

## CHAPTER I

# Trans-nationalizing innovation systems – New spatio-cognitive spaces and the role of higher education institutions

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### Introduction

Innovation activities are concentrated to a relatively small number of locations around the globe and this tendency may remain although some of the strong present-day locations may change to some new ones as a part of the ever on-going change in the global division of labour. What has rarely been studied so far are the linkages, institutions and interconnectedness between these locations of intense innovation activities which cross the national borderlines and reach in many cases to other continents facilitated by foreign direct investments, collaborative networks or mobility of educated and entrepreneurial people. Even less than empirical studies there are contributions to conceptual and methodological aspects on this phenomenon we refer to as trans-nationalizing innovation systems. This broad issue is our interest in this paper, with the focus on the role played by higher education institutions.

This phenomenon was anticipated by Freeman (2002) who stated that the *national* level was the major arena for processes of forging ahead, catch-up and falling behind during the 19th and the 20th centuries. During the 21st century this may change due to an increasing capacity to use information and communication technology as well as to exploit the highly developed transport connections. Competitive power will increasingly depend on the capability to manage international networks in production and marketing, with the core activities of research, design and development of software and hardware. These networks are dependent on a variety

of information services and knowledge-based activities, but as they are embedded in social systems, political and cultural changes may then take precedence in the complex interactions between the various sub-systems of society at all levels of the global system. (ibid. 2002, 209–210.) For innovation activities, this means that the various institutional preconditions has to be at place, be these cognitive, regulative, normative or financial, among other key factors. The national innovation system approach (e.g. Lundvall 1992, Lundvall et al. 2010, Edquist 1997) and its variants, e.g. regional and sectoral approaches (Cooke 2004, Malerba 2002) are developed to encompass such a variety of factors. Nevertheless, the approach has its limitations what comes especially to its spatial dimension.

This chapter will first discuss some key concepts that are necessary to make sense in analysing and measuring globalization of innovation. In this context, some theoretical categorization is been presented (section 2). This categorization is then deployed in the analysis of statistical data (section 3). Section use secondary data and shortly pin points the directions of change, and transformation of innovation processes and systems to *less national*. The findings indicate, among other things, that the process of trans-nationalization of innovation is more relevant in the context of such countries that can be characterized as small economies whereas the larger economies are yet less inclined to rely on external linkages (at least on average at a national level). It also seems evident that the regional level (or labour market area) would be a more appropriate spatial level of analysis than national. After preparing the grounds for the arguments, we move (in section 4) to discuss its key point, the dynamics of trans-nationalizing process involving knowledge-intensive and innovation-driven geographical agglomerations that connects and builds interdependence between them. Innovation systems, then, co-evolve with these processes by their diverse formal and informal institutions and organizational settings.

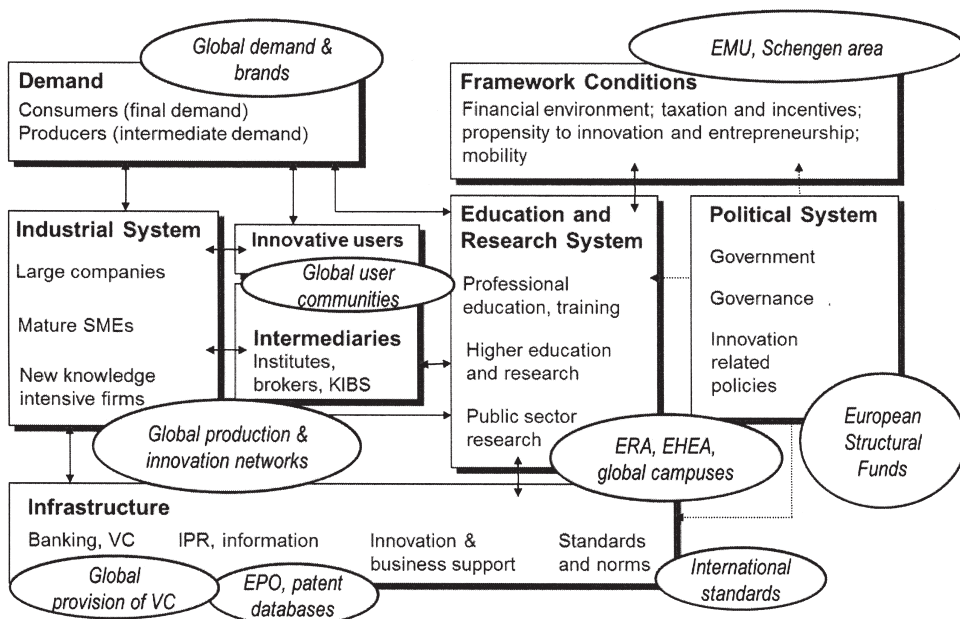
We briefly outline the emerging framework aimed to capture the essence of the drivers, formation and impacts of trans-nationalizing innovation systems by introducing a heuristic twin concept of “*trans-national channel*” and “*local platform*”. The illustrative example from higher education institution (HEI) point of view is Songdo International Campus from South Korea. It is used to illustrate the approach as such, but also to emphasis the significant role of HEIs in governance of trans-nationalizing innovation systems. While many forces tend to weaken the systemic nature of relations of different actors, HEIs may have a contrary role. National educational systems were not just sources of knowledge production in national innovation systems, but also important sources of social capital and mutual understanding – common cognitive mind-sets – among the actors of innovation systems. This role may be acquired by HEIs, when building the cognitive proximity among the actors who originates and operates in different countries

and even continents, when interactions are challenged not just by the spatial distance but often even more so by the cognitive distance. This may be seen as an important goal, when building and governing mutually beneficial long-term trans-national innovation systems between the innovative regions, in search of productive order to fragmentation process driven by globalization. Finally, a short conclusive section follows (5).

## From national to trans-national

### Fine-tuning spatial processes and concepts

As our focus in this chapter is most of the time not that of nation-states and national innovation systems, it is important to clarify some of the key concepts. First, Figure 1 illustrates the key elements of a national innovation system and further indicates some processes of trans-nationalization.



**Figure 1.** Elements of a national innovation system (rectangles) and examples of trans-nationalization (ellipses); (modified from den Hertog 2000, Smits & Kuhlman 2004.) Abbreviations: EMU=European Monetary Union; ERA=European Research Area; EHEA=European Higher Education Area; EPO=European Patent Office.

Portes (2001) bases his definitions of cross-border organizational structures and activities on type of actors and sources and scales of activity. Modifying his definitions, the following are used here:

- **Trans-national**<sup>1</sup> in this context comprise two concepts of Portes' (ibid.) – multinational and trans-national – as the main point is to distinguish the activities that are clearly based on the activities of governmental actors of a nation state from those who have no strong spatial obligations for their activities. Both individuals and firms are usually connected with their local environment with multiple ties and bonds, but they nevertheless have opportunities to conduct their innovation-related actions and attempt to steer the possible output to any location that seems to fit them optimally. Difference is that a nation state or any other geographically defined regional authority does not have this opportunity but their goals mostly have to be confined to this certain spatially defined area. Trans-national is not totally free from the spatial bonds, but in that context significant and long-term interactions are conducted mostly between the limited amount of locations rather than everywhere, globally.
- **International** is then very similar concept with Portes (2001); i.e. agreements and activities between nation states (e.g. national governments, regional development agencies). In the case of innovation activities, this refers to policies that aim to enhance the performance of the national innovation systems with activities and agreements crossing the national borders. Whereas trans-national activities *transcends* the nation states and its spatial limits, international activities take place and are organized between them specifically to foster innovativeness of those national economies.
- **Globalization** is a more macro-level concept that refers to the overall interconnectedness of the economy and economic agents. Key agents are forums and institutional bodies, mostly created by national governments, which are able to make global (e.g. United Nations, World Bank) or supra-national (OECD, European Union) agreements that have impact over all or many nation states.

Thus, innovation-related interaction and activities that take place at micro-level between the private agents (firms and individuals) crossing the national borders may be seen as *trans-national activities*. They are not global in terms of multiple interconnections but rather build connections between two or limited number of agents (and regions) in most cases. Multinationals fit with this logic and behind the emergence of concept of trans-nationalism was actually the growing importance of multinational corporations (MNCs) in 1980s (see Vertovec 2009).

## Measuring innovation in trans-national settings

There are not many datasets and sources related to the trans-nationalization of innovation and of innovation systems. Table 1 presents the most common statistical data available. These relate to Research and Development (R&D), patenting, Intellectual Property Rights (IPR; as Technology balance of payments) and migration of the highly skilled people. The table also briefly comments the quality and relevance of such a data in measurement.

Even at the national level the measurement of innovation includes several shortcomings. Three most common areas of measurement have their problems<sup>2</sup> to mention just a few of them: 1) R&D expenditures measure the input rather than the output (innovations); 2) Patent data includes those inventions that are new and worth patenting but nevertheless they may never turn out to be innovations if they are not introduced in the market as is often the case; 3) Innovation surveys may be partly subjective and lack time-series and international comparability. As these problems indicate, there is a lot of work to do especially at the international to produce more accurate data and indicators to understand innovation activities and its complex relations to many underlying social processes and institutional underpinnings and dependencies. Further, this all clearly points out that also qualitative data is much needed to increase the understanding of the phenomenon.

**Table 1.** Data on trans-nationalization of innovation (modified\* from Smith 2010, 77)

Indicator	Definition	Data availability	Quality and relevance
R&D flows	BERD (Business Expenditure on R&D) investments by firms domiciled elsewhere	Questionable	'Arms-length' indicator of knowledge flows
R&D by affiliates	BERD by foreign-owned affiliates	Good	Highly relevant for interdependence
Patents by location of applicant	Patents by foreigners in domestic patent offices, or by domestic patent holders abroad	Excellent	Measure of invention; patents often unused
Technology balance of payments	Royalty payments and payments for patent licences	Poor	Relevant but limited by data quality
Migration, especially of the highly skilled	Cross-border movements of highly qualified people	Poor	Strongly relevant, with some signs of improvement in data quality

\*Note: those indicators mentioned by Smith are omitted here that are not necessarily directly related to innovation activities (commodity trade, trade in services, foreign direct investment, foreign portfolio investment)

## Taxonomy on cross-border innovation activities

Despite of the many problems of measuring, recent years have witnessed much progress. Archibugi and his collaborators (e.g. Archibugi and Mitchie 1995, Archibugi et al. 1999, Archibugi and Iammarino 2002) have proposed a useful taxonomy on technological development and innovation activities that have a cross-border nature (see below the list of categories). Nevertheless, they have also found that the conceptual categories they have developed do not match well with the statistical indicators (Archibugi and Iammarino 2002, 105).

Recent ideas in innovation debate, such as open innovation, inclusive innovation economy, employee-driven or democratizing innovation and growing importance of labour markets (Lundvall & Lorenz 2010, Chesbrough 2003, von Hippel 2005), suggest that virtually all employees and individuals are potential contributors in innovation processes. Thus the perspective on innovation activities has broadened to cover many actors, individuals and organizations outside of science-driven or R&D-related activities. In addition, emerging economies and some development countries have become important players in the global (innovation) economy and as such also as objects of innovation policy-making in most advanced economies. Therefore, also the taxonomy seems to need some modification as well (additions by the authors in italics):

## International exploitation of nationally produced innovations

- By profit-seeking firms and individuals in a form of 1) exports of innovative goods, 2) cession of licenses and patents, 3) foreign production of innovative goods internally designed and developed
- By public and non-profit organizations as a transfer of good practices and social innovations (service models, operation practices, concepts, policies etc.). There are many these kinds of organizations that are interested in diffusing abroad their innovations that have proven some merit, in order to create partnerships with similar organizations in other countries or to attract new international clients and foreign direct investments, for example.
- Concerns the use by innovators to deploy their technological competences in markets (or other geographical entities) other than the domestic one
- The category is labeled 'international' in opposition to 'global' because innovations often preserve their own national identity, even when they are diffused and marketed in more than one country.

## **Global generation of innovations**

- By multinational firms in a form of 1) R&D and innovative activities both in the home and the host countries, 2) acquisitions of existing R&D laboratories, 3) greenfield R&D investment in host countries
- By supranational organizations as a transfer of good practices and social innovations (service models, operation practices, concepts, policies etc.)
- By individuals and firms in a form of virtual development projects (Open Source Software, user communities etc.). Internet has provided a new platform for virtual cooperation over long distances and has helped to create communities of specialists.
- The focus is on innovation generated on a global scale, often by multinational enterprises (MNEs, see e.g. Ghoshal & Bartlett 1990). Innovations here are based on inputs from multiple locations in different countries and these innovations are conceived on a global scale from the moment they are generated.

## **Global techno-scientific collaborations**

- By universities and public research centres with 1) joint scientific projects, 2) scientific exchanges or sabbatical years, 3) international flows of students. Academic world has always transmitted knowledge from one scholar to another within a trans-national setting. During the last decades, activities of higher education institutes (HEI) have enormously expanded as they not only conduct knowledge transfer activities to industry but are entrepreneurial themselves by, for example, setting up campuses to foreign countries.
- By national and multinational firms in a form of 1) joint ventures for specific innovative projects, 2) productive agreements with exchange of technical information and/or equipment. Recently technological collaborations have increased also within the private sector. These are joint ventures in which two or more firms aim at developing new knowledge and/or products together. These joint ventures are often driven by a necessity to reduce the costs and risks of innovation and to cope with its increasing complexity. More and more these joint ventures take place between firms located in different countries.

## ***Trans-national innovation community-building***

- By “scientific diasporas” and trans-national innovation-related networks (immigration powered social spaces, etc.).

- By global innovation communities, brain circulation and “trans-national bridge builders” (expat-networks / associations, etc.).
- These are not necessarily directed to create innovations but they may as “by-products” and they may have a potential to enable them in trans-national settings.
- The power these communities may have in terms of innovation is in their capability to overcome the cultural and cognitive distance that may be entailed in national borderlines or in lack of geographical proximity.

The groupings presented above hint that any fixed spatial categories (e.g. a nation or a region) may not be very accurate as innovation activities are getting increasingly global or trans-national. Instead, a complex web of heterogeneous innovation-related cognitive structures and spaces has emerged that occurs in various geographical configurations.

## Some evidence on trans-nationalizing of innovation

In this section, we will take a brief look into some contours of development related to the trans-nationalization of innovation (and as such, reflected on innovation systems). We already pointed to the lack of relevant statistical data. Above we presented the taxonomy with four main categories of which we will study next two that are “International exploitation of nationally produced innovations” and “Global techno-scientific collaborations”. The reason to leave out the other two is that, first, the multinational firms and their efforts to globally generate innovations<sup>3</sup> is quite extensively studied phenomenon and for that reason it is not in our key interests. Second, trans-national innovation community-building is just added by us among the categories originally presented by Archibugi and his collaborators (1995, 1999, 2002) and is very likely the most difficult one to study in terms of availability of statistical data. If data cannot directly prove the trans-national nature of the phenomenon, it evidently proves the decreasing role on national level.

Therefore we concentrate on the two categories where firms and organizations operate on a trans-national scale. This data is acquired from the OECD, mostly from the recent report “Measuring Innovation – A New Perspective” (2010), where a good deal of different perspectives has been combined to come up with a coherent picture of the recent developments at the international level. The following key points can be made, based on the statistical evidence:



- During the period of 1997–2008, *international technology flows* have steadily grown faster than the GDP in a majority of the OECD countries although in some large economies the growth has been only on a same level than the growth of the GDP.
- Out of 25 countries, in 14 (mostly smaller) countries it was reported that innovative firms have *collaboration on innovation* at least as much with foreign partners than with domestic partners (CIS-2006). There is also some other evidence that the countries most involved in this form of globalization are the smallest and the most technologically dynamic (c.f. Archibugi & Iammarino 2002, 111). This is to a great extent because of the limited size of their domestic market – a reason that has always induced firms to search for larger markets and especially so for products that require high investments (e.g. on R&D).
- Concerning *co-operation on scientific articles* during the last twenty years, an evident tendency was from single authorship to co-authorships but here international co-operation have not, although grown considerably, caught up domestic co-operation but the gap has remained the same. Here, too, it seems that the small countries are more open to international co-operation. Nevertheless, in a case of the highly cited top scientific articles, the likelihood to foreign co-authorship increases. Among these articles, the position of the US is overwhelming.
- Within the OECD countries, the average share of *international students* is seven per cent of all students on the tertiary level. English-speaking countries have a stronghold here as six countries belong to the top-seven countries in this sense.  
Concerning the geographical pattern of patent collaboration (co-invention), out of the total of 29 countries with the data, in ten countries foreign co-inventors are as usual for inventors than domestic co-inventors.

As the main outcomes of these findings, three things can be highlighted. First, the phenomenon of *trans-nationalizing of innovation activities can be observed by all the indicators* although with very versatile pace and with heterogeneous forms varying from country to country. Second, the phenomenon seems to be *more typical or acute for many small countries including some of the most dynamic innovation economies* (e.g. the Nordic countries and Switzerland). Nevertheless, small countries form a heterogeneous group as many small countries indicate the same inward-oriented tendency than the most of the large countries.

Large countries thus tend to be usually somewhat inward-oriented in their innovation collaboration patterns measured on an overall national level. However, this kind of observations may be grossly misleading because in many large countries, regional patterns of development may differ greatly especially in terms of innovation activities. Examples of this are the USA with its well-known Silicon Valley and some

other regions *vis-à-vis* many Mid-Western states or China with Beijing, Shanghai and Greater Delta River Region compared with its most western landlocked territories.

Therefore, third, *spatial level of analysis has to go beyond and within the nation-state*. To recognize trans-nationalizing innovation systems, data from the regional, city-region or labor-market levels would be required. This is a challenge, because indicators of innovation are in general at their infancy rather than well-developed and easily available. The same can be said of international comparisons at the regional level, and further analyses of interdependence between the regional economies (consisting trans-national innovation systems).

## Trans-nationalization of innovation systems in the CHAPS framework

### Towards the interconnected regions of innovation?

Trans-nationalization of innovation activities is very place-specific phenomenon in a sense that innovation activities to a great extent concentrate on a limited number of locations around the globe. This notion can be traced back to the Marshallian concept of an industrial district of the 19<sup>th</sup> century English industrial cities. Later, scholars such as Porter (Porter & Sölvell 1998, 441) stated that “(f)irst, a large proportion of total world output of particular goods is produced in a limited number of highly concentrated regions. Second, firms in particular industries, or firms which are technologically or otherwise related, tend to collocate and form spatial clusters. Third, these both these phenomena tend to be persistent over time.”

Recently, Florida (2005) has come up with an argument that “...our world is amazingly ‘spiky’. In terms of both sheer economic horsepower and cutting-edge innovation, surprisingly few regions truly matter in today’s global economy. What’s more, the tallest peaks – the cities and regions that drive the world economy – are growing ever higher, while the valleys mostly languish.” (Ibid., 48.) However, not the spikes themselves but the drivers, dynamics and impacts of interconnections and interdependence of different types of knowledge-intensive and innovation-driven cities and other agglomerations create the mechanisms that re-produce some spatio-cognitive glue to globally fragmented spaces.

In our work, we deploy the concepts of the innovation system (IS) approach because we are interested in the wider system of informal and formal institutions and organizational settings that nurture or hinder innovation activities emerging beyond

the national borders. At the same time, we consider that the IS approach is in the need of development: the national perspective still tends to focus on the nationally limited scale (see e.g. Lundvall et al. 2010), and the regional variant (see e.g. Cooke 2004) has often recognized the multilevel characteristics and interdependencies of innovation but has not yet provided much tools to grasp the phenomenon. Sectoral perspective (see e.g. Malerba 2002) is more interested in the industrial dynamics as such than the institutional and spatial conditions that enable or hinder these dynamics. So far there has been a lack of innovation system level analyses and theorization of globalization (Oinas 2000, Carlsson 2004), with an exception concerning the role of large multi-national or trans-national companies (MNCs or TNCs) and their R&D structures as vehicles of knowledge transfer between different national innovation systems.

So far, only few attempts have been made to cover this challenging field in broader terms, including also other kinds of flows and linkages and trying to contribute to analytical and methodological development as well. Among the exceptions there are contribution by Coe and Bunnell (2003) on transnational innovation networks and by Wixted (2010) on the external, often global networks of geographical clusters. Or as he puts it, "...at least one sub-field of the study of innovation systems should focus on a multi-spatial framework which facilitates analysis of how places are connected to one another". (ibid., ix.) On the firm level, concepts such as global pipeline by Owen-Smith & Powell (2004) and Bathelt et al. (2002) have recently been presented.

Cooke and Laurentis (2010) integrate issue of governance of regional innovation systems to internationalization in their conclusions drawn from the extensive international research project (Eurodite). They have developed a regional governance models (including "platform governance") emphasizing the need of "being open to the world for understanding, while applying the transferred knowledge to indigenous economic assets". There is a need to combine industrial and governance knowledge flows in a specific territory with international innovation system proximities. (Cooke & Laurentis 2010, 358.) In fact, several studies have conducted regional or national level analyses to pinpoint the benefits of spatial proximity and social capital based on the common history, mutual understanding and trust (Doloreux 2002, Maskell & Malmberg 1999).

While strong regionally interdependent regions are hard to find, there are some examples of cases where border crossing takes place in spatial proximity, i.e. between neighbouring countries (e.g. Lundqvist & Trippel 2011) and even more so at the cluster level (e.g. Health Axis Europe, UK/Belgium/Germany). In the following example, we focus on the more typical phenomenon that may be seen as the sectoral

level case but highly important element when building the systemic qualities of innovation processes in trans-national context. Here, international education can be conceived as a platform to enable governance of trans-nationalizing innovation systems with opportunities to reproduce the cognitive and relational proximity for fragmented global settings.

## Re-building spatio-cognitive spaces through trans-nationalizing HEIs

For a more detailed discussion, we introduce a heuristic twin concept of “*trans-national channel*” and “*local platform*” in the context of illustrative examples. First, trans-national channel can be thought of as a “bridge” between two localities over which many types of “vehicles and cargos” are being transported (i.e. people and their skills, experience, ideas, R&D cooperation and inventions, innovations, IPR, innovation policy cooperation and good practices, and so forth). Local platform, then, is a “junction” from which these different vehicles find their way to their destinations. As mentioned, higher education institutions serve these both functions, and play important role in rebuilding of cognitive spaces for global environment. The most obvious example may be the Silicon Valley and connections with Asia, built often by those who came to study from China and India to the USA, and then set up a business and business relations between the continents. The understanding of Asian and American (business) cultures was an essential asset in this process (Saxenian 2006), i.e. building of new cognitive proximity between the distant places. Higher education system was obvious platform that enabled the vast interactions between the regions, and enhanced the economy especially in Taiwan and then in China.

The other, more recent and intentionally planned example is the Songdo Global University Campus (SGUC) in South Korea. Campus is a university complex of several foreign universities and part of the South Korean strategy to support its innovation economy, where about 80 per cent of the population enrolls to tertiary level education.

Construction of Songdo started in 2009 and the campus is just 20 kilometers from the capital Seoul. South Korea already has two foreign university campuses (Netherlands Shipping and Transport College Korea and the Friedrich-Alexander University of Germany) opened in 2008 and there are expectations for more establishments in the immediate future. Campus locates in Incheon Free Economic Zone (IFEZ), where there is an international industrial city, tax support, free economic activity, high-quality administrative services and good quality living environment that supports the relocation of the foreign university programs, staff and students.

To attract foreign universities, IFEZ authorities also provide, for example, support funds for preparation activities, complimentary faculty housing and funds at the early stage of activities. The aim is to create educational hub (like Dubai and Singapore). However, the concept is “a testing board” for many universities, which in addition to global economic downturn may cause delays in the process, but both local and central government work in order to solve these challenges. Also possible devaluing of new oversea programs or requirements of government to high share of foreign students may create challenges that hinder the development of this “channel”.

In practice universities will grant their own degrees in this global campus, but there will be independent administration for the campus facilities. The aim is to attract at least ten universities to the campus with their “best academic programs”. Eventually an aim is to have even 30 000 students. This would make campus as comprehensive as traditional universities. Universities planning (or already decided) to set up undergraduate programs in Global Campus includes North Carolina State University, George Mason University, The University of Southern California, University of New York at Stony Brook and Belgium’s Ghent University. According to the director of educational affairs at the University of Ghent, offering courses in South Korea is important, because it is

“of great strategic importance to have a foothold in a part of the world that is in full expansion and Ghent hopes to attract students from all over Korea and neighboring regions and to set up a close working relationship with IFEZ, the Ministry of Knowledge Economy, the University of Incheon and other academic and industrial partners.” (Miller 2011.)

This comment well captures the idea of a trans-national channel and local platforms. The example of Songdo also indicates the magnitude of organizational and even institutional changes that are often required, when channels and platforms are properly built. An important question is how these students (mostly management, engineering, science, etc.) are connected with the innovation activities and in which location.

Connections between regions matter in this context only if they have some crucial impacts and therefore a local platform greatly matters. Focal questions include how these processes are or are not organized and governed at the system level and by which actors? To study this, the main content of flows (human capital, finance or ideas and technologies) and processes how to utilize these (adoption/learning) have to be recognized as well as modes of flows (fixed, co-operative, circulation or mobile). What they will be in case of Songdo, remain to be seen in the near future.

Another focal issue is the impact these flows and processes have on the regions in question. Are these mutually beneficial (e.g. providing complementarities) or more for the benefit to the other (e.g. shifting R&D employment from one place to the other). Therefore, several types of impacts can be recognized (e.g. establishing or ceasing innovation activities, complementing or decreasing innovation-related resources, renewing or creating lock-in of regional technological development paths and so forth. (Kautonen & Raunio 2010.)) To be useful, twin concept of trans-national channel and local platform should be able to offer analytical insights to these questions.

*Therefore, we may define that trans-national channel refers to an institutionalization and governance of the flows, directly or indirectly supporting the innovation activities of a national or regional economy, a cluster or a group of firms.* A channel is usually not an outcome of any single intentional activity such as a government policy alone but emerges from activities of multiple actors that happen to operate and share interests between two innovating regions. From this point of view, to gain any deeper understanding of the phenomenon, also case of Songdo, should be placed to wider framework of channels and platforms, in order to define its role as a part of the trans-nationalizing innovation system of South Korea.

Channels often *emerge from initiative and activities of mixed combinations of actors*, such as firms, transnational entrepreneurs, intermediary organizations, universities or NGOs, governmental institutes or alike. Especially policy-based channels rather facilitate the activities of other types of actors than operate themselves. Channels may also partly consist of flows in which actors' intentions may be related to something else than to directly foster the innovativeness of an innovation system they are embedded into<sup>4</sup>. Concepts of platform and channel are often overlapping and interdependent but serve for different ends.

The main division of platforms may be done between the *utilizing platforms* where flows are received and used to support innovation, and *generating platforms* where flows are created and sent to the new location. Songdo as educational platform, for example, refers to latter. On the other hand, utilization refers to the importance of absorptive capacity (Cohen & Levinthal 1990) that also Songdo as a platform supports. While the channel refers to relational proximity which always includes interaction, the platform emphasizes also cognitive proximity, which refers to similarities in mind-sets and behavioral patterns. Platforms are needed to intermediate or "translate" the ideas and resources to fit with a novel environment<sup>5</sup>. For these activities, trans-nationalizing HEIs offer plenty of opportunities.

## Conclusions

We have here, within a very limited realm of a chapter, discussed issues related to the measurement and data on globalizing innovation activities. This was followed by a scant analysis that indicates, among other things, the phenomenon of trans-nationalizing of innovation activities seems to proceed although with very versatile pace and with heterogeneous forms varying from country to country. Companies increasingly exploit internationally their domestically produced innovations by exporting innovative goods or by selling their intellectual property rights or by producing their innovative goods abroad.

It was also noted that the process of trans-nationalization of innovation is more relevant in the context of such countries that can be characterized as small economies whereas the larger economies are yet less inclined to rely on external linkages (at least as an average on a national level). It also seemed evident that the regional level (or labour market area) would be a more appropriate spatial level of analysis than national.

The chapter then moved to discuss its key points related to trans-nationalizing innovation systems and knowledge-intensive and innovation-driven geographical agglomerations. Evident outcome was, that as globalization proceeds, its fragmenting impact to national level systems of innovation is inevitable, and new forms of governance and cohesion building are needed to attempt to steer the innovative actions spatially. First, this was seen as building of connections and interdependence between the regional agglomerations, or at between clusters and key agents within the regions. Innovation systems, then, co-evolve with these processes by their diverse formal and informal institutions and organizational settings. The emerging CHAPS framework was used as a heuristic tool to capture the essence of the drivers, formation and impacts of trans-nationalizing innovation systems. Second, the role of internationalizing higher education institutions was interpreted from the viewpoint of social capital and common mind-set. HEIs potentially build cognitive proximity among the globalized actors that may work as important sources for trans-national social capital and cohesion, providing the groundings for long-term and mutually beneficial interactions over time and space.

Finally, and methodologically, the spatial level of analysis is highly significant in this context. To identify any processes and impacts of trans-nationalizing innovation systems, data from the regional, city-region or labor-market area level would be required. This is a challenge because of the fact that the indicators of innovation are in general at their infancy rather than well-developed and easily available, not to mention international comparisons at the regional level, and further analyses of interdependence between the innovation-driven geographical agglomerations around the globe.

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1. Trans-national is rather trans-local or trans-regional in real-life, because it refers to actual interactions between the private actors (individuals, firms, organizations, etc.) that almost always take place between certain localities or regions rather than nation states. Nation states, however, create significant borders for this interaction, and thus also trans-national connotation is well grounded.
2. Following the idea of the OECD's Frascati Manual; Also bibliometric analysis is an important tool in knowledge-based economy (although it includes several shortcomings as well), yet measuring scientific work (output) rather than innovation. (Smith 2010, 154)
3. Nevertheless, we have to bear in mind that this is the category where probably the most extensive developments have so far taken place by the operations of multinational firms and foreign direct investments in terms of, for example, acquisitions of R&D laboratories and green-field investments on R&D facilities in host countries.
4. It should be noticed that whereas, for example, concept of a global pipeline (Bathelt et. al 2004) refers to intentional collaboration between two firms, we want to underline that in channel there is often a large number of connections between a group of heterogeneous actors and numerous flows of resources between interconnected innovation systems. In addition, there are typically also attempts to somehow govern these connections and flows because these are usually considered important and at least potential sources of competitiveness for regions or nations.
5. Including; human capital flows (e.g. foreign experts, "argonauts" who move back and forth between two locations, expats, international and foreign students, co-operation and collaboration with international partners), corporate flows (financial flows, e.g. foreign direct investments, venture capital) and policy flows (policy models, best practices, and supporting political and economic views and indicators that aim to impact on the form and functions of innovation systems in certain countries).