1990s (e.g. an increasing weight of R&D-intensive foreign affiliates).[8]

Importantly, offshored developments towards other locations are usually not related to (lower) costs of research personnel: qualified R&D staff in Shanghai is basically as expensive as in the EU or the US. Companies attach much more value to a high availability of personnel and knowledge,[9] access to (economically and politically stable) markets and proximity to other activities within the company.

The internal and external connections of national and regional systems matter for their innovation performance. The quality of the regional learning and innovation systems is important to attract "relevant activities or segments" of the GVC. On the other hand, better connecting regions to the global innovation networks is important for local growth and employment.

Not only do the resources of the regional innovation systems matter, but also their internal and external connectivity. Importantly, there are strong complementarities between both inward and outward internationalisation and collaboration for innovation suggesting that policymakers should look at them as two sides of the same coin.

The development of global innovation networks has opened up several opportunities for localized learning, upgrading of skills and capabilities, and innovation. Yet, on the one hand, there is no point at looking for connectivity if local networks do not exist: local business networks, or local education, research and business linkages are vital for innovation, and the existence of the 'system' itself depends on the density of such connections. However, the types of linkages are not 'one and for all': in peripheral regions, for example, university-business links for R&D and innovation are supposedly rather limited, although they may be effective for skill supply and matching the needs of local businesses. In these regions it may be necessary to encourage (cross-) regional or local networking and collaborations (strengthen RIS or local innovation ecosystems) in

[7] 2016 EU R&D Survey

[8] See for instance EU Industrial R&D Investment Scoreboard 2016, Dachs et al (2014)

[9] In relation to this, the importance of investing in skills (maths, physics, engineering but also data analysis, social science skills and entrepreneurial training) at both university and technical level was re-iterated with emphasis. Providing favourable regional conditions for researchers' mobility, in connection with tax incentives and visa for highly qualified human capital, can help bridging regional skill gaps and building-up a strong local capacity.

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order to facilitate further participation and upgrading into GVCs.

As internationalisation offers both opportunities and threats, it is obvious that not all places are expected to benefit equally. This also means that regions can only attract companies if they are present in the relevant networks, if they approach companies in a pro-active way and make reliable offers in a stable policy environment, and if they understand and support local entrepreneurial dynamics.

Trade links may be relevant for further innovation networking. Indeed, early evidence suggests that more intensive trade goes together with more intensive co-invention. Also, countries that trade less show a lower propensity to co-invent.

In summary, supporting local innovation systems extends well beyond increased investments in R&D and innovation. In addition to support innovation framework conditions[10], the strengthening of local knowledge base and human capital, innovation and supplier networks and regional governance capabilities are essential for regional attractiveness and integration into global competition. Thus, attracting the "relevant activities or segments" of the GVCs depends from the opportunities offered by the regional innovation systems, know-how and skills mixes available therein.

The extent to which firms co-locate production and innovation activities depends on industry, product and process-specificities (functional interdependencies).[11]

The degree of co-location or need to co-locate is industry-specific. A higher co-location probability can be expected in engineering industries characterized by high-cost products and systems.

The importance of co-location will also depend on the knowledge intensity, the pace of technological change, the rate of product innovation or length of the product life cycle, the type of R&D and manufacturing activity, as well as the stage of product development. Evidence suggests, for instance, that co-location is more likely in the first stages of a radical product development project.

The latest EU survey on 157 large R&D investors confirm that R&D activities tend to be concentrated in fewer locations than production activities: 34% of the companies perform R&D in only 1 or 2 locations, while for production this is only 17%.[12] In addition, evidence shows that there is certainly an overlap of locating R&D and production activities: the majority of companies sampled perform the highest share of their R&D at the place where also the main production activities are.

More evidence is needed on how corporate R&D and innovation activities are sliced and diced across GVCs, on how these global corporate dynamics interact with national and regional innovation systems and on how they impact on local growth and employment.

Although research on GVCs has been flourishing, there is a need to further improve our understanding on their evolution and interactions with the exiting corporate innovation networks. More precisely, additional efforts should be undertaken to improve the collection of micro-level, quantitative and qualitative, information on the geographical location of research, development, innovation and production activities.

More research is also needed to better understand how R&D and innovation processes are distributed around the existing GVCs and the networks of actors and places that shape them. Particularly, more accurate representations of how companies refine and break down their R&D and innovation into sub-functions/activities will help for a better understanding of which activities, beyond the mere R, D and I rubrics, are more sensitive to colocation. A better knowledge of sectoral and technologies specificities, particularly for the activities related to new emerging technologies and industries, might also help to guide countries and regions in the identification of local investment priorities and opportunities to support research and technological development.

Moreover, the increasing role of Contract Research Organisations (CROs) and other innovation intermediaries in the innovation processes should be further investigated across different sectors.

In summary, the design of more appropriate territorial innovation policies will require better knowledge about the links between GVCs, the international division of labour for innovation, on the one hand, and the dynamics of local innovation systems and regional growth and employment (where the value and jobs are actually created), on the other hand.

[10] See European Commission (2016), *Better regulations for innovation-driven investment at the EU level*. Commission Staff Working Document, DG Research and Innovation.

[11] See for instance Ivarsson et al. 2016, European Commission 2014.

[12] See: http://iri.jrc.ec.europa.eu/survey16.html

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** See also the presentations of the 8th IRIMA workshop*

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