The Geography and Structure of Global Innovation Networks: Global Scope and Regional Embeddedness[i]

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Abstract

The paper discusses the spatial aspects of increased globalization of innovation analyzing both the role of the region influencing the propensity of actors to engage and have different roles in GIN. Until now different concepts such as global value chain (GVC), global production networks (GPN) and global innovation networks (GIN) have been used to explain the increase globalization of innovation activities. The paper provides a critical overview of these concepts. The involvement of new actors (not only multinationals and firms) and from different locations (not only from developed economies) show the limitations of frameworks such as GVC and GPN in explaining the structure and dynamics of global networks. The paper highlights how the concept of GIN properly addressed can lead to a better understanding of micro and meso dynamics of the new phenomena of globalization of innovation activities.

1. Introduction

The spurt in the de-localization of innovation activities to and from emerging economies (Unctad 2005) has triggered a growing interest among scholars of diverse disciplines in understanding the drivers and consequences of the increased globalization of innovation activities; these scholars have used a variety of concepts, from global value chain to global production networks and global innovation networks. The aim of this chapter is to provide an overview of what we know (and what we need to know) about the structure and the geography of these global innovation networks, by looking, in particular, at the geographic concepts that underpin current work on global innovation networks as well as the spatial implications of the increased globalization of innovation activities.

We start this chapter with an overview of the changes in the concepts that are used to explain the increasing globalization of innovation activities – from global value chains to global production and innovation networks, highlighting how geography and space have been tackled in the different frameworks. In the next section we go deeper into the geographical aspects of global innovation networks, discussing why innovation networks may become global as well as the factors that influence the propensity of firms to engage in local or global networks, with particular reference to the role of regions. Finally, we round up with some suggestions for future research.

2. Global innovation networks (GINs) as a new phenomenon

Innovation has long been an international phenomenon, but arguably it has not been a global one. The empirical evidence at both macro (Castellacci & Archibugi 2008) and micro level (Cantwell & Piscitello 2007; Saliola & Zanfei 2009) on the internationalization of innovation activities (mainly R&D) suggests that: 1) the majority of R&D is conducted close to a company's headquarters; 2) when R&D is internationalized, inbound and outbound R&D flows take place between technologically and economically advanced high-income countries; and 3) international flows of R&D have been driven almost exclusively by large multinational companies (MNCs) headquartered in high-income countries (Chaminade et al. 2014). As a consequence, the existing literature has been almost exclusively concerned with analysing 'the success achieved by an elite class of firms in a small number of lead countries that benefit from being integrated into such privileged chains and networks' (Parrilli et al., (2013, p.971).

Economic geography has long argued that the difficulties in globalizing innovation-related activities are strongly related to the intrinsic characteristics of knowledge and the spatiality of knowledge-creating processes (Bathelt et al. 2004). Tacit knowledge tends to be sticky and to be bound to specific locations. Exchanging knowledge across large geographical distances is challenging, but not impossible. Recent studies in economic geography have contributed greatly to our understanding of the conditions under which innovation and knowledge-creating activities can be organized across space. We know that geographical distance can be compensated for by other forms of proximity – for example, social or organizational proximity (Boschma 2005; Gertler 2008); that knowledge bases influence the geography of knowledge networks (Martin 2012); and also that the region in which a firm is located can determine the geography of its knowledge networks (Plechero & Chaminade 2013).

In this chapter we point to evidence indicating that a gradual change is taking place in the predominant paradigm of innovation – the paradigm in which innovation is almost exclusively concentrated in developed countries and globalization of innovation is exclusively driven by large MNCs. R&D and other innovation activities are becoming global, and global innovation networks are no longer a phenomenon that is exclusive to large MNCs. We argue that existing concepts like global value chains and global production networks are quite limited in how they explain the emergence and dynamics of innovation networks, particularly when those innovation networks are formed around

relational, reciprocal, long-term relationships, which may or may not be with lead firms. Furthermore, we argue that global innovation networks are highly embedded in territories and are pinned down to certain locations, and that, at the same time, regional characteristics have a strong influence on the geography of a firm's innovation networks.

A global innovation network has been defined as a globally organized web of collaborative interactions between different organisations (firms and/or non-firm organisations) engaged in knowledge production that is related to and resulting in innovation (Barnard & Chaminade 2011). Global innovation networks (GINs) have specific characteristics in terms of their geographical spread (global), the nature of the interactions (networks) and the outcomes (innovation).

A key conceptual issue raised by the emergence of GINs is whether they represent a deepening of a long-standing phenomenon already captured by the literature on global value chain and global production networks, or whether they represent a different organizational form; In the latter case, what are the main characteristics of GINs as compared to global production networks or even global value chains? In other words, how can the global innovation network literature contribute to our understanding of the spatial implications of the increased globalization of innovation activities?

First, the term 'innovation network' refers to a network formed with the aim of exchanging knowledge relevant for innovation. The works by Ernst (2006, discussing the role of Asia in the electronics industry and Cooke (2013a; 2013b) analysing the ICT industry and Apple's network, respectively, are cited as examples in this new stream of literature (Parrilli et al. 2013). In contrast with global production networks[ii] (GPNs) (Dicken et al. 2001; Ernst & Kim 2002; Henderson et al. 2002) *the focus of GINs is on knowledge exchange and innovation, not on production*. Some authors in the GPN tradition (Ernst 2002; 2006; 2009) have gradually been incorporating R&D functions and other high-value added activities[iii] into their analysis of GPN in specific industries (for example, electronics) across geographical frontiers, thus moving closer to a global innovation network rather than a global production network (Parrilli et al. 2013). However, the perspective of innovation as an add-on function of GPN assumes that innovation happens in the same structure as the GPN. From our perspective, such an assumption may be flawed for many reasons. First, the motivation for the internationalization of innovation-related activities is different from the motivation for the internationalization of production. Globalization of production is mainly driven by an efficiency-seeking or market-seeking strategy, while globalization of innovation is mainly driven by a knowledge-seeking strategy (Brusoni et al. 2001; Castellani & Zanfei 2006; Dunning & Lundan 2009). Second, the structure of the global network

for innovation tends to differ from the structure of the global network for production and this is particularly evident for high-tech industries (Audretsch & Feldman 1996). So GINs may overlap with GPNs in certain industries (for example industries in which knowledge creation is based on engineering skills and this R&D and other innovation related activities tend to follow production like the automotive industry) but not in all.

Likewise, in contrast with global value chains (GVC) – which are vertically integrated types of interactions – the concept of an innovation network opens up the possibility of looking at external collaborations of a horizontal nature (Barnard & Chaminade 2011). That is, the coordination mechanism that governs global innovation networks is the network, not the market or the hierarchy, and this has important implications. Networks support exchanges of knowledge based on reciprocal, preferential and long-term relations in which all parties are dependent on resources controlled by another, and 'there are gains to be had by the pooling of resources' (Powell 1990, p. 304). While hierarchies are rather stable and difficult to change, networks have a more open and dynamic character, and thus can evolve over time to respond to the needs of firms as well as their capabilities.

The GPN literature and the GIN literature share a concern about the spatial aspects of globally distributed networks and the importance attributed to institutions (Cooke 2013b), but while the GPN literature is mainly focused on the distribution of production activities globally and still today has a strong focus on lead firms, the GIN literature is concerned with the spatiality of knowledge creation processes and knowledge networks. The different aims of GINs and GPNs imply that the actors in GINs and GPNs can be different, and the ways in which GINs and GPNs are organized can also differ. Therefore, global innovation networks may have different structures and dynamics from global production networks, particularly in certain industries.

Networks are a more flexible form of organization of innovation activities worldwide, and can be especially appealing to firms in developing countries (Barnard & Chaminade 2011). Using firm-level data collected through a survey in 2010 in five European countries (Denmark, Sweden, Germany, Norway and Estonia), as well as Brazil, China, India and South Africa, Barnard and Chaminade (2011) provide an empirical overview of the different types of engagement of firms in global innovation networks, the role of different actors, such as MNCs and non-MNCs as well as larger and smaller firms, in global innovation networks, and, importantly, the role of firms located in high- and middle-income countries in such networks. They found evidence that 12.2 percent of the sampled firms were engaged in one or another form of global innovation network.[iv] In addition, they found that firms

located in middle-income countries (and especially in India) are most likely to participate in GINs that operate beyond the Triad of developed countries (Europe, the US and Japan). Although many GINs involve MNCs, they also found a significant number of standalone firms involved in GINs. Similarly, although many GINs involve firms with more than one thousand employees, a substantial number of firms involved in GINs are smaller, having between 250 and 999, or even fewer, employees. In summary, the findings of this study indicate that there is a large variety of actors engaging in GINs, and it confirms that firms in middle-income countries are indeed emerging as participants in global innovation. The evidence suggests that GINs are a new emerging phenomenon in terms of actors and the geographical scope of the networks.

By looking at the spatiality of knowledge, economic geography may provide powerful explanations for why these global networks for innovation are formed and how they are bound to special locations, thus complementing the literature on networks.

3. The geography of global innovation networks

3.1. The role of the region in the spatial configuration of global innovation networks

Scholars in the field of the geography of innovation have always considered it fundamental to understand the mechanisms and dynamics that – at a regional level – may sustain firms' innovation and competitive advantage in a globalized and interconnected world (Asheim et al. 2003; Cooke 2001; Mackinnon et al. 2002). This is because, despite globalization, the level of innovation activities as well as the competences required (such as skills, knowledge and institutions (Chaminade & De Fuentes 2013)) remain unevenly distributed across regions (Amin & Thrift 1994; Asheim & Gertler 2005; Cooke 1992; Cooke 2001).

By underlining regional differences, the existing research has directed attention to the relationships between, on the one hand, certain types of regional knowledge-based competences and regional institutions and, on the other hand, the international network that is sourcing innovation from the region[v] (Asheim & Coenen 2005; Blažek et al. 2011; Coenen et al. 2006; Martin & Moodysson 2011; Martin & Moodysson 2013; Moodysson et al. 2008; Sotarauta et al. 2011; Tödtling et al. 2011).

In the literature on knowledge bases it has long been argued that the spatial distribution of the network may be conditioned by the specific knowledge base prevailing in a region (Asheim & Coenen

2005; Coenen et al. 2006; Martin & Moodysson 2011; Martin & Moodysson 2013; Moodysson et al. 2008). International networks seem to be particularly important for regional activities based on analytical knowledge, which are naturally more prone to codification processes (Bathelt et al. 2004; Moodysson et al. 2008; Owen-Smith & Powell 2004).[vi] Localized networks, where tacit knowledge and face-to-face interaction occur among customers and suppliers, still remain important for regional synthetic and symbolic knowledge-based activities (Martin & Moodysson 2013).[vii] Thus, global networks may emerge to access specific knowledge bases that are highly concentrated in certain regions around the world.

Other studies in this field have also stressed that the ability of a firm to develop global innovation networks can also depend on the specific qualities of the regional innovation system (RIS)[viii] in which the firm is located (Asheim & Gertler 2005; Eraydin 2005), and, in particular, on the organizational and institutional thickness of the RIS (Amin & Thrift 1994). The study by Tödtling et al. (2011) shows that in an RIS that is strong in terms of institutions and organizations, firms will tend to establish more domestic linkages with innovation sources, while in an RIS that is marginal firms will tend to establish more international linkages, probably to overcome the limitations of the innovation system in which they are embedded.[ix] In a similar vein, Chaminade and Plechero (2015a) investigate a number of regions, both in Europe and in emerging economies, and show that firms located in regions that are organizationally and institutionally neither too thick nor too thin engage more in global collaboration for innovation. While firms located in marginal regions may lack sufficient capabilities to engage in a GIN, firms located in strong regions may find the knowledge to innovate directly from the regional pool and may not have enough incentive to look for global partners, regardless of whether they are located in a developed or an emerging economy. The results resonate with some recent work by Srholec (2015), who finds that firms located in weaker institutional environments show a higher propensity to internationalize their innovation activities and engage in global networks for research collaboration.

Chaminade and Plechero (2015a) and Plechero and Chaminade (Forthcoming) analyse the spatial distribution of the network of collaboration for innovation in the ICT industry, and find that regions with a high degree of specialization, and therefore with very strong competences in the ICT area, tend to rely more on local networks than on global networks for innovation. Plechero and Chaminade (Forthcoming) also show that emerging economies with an RIS in formation have, in general, a higher propensity to develop 'truly' global collaboration for innovation (with partners from the north and from

the south of the world) than regions in developed countries where the extent of networks of collaboration for innovation remains mainly within the Triad. This may not only be because of the natural propensity for firms located in the developing regions to compensate for their weak RIS by looking to establish collaboration with the most dynamic environments in developed economies, but it may also be the result of the fact that some of these regions have recently increased the availability of well-trained human capital (Li & Scullion 2006; Mitra 2006; Oecd 2008). A good pool of skilled people in a region in an emerging economy seems to be an incentive for firms from developed countries not only to offshore R&D, but also to establish collaborative networks with local partners in those locations (with suppliers, but also with organizations such as universities and research centres) (Chaminade & De Fuentes 2013). These last findings show that the regions in which firms have a higher propensity to be involved in GINs are the ones where there is a good regional absorptive capacity (Cohen & Levinthal 1990) but where firms cannot find close by all the resources they need to innovate.

3.2. The impact of the geography of networks on innovation

In the previous section we have discussed how regional characteristics such as the predominance of knowledge bases, organizational and institutional thickness, and the degree of specialization influence the propensity of firms to engage in global innovation networks. In this section we will discuss how the structure and geography of the innovation networks influences the degree of novelty (which potentially can have an effect on the innovation dynamics of the regions in which these more innovative firms are embedded).

One recent object of study in the geography of innovation is indeed the specific relationship of the geography of the network and the capacity of firms to generate innovation (Fitjar & Rodríguez-Pose 2012; Trippl et al. 2009). By integrating theories from economic geography (Trippl et al. 2009) and international business (Tallman & Phene 2007), some scholars have investigated whether a mainly local or a mainly global spatial scale for these innovation networks would matter more for innovation (Bathelt et al. 2004; Belussi et al. 2010; Boschma 2005; Gertler & Levitte 2005; Giuliani & Bell 2005; Moodysson et al. 2008). Their main argument is that local knowledge needs to be complemented by global sources of knowledge, and that, in general, international knowledge linkages are positively related to the innovation performance of firms (Doloreux & Shearmur 2012; Fitjar & Rodríguez-Pose

2012; Gertler & Levitte 2005); however, by and large they do not specify which spatial patterns for network collaborations may lead to the highest level of innovation performance, particularly in terms of degree of novelty (an exception is the recent work by Fitjar and Huber (2015,),[x] or whether there are differences between firms located in different contexts. Furthermore, with a few exceptions (Grillitsch & Trippl 2014) the existing literature on the geography of knowledge sourcing does not go beyond the distinction between local/regional, domestic and international, and international can include both neighbouring countries as well as distant ones and countries in very different stages of development.

Moreover, most of the above-mentioned literature uses evidence from firms in developed economies, and it may therefore fall short in explaining the importance of local or global linkages in less developed countries. In developing countries, firms often innovate by acquiring technology that was developed abroad and adapting it to local needs, or by imitating products developed in industrialized economies (Altenburg et al. 2008; Srholec 2011; Yeung 2007). Using dedicated survey data from a Chinese and an Indian region, Plechero and Chaminade (2010) and Chaminade and Plechero (2015b) investigated the impact of the geographical configuration of the innovation network on the degree of novelty of innovation in firms located in Pune and Beijing. They found that, for firms in these two countries, networks of research collaboration with global partners seem to be crucial for achieving the highest degree of novelty in product innovation. Moreover, research collaboration at a global level seems to be particularly important for 'new to the world' innovation, confirming the ideas of scholars studying development that in those contexts global interactions are fundamental for catching up (Lundvall et al. 2009; Pietrobelli & Rabellotti 2007). These results confirm that in this less developed context, research collaboration at a local level does not seem to be enough to help firms to upgrade from innovations that are 'new to the firm' to innovations that are 'new to the domestic market' or 'new to the world'.

While in developed countries the role of local institutions and organizations that foster innovation remains crucial, in emerging economies and developing countries the local system of innovation, as well as the local absorptive capacity of the firms, may still not be able to stimulate high innovation performance (Grimpe & Sofka 2009). These findings confirm what previous authors had already claimed – that location-specific factors have an impact on the likelihood of engagement in an innovation network and on innovation performance (Crescenzi et al. 2012; Doloreux & Shearmur 2012; Fernández-Serrano & Romero 2012; Herstad & Ebersberger Forthcoming).

A further step in the analysis is to look specifically at the structure of the networks – in terms of the actors – as well as the specific location of the partners. In a series of exploratory papers based on the INGINEUS survey,[xi] Harirchi and Chaminade (2014) and Aslesen and Harirchi (Forthcoming) introduce both the location of the firm and the location of the partner in the network to investigate their impact on the degree of novelty. Harirchi and Chaminade (2014) analyse the role of collaboration for innovation with global users, as one specific type of actor, by making a distinction between users located in the south and those located in the North,[xii] as well as considering the location of the focal firm.[xiii] Their findings on a sample of ICT, agro-processing and automotive firms show that firms in emerging economies benefit more from interaction with users in the south, while collaboration with users in the north does not yield any positive impact in terms of a higher degree of novelty for these firms. On the other hand, firms in the north benefit from user-producer collaboration with firms in the north and in the south. When the sample is limited to one specific sector (ICT) and to small and medium-sized firms in Sweden, Norway and India, the results of the comparative study of Aslesen and Harirchi (Forthcoming) on ICT firms show that firms in Norway and Sweden benefit more from global linkages in relation to the novelty of innovation than do Indian firms. Their overall results imply that engaging in global innovation networks and benefiting from such linkages is both sector- and country-specific. Furthermore, the degree of engagement in global linkages may also be moderated by both resource support and strong regional innovation systems (Ebersberger & Herstad 2013). Too much dependence on local interactions for innovation (Visser & Boschma 2004), at least in the case of smaller countries such as Norway or Sweden, may generate a system lock-in that inhibits the generation of radical innovations (Uzzi 1997).

4. Implications for a research agenda on the geography of innovation networks

Global innovation networks seem to be a relatively new phenomenon and the literature dealing with the structure and dynamics of GINs is still in its infancy, in both theoretical and empirical terms.

Theoretically, the global innovation network literature can be enriched by developing a framework that integrates knowledge base characteristics (transferability and availability of knowledge), firm idiosyncrasies (accessibility of knowledge), location (territoriality) and structural network characteristics. By adopting a multi-level and multi-scalar approach we can understand the micro and

meso level dynamics that influence the geography of innovation networks and how this changes over time.

Advanced tools in social network analysis (SNA) can be used for an empirical approach to this multi-level and multi-scalar analysis. Hitherto, with very few exceptions (Balland 2012; Balland et al. 2015; Balland et al. 2013; Cassi et al. 2012), most of the studies on global knowledge and innovation networks have been rather static or confined to only one form of innovation network. Studies on the dynamics of global innovation networks are sorely needed. However, the geographical coverage of these studies is very limited by the need to use certain indicators for which there is available relational data (co-patenting, and co-publications as a proxy for research collaboration), or is confined to a number of countries for which richer relational data is available. Regarding data, a very promising line of research is based on the construction of relational data from social media and other internet-based networks, on a global scale and over time. In terms of geographical coverage, a particular future research area related to south-south and south-north interactions, to complement the dominant north-north perspective, should be explored.

A field of research that also deserves more attention is related to understanding how the dynamics of GINs may or may not favour economic development in certain regions. Further research may be devoted to investigating where the main value of innovation activities is retained, geographically speaking. While this is a topic that has been extensively analysed in relation to global value chains and global production networks, it still remains at its infancy from the GIN perspective. Related to this, another very promising line of research is to investigate how global innovation networks may contribute to path creation, defined as the emergence of new industries, and path renewal, the branching of existing industries into different and related ones (Isaksen & Trippl 2014).

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[ii]A GPN is defined as 'the globally organized nexus of interconnected functions and operations by firms and non-firm institutions through which goods and services are produced and distributed' Coe, N., M. Hess, H. Yeung, P. Dicken and J. Henderson (2004), 'Globalizing'regional development: a global production networks perspective', *Transactions of the Institute of British Geographers*, **29** (4), 468-484.

[iii] Notably, engineering, product development and R&D.

[iv] The global scope measure was based on the question: "Regarding the development of the most important innovation of your firm in the last 3 years: who did you actively collaborate with and in which geographical location? If firms were relying on at least one innovation partner from a Triad country as well as at least one innovation partner from an emerging location, they were coded as global (g). If firms relied on innovation partners outside their home country from at least two traditional Triad regions, and from at least two middle-income regions, they were coded as highly global (G). The network scope measure also relies on the question, "Regarding the development of the most important innovation of your firm in the last 3 years: who did you actively collaborate with and in which geographical location?". Regardless of the geographical locations in which a partner could be situated, the authors simply identified whether or not a firm had worked with a particular type of partner to innovate. In the measure of network scope, firms were regarded as highly networked (N) if they indicated that they offshored innovation and if they also indicated that they worked with four or more types of network partners. 149 firms were highly networked. In contrast, firms were regarded as somewhat networked (n) if they indicated that they worked with at least three types of network partners, or if they indicated that they offshored innovation.

[v] Sources of innovation are considered by this literature to include both market and technological knowledge.

[vi] Analytical knowledge, characterized by scientific knowledge and rational processes, is devoted to the discovery and application of scientific laws, and is usually relevant for sectors such as biotechnology Asheim, B., L. Coenen and J. Vang (2007), 'Face-to-face, buzz, and knowledge bases: Sociospatial implications for learning, innovation, and innovation policy', *Environment and Planning C: Government and Policy*, **25** (5), 655-670..

[vii] Synthetic knowledge is defined as knowledge that has originated from the application of or through the new combination of existing knowledge and its construction, and is often triggered by the need to solve specific problems or to answer the specific needs of customers or suppliers (for example in the engineering industry). Symbolic knowledge is principally built on aesthetic and design attributes, and on the symbolic value of the product Martin, R. and J. Moodysson (2013), 'Comparing knowledge bases: on the geography and organization of knowledge sourcing in the regional innovation system of Scania, Sweden', *European Urban and Regional Studies*, **20** (2), 161-169.. This last type of knowledge characterizes, for example, regions and clusters oriented towards fashion production.

[viii] RIS can be defined as the 'wider setting of organizations and institutions affecting and supporting learning and innovation in a region' Asheim, B. (2009), 'Next generation regional innovation policy: how to combine science and user driven approaches in regional innovation systems', *Ekonomiaz*, **70** (01), 106-131.

[ix] Regions can be considered strong (institutionally and organizationally thick) when they have a solid organizational infrastructure (i.e. a high number and diversity of organizations in that particular innovation system), high levels of

interaction among local actors, a culture of collective representation and shared norms and values that serve to constitute the social identity of the particular locality Amin, A. and N. Thrift (1994), *Globalization, institutions, and regional development in Europe*, Oxford: Oxford University Press; Asheim, B., J. Moodysson and F. Tödtling (2011), 'Constructing regional advantage: Towards state-of-the-art regional innovation system policies in Europe?', *European Planning Studies*, **19** (7), 1133-1139; Tödtling, F. and M. Trippl (2005), 'One size fits all?', *Research Policy*, **34** (8), 1203-1219. Regions are, by contrast, usually considered marginal (institutionally and organizationally thin) when these elements, or parts of these elements, are missing.

[x] The most common and widely accepted definition of the degree of novelty, used in various types of innovation surveys including community innovation surveys Hong, S., L. Oxley and P. Mccann (2012), 'A survey of the innovation surveys', *Journal of Economic Surveys*, **26** (3), 420-444; Laursen, K. and A. Salter (2006), 'Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms', *Strategic Management Journal*, **27** (2), 131–150; Smith, K. H. (2004), 'Measuring innovation', in J. Fagerberg, D. C. Mowery and R. Nelson (eds.), *The Oxford Handbook of Innovation*, Oxford: Oxford University Press. is related to that given in the Oslo manual. The manual makes a clear distinction in relation to the degree of novelty: new to the firm (the minimum implementation requirement for an innovation) as opposed to new to the market, new to the industry or new to the world, which all require that the innovation is also introduced for the first time in that specific geographical area or field Oecd (1997), *Oslo Manual: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*, Paris: OECD.

[xi] This survey was conducted across nine countries under the auspices of the EU-funded INGINEUS Project in 2009. Data on firms in Europe was gathered from certain leading economies with an average per capita income above US$ 45,000 per year, namely Denmark, Germany, Norway and Sweden. Estonia, a transition economy, was also part of the survey. Data was also collected from four prominent middle-income countries: Brazil, China, India and South Africa. The choice of countries allows a clear comparison of economies that are global leaders and economies that are emerging economies in the global arena, in line with the overall aim of the project. The survey for each country focused on information and communications technology (ICT), the automotive industry, or agro-processing, whichever sector was of economic importance in that country.

[xii] This survey has also allowed a clear distinction to be drawn on the geographic location of resources used for innovation. Locations in the north included North America, Japan, Australasia and Western Europe. Locations in the south included South America, Central & Eastern Europe, Africa, and the rest of Asia.

[xiii] In a similar vein they defined firms to be located in the north if they were in Denmark, Germany, Norway or Sweden (high-income countries), and firms to be located in the south if they were in Brazil, China, India, South Africa or Estonia.