Synthesis

Introduction: Definitions

“Production processes have become more geographically dispersed as companies increasingly locate different production stages across different countries through network of independent suppliers and their own affiliates” (Interconnected Economies, Benefitting from global value chains, OECD 2013). Relatedly, innovation processes have become more open and geographically dispersed.

Global Value Chain / GVC

The full range of firms’ activities, from the conception of a product/service to its end use is called a value chain. It includes activities such as design, production, marketing, distribution and support to the final consumer. These activities can be undertaken by a single company or divided among several firms. They can be concentrated in one location or spread over different locations. The term GVCs was coined to reflect a strong trend towards the dispersion of these different activities across the world. CVCs combine outsourcing and offshoring.

Global Innovation Network

The term GIN is used to suggest the networked organisation of firms’ innovation activities, which results from a combination of outsourcing and offshoring of R&D and other innovation inputs. The development of global networks results from the combination of two trends: open innovation and GVCs. As a result, RDI activities follow the global dispersion of production and marketing as well as the expansion of the potential sources for technology around the world.

GVCs and GINs thus partly result from the same evolutions of the global economy and partly have their own specific dynamics as in the case of technology sourcing.
1. Global value chains: macro- and microeconomic perspectives

What do we know about GVCs? Country and sector differences,

Koen DeBacker, OECD

Results
Over the last 15 years, increasing share of foreign value added in national production, including exports. The phenomenon is largely spread across countries including both high wages and emerging countries. The position of countries are nevertheless quite different, with in particular some countries, like China, being integrated in GVCs backward, i.e. mainly receiving components for assembly, and others, like the US, being integrated in GVCs forward, i.e. mainly producing components for exports. The position of EU countries tends to be complex with both forward and backward integration. The integration of EU countries is also mainly at the EU level, as for trade in general.

The detailed statistical work of OCDE allows to distinguish differences by sectors and to analyse both linear and network types of GVCs with several layers of intermediate goods producers.

These analyses allow to see more clearly the importance of embedded services in products and exports. This is related to the increasing role of intangibles in manufacturing, from R&D and design before production to marketing or logistics after production. This is an important result for high wage countries and thinking about the knowledge economy. OECD shows that the revealed comparative advantage is positively related to knowledge based assets (skills, intangible capital).

OECD data also indicates that most productive activities are increasingly internationalised. R&D is less internationalised than most firms’ functions, but nevertheless increasingly so.

Policy issues
• Importance of services and knowledge capital to countries’ positionning within GVCs
• Overlay between GVCs and global innovation networks (GINs)
• Is the identification of an “Erosion of the commons” right? What are the interactions between GVCs and GINs?
• How far will offshoring go? – back-/re-/near-shoring

Meeting the firms involved in GVCs

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At the firm level, GVC involves more complex internationalisation strategies, combining importing of components, offshoring or internationally outsourcing certain parts of the value chain, exporting finished goods or semi-finished goods for further processing and trade.


Results
Even within sectors and countries that are typically identified in the GVC literature as being more GVC involved (Hungary, France and sectors like electronics and textiles), there is still substantial heterogeneity in terms of how intensively firms within these sectors and countries are GVC involved.

There are relatively few multiple mode firms, combining different international activities (import, export, international production), but they are bigger and more trade intensive and therefore substantially drive total trade flows in most sectors.

Multiple mode firms also display the highest productivity premia and are significantly more likely to introduce new product innovations. This is not true for process innovations.

Firms with an intermediate position in GVCs have a significant productivity premium and are more likely to be involved in process rather than product innovation. Locally intermediate firms do not realize any
TFP premium, are more likely to be pure process innovators, and are less likely to be introducing product innovations.

The results show that firms who invest in innovative strategies and human capital are less likely to have seen cuts in turnover or have had smaller cuts in turnover during the crisis. This evidence corroborates the assertion that innovation strategies are important for firm resilience to external shocks.

Firms engaging in simple internationalisation strategies are significantly more likely to be EU-focused in their scope.

The analysis does not suggest a productivity premium nor discount for firms concentrating their international value chain in Europe rather than at the global level.

**Implications**

The analysis provides consistent evidence that the firms that take on the opportunities of global market access, and which source resources globally, are well placed to be the engines of Europe’s innovation-based growth and to drive its external competitiveness on the basis of globally sustainable comparative advantage.

Given their highly specific characteristics, it matters for policy makers to better understand who they are, what they do and what challenges they face.

More firm-level analysis is needed, particularly to trace the performance of GVC-involved firms over time in order to better identify the causal relationship between internationalisation strategy and performance: do firms need to be strong before they can benefit from the opportunities offered by engagement in global value chains, or does engagement in global value chains make firms stronger, and able to weather the gales of fierce global competition?

### 2. Global value chains: country and sector case studies

**The French survey on GVCs: Global or European value chains?**

*Aurélien d’Isanto, INSEE (Institut National de la Statistique et des Etudes Economiques)*

French implementation of the EU “Global Activity Chains survey”, at the company level.

Seven activities
- **Core business activity:** production of goods or services for markets or third parties, carried out by the company and generating a turnover is usually the main activity. It may also include other activities if the company considers that they make up part of its essential functions.
- **Support activities:** activities carried out to allow or facilitate the production of goods or services.

International outsourcing defined as the total or partial transfer of an activity that was carried out within the company or domestically outsourced to another company abroad and belonging or not to the company’s group AND generating a decrease of the activity in France.

**Results**

Between 2009 and 2011, 7.3% of non-financial companies with 50 or more employees located in France outsourced their activities domestically (13.8 % of scope\(^1\) employment) and 4.2% internationally (6.5 % of scope employment).

Domestic sourcing: more often support functions. Internationally sourced activities were more often core business functions in manufacturing and support functions in other sectors.

Sectors: Manufacturing Industry, 8.8 % (13.6 % in terms of employment); information & communication services: 8.8 % (19.2 % empl.)

The share of companies sourcing internationally increases with the company size and exporting companies are more concerned.

Important role of the organization in terms of group

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\(^1\) Scope : population given the sample.
• 95% of companies sourcing internationally belong to a group
• companies already present abroad much more concerned

**Geographical distribution**
55% of companies sourcing internationally do so within the EU. This is particularly true for support functions. NMS: firstly administration and management support function. Others: Core business and logistics/transport functions
Africa is well ranked concerning core business and marketing/sales services/after sales services functions. Then China (mostly core business functions) and India (mostly support business functions).

Most international sourcing takes place within the group:
• 73% of cases within a group,
• particularly for core business activities and design, R&D, engineering and technical services.
ICT services are sourced internationally outside of the group as much as inside of the group

**Motivations**
EU15: Reduction of costs other than labour costs; factors more diversified than in the other areas
Africa: almost always motivated by a reduction of labour costs
China and India: Reduction of all costs + access to new markets
NMS: attractive labour costs, but also reduction of other costs

**Impact on employment**
Estimation of jobs directly lost in France due to international sourcing (2009 – 11, companies with 50 or more employees):
• 20,000 jobs (11,500 in manufacturing) => 6,600 per year; 0.3% of the employment of the scope
• Two thirds concern core business activities
Other studies in France have found more jobs lost, taking into account sub-contracting.

**Comparison with similar surveys in the EU**
% of companies (100 or more employees) that sourced activities internationally 2009-11

**GVCs and global R&D in the German car industry**
*Gary Herrigel, University of Chicago*

The relative shift of world manufacturing demand toward emerging markets has generated a significant change in the character of global manufacturing MNC strategies.

Previously, global manufacturers serviced demand in emerging economies primarily through exports or through low technology, production-only FDI projects. This pattern has changed as current emerging
economies demand growth levels overwhelm the relatively flat rates of manufacturing demand growth in developed markets. In order to be competitive there, those MNCs need to produce locally and accommodate their products to host country standards, regulations and growing indigenous customer sophistication. This “produce where you sell” strategy involves considerable upgrading for MNC operations in markets such as China: Production facilities need to be made more sophisticated, supply chains must be improved, and local R&D, design and engineering competence must be expanded.

These developments abroad have significantly affected German car manufacturers’ internal governance processes and home country operations. They are developing global monitoring and exchange systems that both support disparate local technical and organizational experimentation processes and capture and distribute promising developments from those locations to other operations that could profit from them. Corporate production systems and the cultivation of a globally circulating engineer and technician cohort facilitate these learning and innovation oriented governance practices.

Home locations are being recomposed in three significant ways. First, home location centrality for future oriented R&D is both solidifying and expanding in scope. It is solidifying because home locations have a comparative advantage for engineering talent and contact with R&D infrastructure and support: Universities and polytechnics, pools of highly qualified engineering school graduates, and talented clusters of dedicated research firms and consultancies. But the role of home market product development is also expanding as researchers need to take into account the rapid development and proliferation of product applications and modifications occurring across an unprecedented array of foreign markets. R&D participates at various levels in product development teams and collaborates with engineering and manufacturing counterparts in all global locations. The qualitative and quantitative demands on central competence are increasing enormously. Firms need to expand their engineering workforce to accommodate this.

Second, driven by the new internal governance practices noted above, home country R&D competence is drawn in to a support role for far flung technical experimentation processes. Engineers in subsidiaries all over the world call on home country competence for aid and input in their local experiments. Globally mobile cohorts of engineers, based in Germany with close ties to R&D engineering expertise, cooperate with and monitor the progress and needs of subsidiary product development processes. Such activities are growing along with the expansion of competence and production sophistication abroad, thus increasing home country demand for production engineers and technicians.

Third, production operations in Germany are also changing as a result of offshore upgrading. Crucially, competence and capacity development in emerging markets has NOT resulted in a loss of either competence or capacity in home market locations. Instead, home production location profiles are being recomposed. The same “produce where you sell” logic that leads firms to expand their production and development operations abroad leads them to retain production and development competences at home. But because home country R&D operations have expanded, the need for home location prototyping, small batch and quick turnaround manufacturing capacity has expanded accordingly. This has increased demand for skilled production labor.

Interestingly, it has also created demand for highly flexible manufacturing suppliers who can take over mature process capacity and free up in house manufacturing capacity within German locations. This is generating a return of component and capacity sub-suppliers in developed locations and a corresponding decline in the use of offshore (eastern European, Mexican and Chinese) suppliers for basic manufacturing processes. The old segmentation lines dividing sophisticated producers in developed economies from low-wage/low-sophistication suppliers in developing economies that emerged in the last twenty years during the peak of offshore outsourcing are in this way being undermined. Those offshore (eg.: Chinese) suppliers are turning inward, becoming more sophisticated and seeking domestic customers. At home, by contrast, a new segmentation between highly flexible manufacturing integrated into product development processes and capacity suppliers increasingly (re)-located in home market locations seems to be emerging.

The discussion of this case study underscored the fact that GVCs can have strong sector and country specific characteristics for a given level of foreign value added. Foreign value added is high in both electronics and the car industry, but with different locations, organization and product or knowledge flows. The often mentioned “smile curve” for example appears more relevant in the electronic sector than in the automobile sector as analyzed by G. Herrigel.
3. Global R&D networks and GVCs

What do we know about the location of R&D and its relation with GVCs?

Frédérique Sachwald, Ministry of Higher Education and Research (France) and i4g

Internationalisation of R&D

Since the mid-1980s, increasing share of foreign R&D. Since the late 1990s, the phenomenon seems to have reached a plateau in some economies such as Belgium, Canada, Finland and Spain. In others, often larger and less open economies, it is still slowly increasing (France, Germany, the US). In Japan, it is very low but slowly increasing. The share of R&D abroad by domestic firms is not monitored by national surveys except in very few countries like the US. For the US and Germany foreign R&D and R&D abroad are similar, respectively around 15% and around 25%. For Sweden the share of R&D abroad by domestic companies is much higher than foreign R&D in Sweden. Japan is in the reverse situation. Since the 2000s, the geography of foreign R&D has changed dramatically with a high share of new R&D locations in emerging countries.

Global innovation networks (GINs)

With increasing internationalisation of R&D, foreign locations have become more geographically dispersed in different types of countries and their functions have diversified. Three types of R&D foreign centres may be identified.

Distribution of inward Business R&D

The diagram below identifies the factors of attractiveness of each of these types of R&D centre by distinguishing the factors of supply and demand in the host country. For each type of centre it indicates
the main determinant in the choice of location (bold face) together with secondary factors of attractiveness.

LDCs are designed to provide support for production and sales in the foreign country by helping to tailor supply to local demand. These centres are therefore logically located close to production plants. In Europe, however, some development centres are not aimed solely at one local market but at a region that can encompass more than one country. The deployment of LDCs will tend to follow the development of markets and production abroad. Most LDCs are thus still located in high-income countries, although a growing number have been attracted to emerging countries with dynamic markets.

GRLs, in contrast, are attracted by top-tier scientific and technological resources concentrated in clusters in which leading consumers, firms at the leading edge of their fields and world-renowned research institutions interact with one another (Diagram).

GDCs perform studies and provide back office support in R&D. They are therefore located in countries where it is possible to employ efficient engineers and technicians at relatively low cost compared with the home country (Diagram). This type of choice of location seems to be particularly common in IT and telecommunications sectors, notably in Asia. India, for example, has attracted many software development centres, as well as sub-contracted R&D activities in other sectors. The new EU Member States and Russia have also attracted this type of R&D centre. In contrast, the foreign R&D centres in China appear to have located there in response to the rapid expansion of production plants.

### Determinants of the choice of location for different types of R&D activity abroad*

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<th>Type of R&amp;D unit</th>
<th>Attractive local characteristics</th>
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<td>Local development centre (LDC)</td>
<td>Quality of training (engineers, technicians)</td>
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<td>Local technological infrastructure</td>
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<td>Global research laboratory (GRL)</td>
<td>Centres of excellence</td>
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<td></td>
<td>Good relationship between research and industry</td>
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<td>Global development centre (GDC)</td>
<td>Good cost benefits of labour for R&amp;D activities</td>
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<td>Protection of intellectual property</td>
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Each R&D centre has its own dynamics and can progressively upgrade and play one or several role within the global innovation network of its mother company. Besides, GINs are organised to benefit from open innovation practices and in particular cooperation with both academic research and innovation cooperation with other firms. The type of partner will depend on the main function of the R&D centre. Thus LDCs will mostly cooperate with customers, while GRLs will try to tap into the scientific and technological environment by cooperating with academic research and start ups.

### Implications

The objective is not to study internationalisation of R&D as such, but the operation and efficiency of GINs as part of GVCS. This involves taking into account in particular sector characteristics and open innovation practices by companies.

Knowledge on GINs is still hampered by data problems, in particular on foreign R&D location by multinationals from most countries (as opposed to foreign R&D in home countries).
Global innovation networks and the channels of technology sourcing:
A transatlantic perspective

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How successful are German companies with different technology sourcing (TS) activities in the US? TS: Sourcing technological knowledge from local knowledge pools. In the US, which is considered as the technology frontier.
Success measured as increase in total factor productivity (TFP)

Covered sourcing activities:
- Placing inventors in the US
- Joint research with a US company that results in a patent application
- R&D collaboration with a customer
- R&D collaboration with a supplier
- R&D collaboration with a competitor

The empirical strategy consists in estimating a production function augmented with external knowledge stock.

Spillover weights are defined as follows:
- % Inventors US: share of patent applications with at least one inventor in the US
- % Co-applications US: share of patent applications with a US company as coapplicant
- Dummy R&D cooperation in the US during time period of the sample, with customers, with suppliers, with competitors.
- Analogous definition of the weights for activities in Germany

Results
Among the TS activities, placing inventors in the US, conducting research with a US company leading to a patent and cooperating with suppliers have a positive impact on sales.

Thus
- The type of R&D activity and channels for TS matter
- Important how close contacts are — closer contact better for TS
- Cooperation with customers may increase sales abroad but we do not find a productivity effect at home
- Learning from suppliers, collaboration may result in advanced intermediate goods with good fit to production requirements at home facility

Policy implications
- It can be positive for the home country, if companies send researchers abroad because it has an impact on their productivity
- This positive effect may outweigh the negative effect of losing highly qualified R&D jobs at home
4. Global innovation networks, national innovation systems and clusters

Internationalisation of R&D and home knowledge production

Grazia Santangelo, Catania University

Internationalisation of R&D

One ambition of the paper is to take into account both the International business and Economic geography literatures.

The increasing internationalisation of R&D has been analysed as a problem for home countries, based on two types of arguments.

1. The empirical significance of geographical proximity implies codification problems, which may rise, hampering the effects of knowledge transfer at a distance;
2. The globalization of R&D&I could erode the R&D-based stronghold of advanced regions as a result of an incremental shift of R&D activities in EEs where science and engineering talent continues to grow.

On the contrary, foreign R&D locations could contribute to the home knowledge base.

1. A substantial part of R&D activity is executed in foreign locations for the sake of home-based augmenting knowledge
2. This tendency to perform R&D abroad implies a strengthening of the notion of regional system of innovation (RSI), rather than the opposite:
   - specific skills and competencies in people are not perfectly mobile, technological capabilities of regional innovation systems cannot be tapped into easily from a distance
   - MNEs aspiring to use of such specific knowledge have to establish or acquire local presence.

Fast-growing EEs comparative advantage:

- specific high-quality R&D services at a low costs (e.g. India’s supply of engineering),
- location-specific supply base of technological and knowledge externalities that firms draw upon for their competitiveness (e.g. India’s strengths in software, Taiwan’s strengths in computers)

As a consequence, home and foreign R&D locations should be complementary and contribute to reinforce the performance of home MNEs.

Results

Typology of R&D locations used in the empirical tests:
- Research, pre-competitive, generates scientific knowledge
- Development of products is oriented to the market and/or product/process characteristics
- Adaptation relates to adjustment to customer needs

Data on regions from 21 OECD countries, estimation of a knowledge production function (PCT patents).

Results indicate that emerging countries have a comparative advantage in the location of R&D for less complex technologies and R&D activities oriented to adaptation. GINs thus include foreign R&D locations in fast-growing EEs that provide useful knowledge in adaption.

As a result, R&D FDI does contribute to KP at home also when located in fast-growing EEs

Policy implications

R&D location in emerging countries may be a positive sum game:
- potential gains for home advanced locations and host emerging locations;
- in advanced country regions needs for structural policies to strengthen efforts and expertise in high-tech sectors.
Clusters vs. international connexions for innovation
Andrés Rodríguez-Pose, London School of Economics and i4g

Clusters and pipelines

Cluster policies have been common place during the last two decades. However, in order to design effective measures to enhance the innovative capability and the economic dynamism of a territory, policy-makers must account for important factors such as the geographical scale and the potential for interaction among actors located where the intervention is implemented. In today’s world, large urban agglomerations are often regarded as the main catalysts for innovativeness, productivity and development. However, the policy options to enhance the competitiveness of urban cores are not easily transferable to stimulate innovative activities in intermediate and ‘peripheral’ locations, because the interaction between actors that is taking place in core regions is not reproduced elsewhere. The constant generation of knowledge of high-density cities, resulting from the generation of positive synergies among agents and organisations cannot be easily replicated in contexts characterised by a smaller size. In relatively small and/or peripheral areas, policies aimed at generating industrial clusters with the aim of achieving agglomeration-effects similar to those found in larger cities is likely to lead to short-living networks incapable of guaranteeing long-run innovation. In these contexts knowledge exchange at large distance through the creation of external connections and bridges to the outside world is likely to prove a more effective type of intervention in order to overcome the lack of economies of scale.

The innovation policies capable of strengthening the competitiveness of large cities are those promoting the creation of localised networks, facilitating the diffusion of knowledge, supporting the agglomeration of firms in the same or related sectors. The co-location of enterprises and labour force, if adequately stimulated, allows to create positive externalities that trigger a mechanism of self-reproducing innovation and growth, which provides urban centres with a comparative advantage with respect to all other locations. Small and isolated regions have little chance to compete with cities ‘on their same ground’, adopting strategies that hope to foster the innovative performance by creating concentrations of firms in industrial clusters. In the absence of a sufficiently large critical mass of economic activity, the effects of network policies supporting the generation, diffusion and absorption of innovation within the system would be limited. Conversely, a more likely outcome of these interventions is that the same information will keep on circulating among the few actors in the closed environment, preventing the acquisition of new knowledge and producing a situation of ‘lock-in’.

Supporting the creation of linkages with agents well beyond the borders of the community, city or region may be a more viable way of maintaining and enhancing the dynamism of intermediate and peripheral areas. Through the establishment of links between selected internal industrial sectors and strategic external areas, the local economy will be exposed to new knowledge, ideas and trends that will promote its competitiveness with respect to fast-growing metropolises.

Results

Norway illustrates the effectiveness of innovation through long-distance knowledge exchange in isolated areas. The level of innovation of enterprises in this country has managed to remain remarkably high, despite a number of evident disadvantages that could have undermined its overall economic and innovative performance. The Norwegian context is characterised by the presence of relatively small cities, distant between each other and located far from the economic core of Europe. The concentration of enterprises in these urban centres is not sufficient to give rise to externalities and knowledge circulations typical of large economies of agglomeration. However, Norwegian cities have been able to maintain their innovativeness through the development of international connections between the local industry and foreign firms. This form of collaboration has helped businesses to acquire new knowledge, which has been in turn diffused within Norwegian clusters and local innovation systems. It has been shown\(^2\) that, in Norway, the number of enterprises’ international partners is positively associated with their innovative capacity, and that both process, product and radical innovations have tended to come especially from those firms which have set up connections outside their clusters and immediate geographical surroundings.

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**Policy implications**

This model of innovation, although still playing second fiddle to the promotion of clusters, has also been supported by public policy. National agencies have promoted the creation of subsidiary offices in foreign cities, in order to provide mentoring and practical assistance to Norwegian firms operating in the areas of exporting, networking and international knowledge transfer. The action of these agencies has been complemented by the activity of Regional Development Agencies, which have promoted firms' internationalisation through the establishment of offices abroad that organised trade fairs and conferences. More broadly, a successful policy that facilitates the formation of external interactive learning linkages is the promotion of exchange programmes for students through scholarship, helping universities and their students to develop international networks.

The success of the Norwegian case is due also to particular conditions existing in the country, not least the high level of human capital, high-quality institutions and the possibility for firms to manage the costs of distant interactions and to bridge the ‘cognitive gap’ with foreign partners. Norwegian authorities had the capacity to identify the right firms and sectors to which to provide support, and to select the suitable areas of the world with which to form international partnerships. Indeed, the design of a support strategy for innovation based on global knowledge exchange requires great attention.

**Summary and next steps**

*Mario Cervantes, and Frédérique Sachwald*

GVCs are well developed and should be taken into account to assess countries’ specialisation and comparative advantages. Discussions about manufacturing and related policies should fully take into account the role of embedded services in products and trade.

Similarly, policies should be based on sophisticated knowledge of GINs and their impacts in various sectors.

For both GVCs and GINs, recent empirical work show complementarities with home/domestic operations with a positive impact on performance. The best interactions and conditions to optimise performance effects remain to be more systematically explored.

In both cases, surveys and case studies begin to be complemented with empirical data. But more data at the firm level are needed. In particular, this is one recommendation from the EFFIGE EU project for GVCs and from the German EFI report 2013 for foreign R&D activities by companies.