

T ransnational innovation systems

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Transnational innovation systems

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ECLAC Subregional Headquarters in México

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Abstract

This paper discusses the concept of transnational innovation systems (TNIS) and presents some experiences in Europe in the formation of TNIS. The real cases show that supporting the emergence of Transnational Innovation Systems has clear benefits for the countries and the regions involved which may be related to the enlargement of consumer, labour and factor markets, enhanced competition, extended division of labour and increased specialization (Lundquist and Tripp, 2011: 3). Regional integration across borders can therefore be of high importance for small and emerging economies, where resources are scarce and markets are not large enough to support and stimulate innovation, like Central America. The paper concludes with some recommendations on how policy makers can facilitate the emergence and development of TNIS.

Introduction

This report discusses the concept of supranational systems of innovation (SSI) or transnational innovation systems (TNIS) both from a conceptual point of view as well as from a more practical approach, looking at real experiences in the emergence and development of supra-national innovation systems in Europe.

The real cases show that supporting the emergence of Transnational Innovation Systems has clear benefits for the countries and the regions involved: integration makes it possible to exploit better complementarities between the partners, while allowing the emergence of synergies which could be capitalized on through interaction (Anderson and O'Dowd, 1999; Tripl, 2010). The potential benefits might be related to the enlargement of consumer, labour and factor markets, enhanced competition, extended division of labour and increased specialization. (Lundquist and Tripl, 2011: 3). Regional integration across borders can therefore be of high importance for small and emerging economies, where resources are scarce and markets are not large enough to support and stimulate innovation.

The report is structured as follows. First, we will review the concept of transnational innovation system (TNIS). In next section we introduce the main components of a TNIS as well as the analytical framework that we will use to analyze TNIS. In Chapter III, two case studies are discussed and compared. Chapter IV discusses the main barriers to regional integration and section five provides some concluding remarks and proposes some recommendations to policy makers for supporting the emergence and development of TNIS.

I. Conceptualizing national and transnational systems of innovation

A. Systems of innovation – concept and adaptation to developing countries

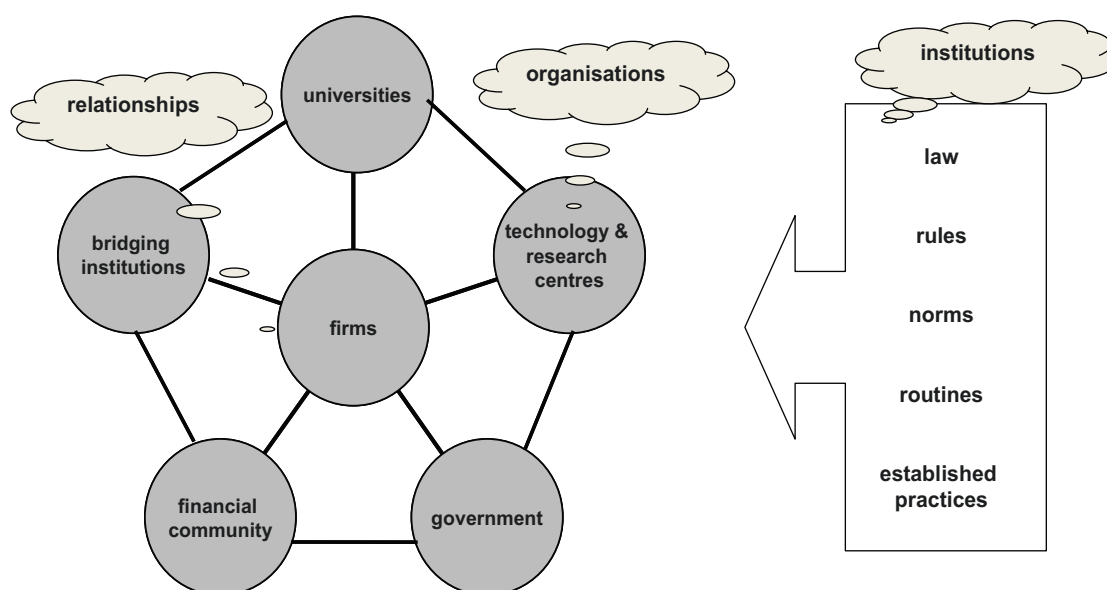
There is a general consensus among academics and policy makers that innovation is not the result of isolated efforts by individual firms but that it has a strong systemic nature. Firms and other organizations innovate in continuous interaction with other organizations (Lundvall, 1992) and it is through these interactions that organizations exchange the knowledge they need for innovation.

The innovation system (IS) approach (Freeman, 1987; Lundvall, 1992, Nelson, 1993 and Edquist 1997) emerged as an alternative to the dominant neoclassical paradigm, which understood innovation in a rather linear way, assuming that knowledge was equal to information and was easily accessible to all firms. In contrast, the IS finds its roots in the evolutionary theory (Nelson and Winter, 1982) and considers that organizations have different competences and that knowledge acquisition is very costly for firms (Edquist, 2004). The main focus of the IS approach is the complex interactions that take place among the different organizations and institutions in the system in order to acquire and use knowledge for innovation.

A system of innovation is usually made of organizations, their interactions and the institutional framework that shapes both organizations and institutions.

Organizations are defined as “formal structures that are consciously created and have an explicit purpose,” (Edquist and Johnson, 1997). They are the key actors in the system of innovation and their attributes (competences), and they can be firms, universities, technological centres, venture capital organizations, public agencies responsible for innovation policy, etc. These organizations engage in formal and informal interactions through which tacit and explicit knowledge is exchanged. Finally, institutions are a “sets of common habits, norms, routines, established practices, rules or laws that regulate the relations and interactions between individuals, groups and organizations,” (Edquist and Johnson, 1997). The different components of an innovation system and their interactions can be seen in Figure 1 below.

FIGURE 1
COMPONENTS OF INNOVATION SYSTEMS AND THEIR INTERACTIONS



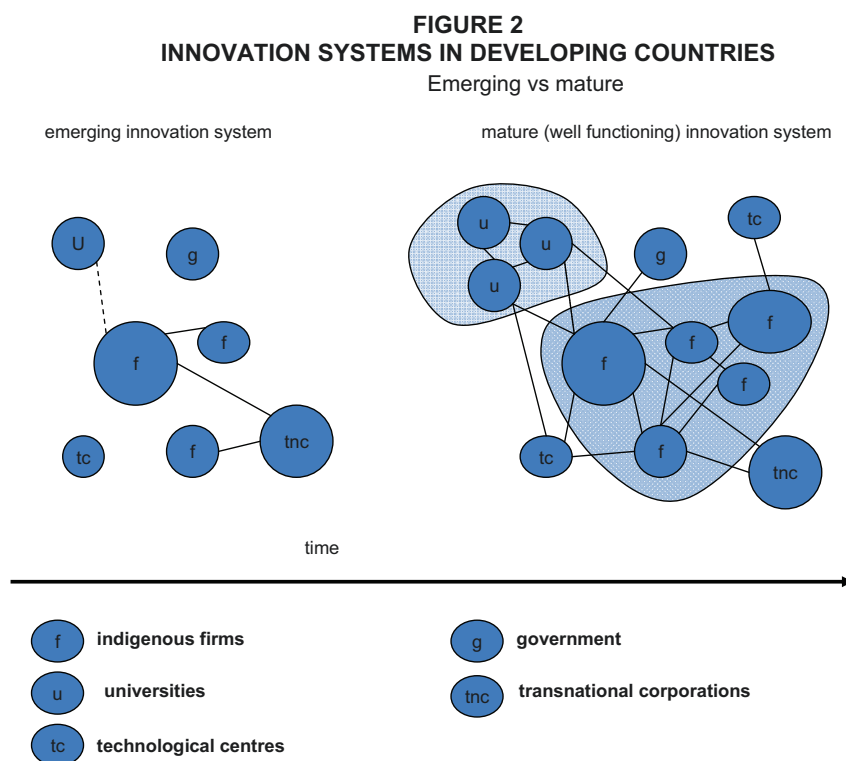
Source: Prepared by the authors.

There are two main approaches to the study of innovation systems. The proponents of the *narrow* approach (Nelson, 1992) suggest considering barely the organizations and institutions involved in research activities (searching and exploring) like universities, R&D departments in firms, and technological institutes. The proponents of the broad definition, on the other hand, prefer to consider “*parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring*” (Lundvall, 1992: 12). Innovation systems in developing countries are better studied through this second, broader approach (Lundvall and others, 2009). Furthermore, innovation systems could be better conceptualized as a system for the support of innovation and competence building. Thus defined, it is clear that a broader definition is needed, one that includes all parts of the economic structure affecting learning.

One could argue if the concept of innovation systems can, as such, be applied to developing countries. Innovation systems in developed countries are characterized by a strong knowledge exploitation and exploration subsystems, high degree of interactions between the organizations and strong institutional frameworks. On the other hand, innovation systems in developing countries are usually characterized by limited innovative capabilities, weak interactions between the different organizations of the system and, more often than not, a lack of an institutional framework supporting institutions.

Furthermore, innovation in developing countries is through the acquisition of technology developed somewhere else more than on the development of own technologies and innovations. In other words, it is more about the absorption of technology developed abroad than on the generation of new technologies and innovations.

If one looks at innovation systems in developing countries through the glasses of the innovation systems literature, one could wrongly conclude that it is not possible to find innovation systems in less developed regions. As we have argued somewhere else (Chaminade and Vang, 2008; Chaminade and others, 2009) innovation systems in developing countries are better conceptualized in an evolutionary perspective, that is, they should be considered as emerging innovation systems, where some of the components of the system are there, but where interactions are still in formation and thus, the system may appear fragmented. Figure 2 plots the differences between an emerging and a mature innovation system.



Source: Chaminade and Vang, 2008.

In emerging innovation systems we might expect weak inter-sectoral links, the absence of interface units and universities specialized mainly in the supply of manpower (Galli and Teubal, 1997). Firms and other organizations of the system are not yet able to produce radical innovations but they are accumulating the competences and capabilities that are needed to engage in different forms of interactive learning. Innovation enabling policies tend to be constrained by (the lack of or limited) capacity and competence of policy makers partly as a function of internal political cultures and resources and the externally imposed requirements (i.e. by IMF and the World Bank) (Chaminade and others, 2009).

The emerging innovation system might gradually evolve into mature innovation systems. In the mature innovation system interactions between the building blocks take place through market and non-market mechanisms such as informational links, interactions and other kinds of formal and informal networks (Galli and Teubal, 1997). We might expect that firms and other organizations in the system have developed their absorptive capacity and are engaged in continuous interactive learning with other

firms, users, universities and other organizations in the system. As said above it thus follows that, at this stage of development, the university-industry linkages become more important for catching up.

B. Scales in innovation systems

Innovation systems can be analyzed at national (Lundvall, 1992; Nelson, 1993; Freeman, 1987), sectoral (Malerba, 1995) and regional level (Cooke, 1994; Asheim, 1995, Saxenian, 1994). The three alternatives have advantages and limitations. The supporters of the national system of innovation argue that most of the interactions take place at national level and that also most policies and other institutions of the system of innovation have a very strong national character (Lundvall, 1992). The scholars in the sectoral system of innovation argue that industries differ significantly in the way in which they innovate (Pavitt, 1984) and that organizations, interactions and institutions have got a strong sectoral character. Therefore, one should look at sectoral systems, independently of the geography of the linkages (that is, if they are regional, national or international). Finally, the supporters of the regional innovation system literature argue that, due to the tacit nature of knowledge, interactions tend to be confined to a certain territory and that RIS are more important for innovation than, for example, national innovation systems.

While information can be (rather) easily transferred across large distances, tacit knowledge requires face to face interaction. The transfer of tacit knowledge is facilitated by a high degree of trust as well as by sharing certain values and culture, which is usually embedded in a certain region. What makes regional approaches valuable is the importance of personal relations, local networking and the cultural and social context of knowledge creation (Granovetter, 1985). Firms are dependent on their economic and industrial environment and the interaction with customers, subcontractors, suppliers and support institutions in the region. The argument of RISs is that those interactions take place mainly at the regional level, given the "sticky" nature of tacit knowledge and interactions (Asheim and Gertler, 2005). Knowledge is usually ingrained in a particular organizational culture or region that is difficult to understand by people outside that particular region or organization. In this respect knowledge is "sticky" and thus difficult to transfer rather than by face-to-face interactions. In terms of economic development, RISs are a good alternative as an analytical framework and a tool for policy making as most of the interactions between firms, particularly SMEs take place at regional or local level (Asheim and Gertler, 2005; Cooke, 2001) and, as such, are gaining momentum in the policy agenda worldwide.

The rapid development of information and communication technologies and the subsequent raise of globalization of innovation activities have not diminished the importance of proximity for innovation. As evidence shows, the majority of interactions continue to take place at regional and domestic level. However, in an increasing number of cases that will be discussed in this report, the regions is not confined to one country, but can cut across two or more borderline countries, thus forming a transnational innovation system (TNIS). The concept of TNIS is discussed in section 2.3 of this report.

C. Transnational regions and Transnational innovation systems (TNIS)

There are many various, albeit concordant, definitions of transnational or cross-border regions¹ (TNR). They all involve a high degree of "*concerted action designed to reinforce and foster neighborly relations between territorial communities and authorities*" (European Commission, 1980).

¹ As indicated earlier the term transnational regions (CBRs) is normally used to refer to sub-national regions although the concept can also be applied to full countries. CBRs are usually formed by adjacent regions in two or more neighboring countries. Examples of such regions are e.g. the Öresund region, which is formed by the Skåne region in South of Sweden and the Sjælland region (Copenhagen) in Denmark. Another example is the so-called "Centropoe area", which is formed by adjacent (sub-national) regions in Austria, Czech Republic and Slovak Republic.

A TNR usually involves some sort of an institutional agreement between the two neighboring countries and their integration is developed through a process of stabilization and social construction. *“This implies that TNR is not only understood as a functional space, but as a socio-territorial unit equipped with a certain degree of strategic capacity on the basis of certain organizational arrangement”* (Perkmann, 2003: 157).

The geographies of TNRs can vary greatly, e.g. in terms of size, scale and location, which determines what kind of integration is prominent to develop and its different potential benefits (Lundquist and Trippl, 2009). Their development is an evolutionary process regarding both formal and informal institutional and organizational factors, which all have their own characteristics and different directions and needs towards regional integration across national borders.

To distinguish between various types of TNRs, three dimensions are especially important: the geographical scope, the co-operation intensity and the type of actors involved. These dimensions are summarized in 1.

TABLE 1
RELEVANT DIMENSIONS OF TNRs

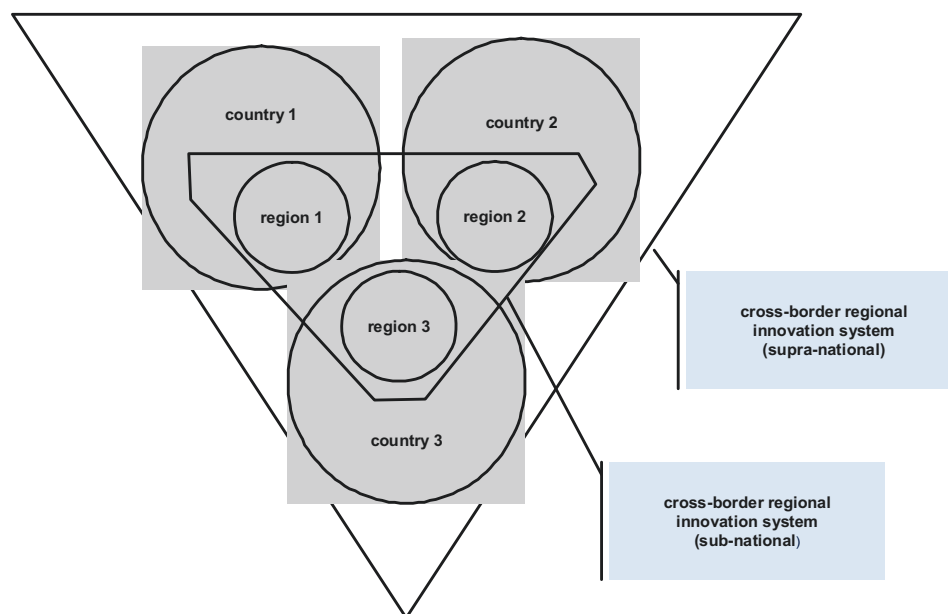
| | |
|------------------------|---|
| Geographical scope | Small-scale transnational initiatives can be distinguished from large initiatives that usually involve five or more regions/countries |
| Co-operation intensity | Referring to the strategic capacity gained by the transnational body and its degree of autonomy vis-à-vis central state and other authorities |
| Type of actors | Local (municipal) authorities can be distinguished from regional ('meso-level') authorities or even national authorities in the case of TNR integrating whole countries |

Source: Perkmann, 2003: 159.

When TNRs involve the integration of research and innovation capabilities, we can talk about the formation of a transnational system of innovation (TNIS). In simple terms, TNIS is the result of an integration process between two or more adjacent regional innovation systems across national borders of two or more neighboring systems of innovation (Perkmann, 2003). The reasons behind the formation of TNISs are the potential knowledge and innovation complementarities it can bring to the adjacent regions. These complementarities can stimulate innovative activities and prove economic beneficial for the regions. A successive integration can e.g. increase local consumption, —labor— and factor markets, extend the division of labor, increase competition and specialization. All these factors could upgrade the competence of the whole area (Lundquist and Trippl, 2009). The success of such regional integration is off course highly contingent to myriad of factors, such as the level of symmetry among these factors between the two or more regions. TNISs, their evolvments, and potential barriers are discussed further below.

The concept of transnational innovation system is used both to refer to the creation of supra-national innovation systems as well as sub-national innovation system. The difference between supra-national and sub-national transnational regions and innovation systems is plotted in Figure 3 and discussed next.

FIGURE 3
A TRANSNATIONAL REGIONAL INNOVATION SYSTEM



Source: Prepared by the authors.

Sub-national regions are found within national borders of one country, and can be defined either as *administrative regions* or *functional regions*. The former has clear administrative borders, e.g. municipality —or state— borders, and certain amount of governance autonomy. Examples of such regions are the “provinces” like San Vicente or San Salvador in El Salvador, Jalapa or San Marcos in Guatemala, etc. Functional regions,² on the other hand, can cross administrative borders or be a ‘special’ area within an administrative region, and are characterized as a geographical area where proximity between various actors can potentially develop social capital, competitive advantage and a stimulating milieu for innovative activities. Examples of such regions are e.g. the Central American Trifinio region, involving Guatemala, Honduras and El Salvador or the Gulf of Fonseca, consisting of regions of El Salvador, Nicaragua and Honduras. It must be kept in mind, that although sub-national regions are within one country, functional regions often cross national borders. The myriad of such cross border regions can be seen all over Europe, and will be further discussed below.

Supra-national regions, on the other hand, are formed by two or more neighboring countries and have some sort of political entity of which is delegated from its member countries. A well-known example of such supranational region is the European Union (EU) which is formed by twenty seven countries.³

² The Swedish VINNVÅXT initiative is e.g. characterized by functional regions, which can cross regional administrative borders (called *län* in Sweden). See <http://www.vinnova.se/en/Activities/VINNVÅXT/> for further informations.

³ Additionally, four countries are currently negotiating membership and five more are considered potential candidates. An updated list of these countries can be seen at http://europa.eu/about-eu/member-countries/index_en.htm

II. Analysis of TNIS

One of the purposes of this review paper is to analyze some of the transnational innovation systems in Europe. There are basically three main dimensions that one should consider when analyzing TNIS: the different components of RIS and TNIS, different forms of proximity and the stages in the formation of TNIS. The rationale behind choosing these three dimensions is that according to the literature, certain organizations and institutions (see. Eg. Figures 1 and 2) and the interactions between them are of high importance for the creation and function of an innovation system. When it comes to interactions between those components, it is very important to consider the proximity dimension, since it highly influences the limits and possibilities of the knowledge transfer and interaction among them (see e.g. section B. above). This is particularly important when one of the forms of proximity (geographical) may be lacking in the Central American case. Then, other forms of proximity become crucial to facilitate knowledge transfer between distant actors. Finally, innovation systems of any sort should be understood in dynamic terms, as an evolutionary process. The characteristics of an innovation system that is at an early stage are different from another one at a later stage. That is, the components of the system change over time. This is why looking at the stages in the development of a TNIS is another important dimension to consider.

A. Components of Transnational regional innovation systems (TNIS)

The experiences thus far in the formation of TNIS, suggest that the establishment of any form of Transnational innovation system involves the creation of common organizations for science and technology (S and T),

the stimulation of transnational linkages for research and innovation as well as the development of transnational institutions that support the creation and diffusion of knowledge across the regions or countries which are part of the TNIS.

With regards to organizations TNIS transcends the organizations that exist in each of the national innovation systems and includes some S and T infrastructure that belongs to all the member countries. These could be transnational universities or research centers. Some examples are the CERN “European Organization for Nuclear Research” or the European Science Foundation in Europe. TNIS usually share a certain common S and T infrastructure among all the member countries. Transnational associations of firms or universities are also considered as components of TNIS like for example, a network of European Universities.

TNIS also have some common institutions, both formal and informal such as transnational S and T advisory bodies formed by the responsible of national S and T policy, common S and T policies, inter-governmental agreements for the mobility of scientists between national councils or networks of scientists or technicians in specific fields. Particularly important are those institutions that support the *diffusion of knowledge* across the region, like intellectual property regimes or technology transfer frameworks as well as those institutions directly related to *financing innovation* such as Risk capital, FDI frameworks or insolvency and bankruptcy regulations (Borras, 2007).

Finally, the creation of transnational linkages is highly contingent to the different forms of proximity between the countries or regions. This last aspect is a pre-requisite for the formation of the TNIS and thus, it will be treated separately in the next section.

B. Proximity

To better understand an integration of transnational regions and their innovative activities, it is very important to analyze how different types of distance and proximity influence potential linkages. This is crucial when one talks about the creation of a transnational innovation system. In the absence of proximity (either relational or geographical) it is very difficult or even impossible that a cross border RIS would emerge. Two main categories are very important in this respect, *functional or geographical proximity* and *relational proximity* (Moodysson and Jonsson, 2007).

Geographical proximity refers to factors such as accessibility and physical distance, where mainly time and cost factors are important, not so much the distance itself (see e.g. Torre and Gilly, 2000). Geographical proximity is usually quite important when it comes to knowledge interactions which are dependent on face-to-face contacts, especially regarding the exchange of tacit knowledge.

Relational proximity, on the other hand, deals with non-tangible factors, such as relatedness and resemblance among different actors. Relational proximity can further be decomposed in *cognitive-, organizational-, social- and institutional* (Boschma, 2005). “[T]he main rationale for grouping these into one category, besides making the empirical analysis more manageable, is that they are all ultimately affected by the same set of basic ‘mediators’” (Moodysson and Jonsson, 2007: 118). It is important to mention that these dimensions (i.e. both geographical and relational) are all related and/or complement each other up to a certain point.

1. Functional or geographical proximity

Geographical proximity is here simply defined as both the relative and absolute distance (physical and spatial) between economic actors. Geographical proximity has proven to be important for interactive learning and innovative activities, but to understand how it does, it is important to understand how it interacts with the other dimensions of proximity. In fact it is not only geographical proximity per se that directly underpins interactive learning, there is always a need for some level of cognitive proximity (i.e. for the diffusion, absorption and processing of external knowledge). Geographical proximity is as well not necessarily a prerequisite or even necessary for interactive learning, and up to a certain point it can even be substituted by other dimensions of proximity (Moodysson and Jonsson, 2007). This is extremely

important when the issue under scrutiny is the creation of a transnational supra-national regional innovation systems, involving parts of an innovation system that may be geographically dispersed (in different countries) like a transnational regional innovation system in Central America, where some of the components of such a system may be located in the capitals of the different countries and, thus, will be geographically distant.

It is important to acknowledge that too much geographical proximity can be detrimental for interactive learning and innovative activities, and as with other dimensions of proximity discussed above, such situation could lead to a lock-in situation where local actors do not absorb external knowledge sources which have proven so important for innovative activities. Geographical openness (i.e. more openness to the outside world) could help to solve this problem, at least partially, but it is neither necessary nor sufficient to do so as discussed above, i.e. alternative solutions may be provided by other dimensions of proximity. Geographical openness can nevertheless stimulate and facilitate interactive learning through the other dimensions of proximity (Boschma, 2005).

2. Relational proximity

As indicated earlier, relational proximity can be further decomposed in 4 dimensions of proximity: cognitive, organizational, social and institutional proximity.

a) Cognitive proximity

Cognitive proximity refers to the differences or similarities between individuals and organizations in their level of competences and knowledge. The cognitive level of an organization is related to different factors such as organizational —and technical know-how and different knowledge bases. Too much distance or too much proximity in this respect could hamper learning— and innovation processes (Nooteboom, 2000). Too much proximity means that the potential beneficiaries of knowledge exchange and learning are simply too similar and there is little to gain from such interactions. Too much distance means that there are too much differences between the actors and their knowledge bases. The absorption capacity and the benefits of such interaction are therefore low. An example could be a technologically advanced multinational company and a local SME with low technological capabilities. The likelihood of these two organizations engaging in interactive learning is low, due to the cognitive distance between the two. A certain balance regarding the diversity and complementarity of the knowledge sources is needed if learning is to take place between actors. Likewise, *“an absorptive capacity that is open to new ideas is essential for interactive learning”* (Boschma, 2005: 64).

In a system of innovation, interactive learning will occur, that is, actors will engage in interactive learning if the cognitive distance between the actors is neither too high nor too low.⁴

b) Organizational proximity

Organizational proximity is very similar to cognitive proximity although it deals with the relations that are shared within an organization or between different organizations (Gilly and Torre, 2000). As with the cognitive dimension, too little or too high level of organizational proximity can be detrimental for learning and innovative activities.

“[W]hile too much organizational proximity is accompanied by a lack of flexibility, too little organizational proximity goes along with a lack of control increasing the danger of opportunism” (Boschma, 2005: 65). There is therefore a need for a loosely coupled system that is both flexible and controlled.

⁴ It is important to note that what is meant by high or low in the literature is rather subjective and very difficult to measure in empirical terms.

c) Social proximity

Economic relations are to a large extent built on their social context, which consequently influences the outcome of economic activities. Here, social proximity is understood as trust based on kinship, friendship and mutual experience. It is not based on common sets of various values and languages, which are important for institutional proximity (and discussed in the following section). Trust is considered a necessary prerequisite for the exchange of tacit knowledge, and is therefore very important for interactive learning and innovative activities, and can even reduce opportunistic behavior (Boschma, 2005). Although being important for economic activities, too much social proximity may have negative effects on interactive learning. It can e.g. hamper the introduction of new entrants, opportunities and ideas. This is mainly due to the often too strong loyalty and emotional bonds between embedded actors, and also when embedded actors are too committed to how things are usually done, which can possibly lead to a lock-in situation (Uzzi, 1997).

d) Institutional proximity

Although organizational and social proximity are much related to institutional proximity, the two former are defined at the micro-level, while institutional proximity is defined at the macro-level (North, 1990). Institutional proximity refers both to formal institutions, e.g. laws and regulations, and informal institutions, e.g. language and cultural norms and habits. Institutions are sometimes referred to as the 'glue' for collective action, i.e. because they reduce both transaction costs and uncertainty in society, and they form the foundation for interactive learning and economic coordination.

From this it is clear that too little institutional proximity is detrimental for collective action, interactive learning and innovative activities. And as with social proximity, too much institutional proximity can also hamper interactive learning and innovative activities'. That could potentially lead to both a lock-in situation where new ideas, entrants and opportunities are difficult to introduce, and institutional inertia regarding the restructuring and adjustment of the old institutional structure. There is no optimal solution, but institutions need to be characterized by stability (to counter opportunism and uncertainties), openness (regarding newcomers and new ideas) and flexibility (regarding the development of new institutions) (Boschma, 2005).

From the perspective of the Government it is very difficult to influence the organizational and social proximity. These usually emerge as bottom up processes. But Government cooperation can certainly strengthen institutional proximity and even influence cognitive proximity by investing in capability building in the participating regions/countries.

Going back to two main categories of proximity, relational and geographical proximity, geographical proximity can often enable relational proximity. But as discussed earlier, it is not a necessary prerequisite or sufficient for such relations to be build (see e.g. also Granovetter, 1985; Moodysson, 2008). It is therefore important to keep in mind that it is not just geographical proximity that facilitates beneficial knowledge interaction, but also the relational dimension. *"It is this interplay between certain degrees of spatial proximity and appropriate levels of relational proximity and distance that under certain circumstances shape a unique competitive advantage of transnational regions compared to other spatial units"* (Lundquist and Trippel, 2009: 5).

Dealing with relational proximity, many scholars (see e.g. Gertler, 2003; Sternberg, 2007) have emphasized the importance of issues like mutual understanding, trust and codes of conduct, institutions, shared norms, and the similarities of organizational and technological cultures, regarding the diffusion and absorption of knowledge and collaboration. Therefore, when it comes to the success of such knowledge exchanges in TNIS, a certain degree of relational proximity is necessary, which can emerge and function without geographical proximity (as discussed above), although geographical proximity can also facilitate relational proximity.

Relations and dependence on various spatial scales are therefore vital to understand TNISs. How the regions are already embedded in and have evolved through time in their own regional and national systems of innovation must also be considered regarding TNIS integration process. An important part for TNIS integration is e.g. to focus on their various industrial complementarities, knowledge bases and

specialization profiles, or a 'high road' development path to innovation. It is not industrial specialization or sectorial diversity in TNISs that is essential to enhance their innovative capacity. Their different or similar industrial characteristics must have a 'moderate' cognitive proximity and cognitive distance for the stimulation of interactive learning, innovative activities and knowledge spillovers. Either a high- or a low cognitive distance between the adjacent regions can potentially mean a low level of learning between the two (or more) regions.

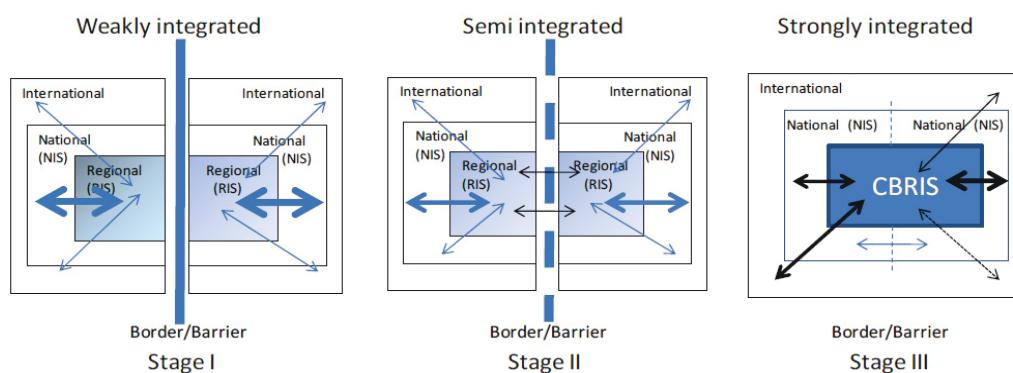
C. Stages in the formation of TNIS

The literature on TNIS also provides some insights on how TNIS can come to be and thus, TNIS can also be analysed and classified regarding their stages in their formation. It is possible to distinguish three stages of the development of transnational integration (Lundquist and Trippel, 2009) corresponding to three different forms of TNIS:

- 1) **Weakly integrated TNIS**, is the first stage characterized by asymmetry between the innovation systems that could be integrated (. In this very early stage, the interactions between the systems of innovation are weak. There is low level of knowledge interactions, innovation linkages and economic relations in general and, when they exist, they are often based on the exploitation of cost differences.⁵ Physical accessibility is somewhat lacking.
- 2) **Semi-integrated TNIS**, which could be defined as an emerging TNIS, where asymmetrical links are still significant even when physical accessibility is guaranteed. In other terms, different forms of proximity are still weak or in formation.
- 3) **Strongly integrated TNIS** is characterized by a high level of knowledge, —expertise— and skill flow across the borders. Economic linkages are symmetrical and physical accessibility is not a problem at all. The last stage is mainly for theoretical purposes, and does in fact not exist in the real world (not yet at least).

These ideal types of different levels of transnational integration can be seen in Figure 4.

FIGURE 4
IDEAL TYPES OF DIFFERENT LEVELS OF TRANSNATIONAL INTEGRATION
(SUB-NATIONAL REGIONS)



Source: Lundquist and Trippel, 2009: 6.

⁵ At least in the European experiences.

III. Cases

A. Introduction

Europe is probably one of the regions in the world in which it is more common to find TNIS. In this report we present two cases to illustrate the formation of TNIS: the TNIS of the Oresund region (between Denmark and Sweden) as well as the TNIS in the so-called Centrope area, involving regions in Austria, Czech Republic and Slovak Republic.⁶

B. The Öresund TNIS

The Öresund TNIS is formed by the Scania region in Southern Sweden and the Zealand region (Copenhagen) in Eastern Denmark. The main reason behind its formal establishment is the increasing international competition. To receive the sufficient critical mass, the two regions realized that together they had a stronger chance in this competition. The size of the whole region is 21203 square kilometers, it has close to 3.7 million inhabitants (~2.5 on the Denmark side and ~1.2 on the Swedish side), and around 1.6 million employees (Lundquist and Winther, 2006). The strait of Öresund divides the two regions, and has been a certain transport barrier before the Öresundbridge was built between the two nations and the train connection was established (Löfgren, 2008) (see Figure 5).

⁶ All is based on secondary literature review.

FIGURE 5
A MAP OF THE ÖRESUND REGION



Source: The Öresund Committee, 2010.

Note. The boundaries and names shown on this map do not imply official endorsement or acceptance.

by the United Nations".

The transnational region was formally institutionalized in 1993, by establishing a forum for voluntary collaboration between the two regions called the Öresund committee (<http://www.oresundskomiteen.dk>). The committee promotes transnational collaborations by focusing on all levels of governance, i.e. from local —to national—, and also to supranational levels (i.e. the EU). This is done through various cooperation, network participations and dialogues with policy makers on all these levels of governance. The Öresund committee is e.g. a member of the Association of European Border Regions (AEBR), the Öresunds Infrastructure and Urban Development (collaboration among Öresunds regions and municipalities), and is engaged in a close dialogue with the Nordic Council of Ministers. The transnational region of Öresund is considered a role model for successful transnational cooperation in Europe, especially regarding competence in the more globalized and knowledge intensive industries.

1. Components of Transnational Innovation System

The larger urban areas on both sides of the straits, i.e. Copenhagen and Malmö/Lund, are characterized by a strong knowledge intensive dynamics and advanced business and producer services. The region is characterized by a high level of living standards, welfare system and education. Large and international competitive research universities are on both sides and an active relationship has been established between universities, industry and government. The innovative environment is therefore considered quite strong in the region (at least on both sides separately). The most prominent industry in the whole transnational region is the well-known life science cluster Medicon Valley, which is formed by about 100 dedicated biotech firms, 70 pharmaceutical firms and around 130 firms focusing on medical technology. The transnational cluster initiative is led by the organization Medicon Valley Alliance, which promotes transnational interactions among firms, universities, service providers firms and hospitals. The hinterlands in both Zealand and Scania can be characterized as more lagging areas with stagnating low-tech sectors (traditional industries) and negative migration (Lundquist and Olander, 2007).

The knowledge infrastructure of the transnational region is excellent and is considered as one of the largest knowledge centers in Scandinavia. It has 14 higher educational centres, several science parks, 190.000 students and over 10.000 university researchers. Alongside having strong knowledge infrastructure, the region has also institutionalized collaboration among knowledge organizations in the whole Öresund region. This is especially done through the umbrella organization Öresund University (ÖU), which aims at enhancing research and education co-operation between universities, and the network organization Öresund science region (ÖSR), which focuses on four main fields, IT, logistics, food and environment.

However, the provision of knowledge centers is not equally distributed across the two countries (Sweden and Denmark) and regions (Zealand and Scania). While Zealand is the capital area of Denmark and is the knowledge production centre in Denmark (e.g. 54% of all university students), Scania plays a much smaller role in the Swedish knowledge production system (has e.g. only 15% of all university students) where the capital, Stockholm, is the major player (Source: Eurostat, 2010a). However, it is expected that the importance of Scania as a knowledge producer will soon be enhanced, as the European Spallation Source material research centre (ESS) —one of the largest infrastructure in nuclear physics in Europe— will soon be built in Lund and will strengthen the whole region and provide myriad of opportunities and complement the areas reputation as an important frontier for innovative activities and cutting-edge research.

When it comes to nature of linkages, there is not much data available (Lundquist and Trippel, 2009). There are some evidence regarding exchange of students over the strait, and linkages between actors in the biotechnology and the food process industries as well as between university researchers. But there are still some institutional factors that act as barriers for transnational networking and the diffusion and absorption of knowledge. These barriers are mainly due to differences in taxation systems, educational systems and legislation between the two nation states. There are also evidence on strong limiting rules regarding public funding of transnational research projects (Garlick and others, 2006).

In terms of the institutional framework, at the time when this report was finished (May 2011) Denmark had announced the re-introduction of border controls, which will also affect the flows of people (there is currently a large proportion of commuters between Copenhagen and Malmö/Lund) and thus the mobility of human resources between the two regions.

2. Proximity

Zealand (Denmark) and Scania (Sweden) are two neighboring regions, separated by a small sea channel, as can be seen in Image 1. The region is currently characterized by a good public transport system, and both internal and external accessibility is quite good in the region. It is possible to travel pretty much everywhere by planes, buses, railways or private cars. The Copenhagen airport (Kastrup) is one of the largest international airports in Northern Europe, with over 120 direct flight destinations. There is also a small international airport in Scania, but traffic there is more focused towards other small airports in Europe.

In 2000, a permanent fixed link between the two regions was established, when the two nations opened the Öresund bridge between Malmö and Copenhagen. That was a major breakthrough for the area and the bridge has proven vital in enhancing the common labor market and the transnational integration process (The Öresunds Committee, 2009). Around 20.000 commuters cross the strait each day to work on the other side. As it has developed so far, the trend is that the Swedes commute to Denmark to work and the Danes to Sweden to live. This can partially be explained by stronger labor market in the Copenhagen area and lower housing prices in the Malmö area.

The institutionalizing of the transnational regions has a long history, but already in the 1960s, local politicians made some effort in enhancing co-operation across the strait of Öresund. This development took more formal and comprehensive character in the 1990s and soon after the formal establishment of the region in 1993, the Öresund committee was given the administrative status of local INTERREG programs in 1996. Several transnational network projects have been initiated by the Öresund committee in the last ten years, but its strategy regarding innovation and regional knowledge is

hard to find. Such topics have so far been more facilitated through the Öresund University (ÖU), Öresund Science Region (ÖSR) and the Medicon Valley Alliance (MVA) (further discussed below).

After a series of regional development meetings, a strategy called ÖRUS was established in 2008 (The Öresunds Committee, 2009). The strategy aims at long-term development (to 2020) and has four main themes:

- Accessibility and mobility
- Knowledge and innovation
- A diverse, yet cohesive labour market
- Culture and events in the Öresund Region

Related to these four themes are three underlying and cross cutting themes:

- An open, attractive and welcoming atmosphere
- Sustainability and concern for the environment
- Health and well-being

In 2009, the OECD recommended that special emphasis was put on further enhancing the integration of a common labor market, increasing the collaboration and cooperation regarding research and innovation projects, and dealing with rising traffic costs between the two adjacent regions (e.g. bridge tolls and train tickets). The OECD also advised the two nations to bring their tax systems closer together and capitalize more on their strengths regarding tourism, international events and businesses, and also try strategically to increase their attractiveness in those and related terms.

3. Type of TNIS according to development stage

Going back to the three stages in the formation of TNIS, it is obvious that the Öresund TNIS has evolved considerably. Beside the evidence that Swedes go more to Denmark to work and Danes go more to Sweden to live, there is little evidence of asymmetrical relationships, most likely due to little social and economic disparities between the two adjacent regions. As discussed above, the Öresund TNIS is equipped with the necessary components of an innovation system, i.e. organizations and institutions. Both geographical and relational proximity seems to be in good balance.

Despite some barriers there seems to be a rather strong institutional and organizational link between the two adjacent regions. It is especially strong regarding the science base and knowledge infrastructure and also within the biotech industry (Medicon Valley). This is also true regarding the various active transnational governance institutions, and both the Zealand and Scania regions have rather high degree of autonomy which is considered good for TNIS integration. Geographical (functional) proximity is in good balance due to good access and transport system within and between the two adjacent regions, but this could be further enhanced by reduction of travel costs. All in all, the Öresund TNIS can be located on stage II, as an emerging knowledge driven system, where asymmetrical links are still somewhat important and physical accessibility is not a major problem (Lundquist and Tripl, 2009).

C. The CENTROPE area

The CENTROPE TNIS was formally established in 2003 on the basis of the Kittsee Declaration. The transnational region is formed by adjacent areas in four central European countries; Austria (The Federal Provinces of Vienna and Lower Austria and Burgenland), Slovakia (The regions of Bratislava and Trnava), Czech Republic (The region of South Moravia) and Hungary (The counties of Byör-Moson-Sopron and Vas). The cities of Trnava, Szombathely, St. Pölten, Sopron, Györ, Eisenstadt, Brno and Bratislava are also active participators in the transnational region co-operation. The CENTROPE area is

about 44.000 square kilometers and the population is roughly 6.5 million inhabitants. The CENTROPE region can be seen in Figure 6 below.

FIGURE 6
THE CENTROPE TRANSNATIONAL REGION



Source: <<http://pgo.centropemap.org/>>.

Note: The boundaries and names shown on this map do not imply official endorsement or acceptance by the United Nations.

The CENTROPE area is characterized by rather significant disparities regarding economic development and dynamics, and also regarding general prosperity, between the four nations (Palme and Feldkircher, 2006). When looking at GDP per capita, Austria is far richer than the three other countries. The Bratislava region is the only exception from this rule as it has the second highest GDP per capita when compared to other CENTROPE regions. These relatively poor regions are however catching up rather quickly and have been characterized by far greater dynamic, i.e. much higher GDP growth rates. The difference in unemployment varies greatly among the regions, but it is greatest in the Vienna region (8.3%) and lowest in the Lower Austria region (3.6%). The Eastern regions vary between 4.3-5.2%, with the exception of the Western Slovakia region (7.8%) (Source: Eurostat, 2010b).

There is also a great diversity and heterogeneity regarding sectors in the CENTROPE region (Huber and Mayerhofer, 2006). The Vienna and Bratislava regions are e.g. much stronger in the service sector (especially in knowledge intensive services) than the other regions, while the other Eastern regions are all stronger in manufacturing (especially low and medium low-tech manufacturing). Despite positive potentials, e.g. within the ICT, —biotechnology— and automotive industries, there is almost no evidence of effective transnational clustering processes as in the previous example of the Oresund region, and little work has been done so far towards that goal (Lundquist and Trippel, 2009).

1. Components of Transnational Innovation System

There are around 25 public universities, over 365.000 students and around 40.000 R&D workers in the CENTROPE region. The Vienna region is a clear leader, but around 37% of all students and about 46% of all R&D workers are there. The other two Austrian regions, Lower Austria and Burgenland have by far the lowest share of students in the whole CENTROPE region; the former has around 2.1% and the latter around 0.4% share. The Burgenland region in Austria and the West Hungary region have the lowest share of R&D workers in the whole CENTROPE region: the former has around 0.8% and the latter has around 3% (Source: Eurostat, 2010b). The whole CENTROPE region is considered rather strong when it comes to knowledge generating organizations, but the research capacity is clearly unevenly distributed among its regions. The Vienna region is by far strongest in that respect. The Czech

and Slovakian regions have good potential, but the regions of Burgenland, Lower Austria and West Hungary are obviously lagging behind.

The nature of transnational linkages in the CENTROPE region is mostly characterized by supplier relation, foreign direct investment, market links and labor mobility (Trippl, 2008). The motivation behind these linkages does not seem to be to enhance firm's innovative capacity or tap into various knowledge sources. Transnational linkages have grown quite much in the last 15 years, but they have mostly been driven by asymmetric relations, i.e. differences in cost and prices and the search for new markets.

Regarding the institutional and political-administrative context, legal frameworks and standards, tax systems, decision making procedures and regional policy competences, there is a considerable degree of difference between the four countries (Palme and Feldkircher, 2006). Austria has a strong federal character, where each region has a strong political autonomy and a rather strong competence in policy making. The development towards increased autonomy of regions in the other three countries has only just begun and the administrative structures are still institutionally thin and rather unstable. Both public and private support is lacking. Long-term focus on such infrastructure has been lacking, mainly due to scarcity of finance, capacity and time, and there has been no clear strategy on how to develop the transnational region (Otgaar and others, 2008). The Austrian regions have acted as the initiators, co-financers, organizers and leaders of most transnational projects and they have so far been the only financier behind the CENTROPE transnational region. The participating regions in the other three countries have not been able to commit themselves fully in the transnational region due to scarcity in finance and human capital. Because of that they have no leverage in the Steering Committee or in the CENTROPE Consortium (Otgaar and others, 2008).

2. Proximity

In terms of geographical proximity, although the regions share borders, there are still gaps in the transportation and communication infrastructures in the CENTROPE region, and is in no context to the population density in the CENTROPE region. Transnational labor mobility is therefore rather low (see e.g. Huber and others, 2010).

Institutional proximity has been facilitated by the fact that all countries currently belong to the European Union. The integration process has already lasted over two decades. When the iron curtain that divided Europe in two distant parts fell after the dismantling of the Soviet Union in 1989, the former communist countries in Central and East Europe transformed towards market economies. This development moved the former periphery countries towards the center of economic activities, and led eventually towards them joining the EU, which means that these countries have common laws, markets, currency, and perhaps most importantly; open borders between the four countries.

The integration process is led by a common agency: the CENTROPE Steering Committee and the CENTROPE Agency, and the presidency rotates between the four countries every six months. The former is a forum for the participating actors where goals and strategies are formed, but close contact with the political level is considered very important. The latter deals with the managerial side of the multilateral co-operation and has offices in each of the four countries. The Agency tries to stimulate further integration process by generating various impulses for co-operation. Special focus is set on four main fields; human capital, knowledge region, culture and tourism and spatial integration. Currently, the lead project is called CENTROPE Capacity, but it builds on the results of two INTERREG IIIA (EU's regional development projects) projects that concluded in 2007. The project, which expires in 2012, aims at building and enhancing a sustainable framework and a platform for the cooperation between firms, public institutions, and local and regional authorities.

Organizational and social proximity are still rather low (Lundquist and Trippl, 2009). Transnational knowledge links are not very common in the CENTROPE region and are mostly active within the same multinational firms. Less than 20% of firms, who have established a transnational knowledge links, do so with only one type of partner, i.e. these firms do not tap into the variety of possible knowledge sources across borders. Firms in the most advanced region, Vienna, have for long

been embedded in their national —and regional innovation— and business settings. They have not so much substituted their already existing international knowledge and innovation links with actors mainly located in West Europe and the United States, by such links with actors in the Eastern part of the CENTROPE region.

3. Type of TNIS according to development stage

Going back to the three stages in the formation of TNIS, it is obvious that the CENTROPE TNIS has not evolved as much as the Öresund TNIS. The CENTROPE region is still characterized by asymmetric relations, due to strong economic disparities and also due to great difference between the four countries (regions) regarding sectors and their knowledge intensity. Many necessary components of an innovation system are in place, but they are nevertheless often undeveloped and weakly linked. The whole CENTROPE region is considered strong regarding knowledge generating organizations, but they are unevenly distributed within the region. Knowledge —and innovation interactions do not seem to be important, and the integration process is mainly driven by cost— and price differences between the adjacent regions. Firms in the most knowledge intensive region, Vienna, are highly embedded in their national and other international settings (mostly with actors in the West) and have therefore not showed much interest in participating with actors in the other CENTROPE countries. The CENTROPE initiative has so far also mainly been led and solely been financed by the Austrian part. There is a substantial degree of institutional distance, as the only regions within the CENTROPE region which are characterized by strong and embedded governance autonomy are the three Austrian regions. The other regions autonomous character is very young and undeveloped to be able to cope sufficiently with such transnational integration processes. Difference in language among the CENTROPE countries also seems to be a certain barrier for integration. Although there are no natural barriers (as the strait of Öresund) between the four countries, it suffers from a relatively high degree of geographical distance due to insufficient transport and communication infrastructure.

All in all, the CENTROPE TNIS can be located on an initial stage (Stage I), as a region that is characterized by asymmetry and cost-driven linkages, low level of knowledge interactions, innovation linkages and economic relations in general, and where physical accessibility is somewhat lacking (Lundquist and Trippel, 2009). Further development of the TNIS will be contingent to the development of better communication infrastructure, the development of the institutional proximity as well as investment in knowledge generation in the regions of Slovakia, Czech Republic and Hungary. The difficulties that this TNIS is facing are a good starting point for the discussion on barriers to the emergence of TNIS.

IV. Barriers to the emergence of TNIS

A. Introduction

The formation of a transnational regional innovation system is not an easy task, as the previous example in the CENTROPE region shows. The three dimensions of the analytical framework discussed above (i.e. proximity, components of SIs and their evolution) will be used as general guidelines to discuss the various barriers of TNIS. Our main argument is that the different innovation capabilities of the regions forming the potential TNIS and their dissimilarities regarding economic and cost structures, can give space for various new synergies and complementarities for regional actors. But these factors can also act as barriers to TNIS integration processes.

B. Barriers

1. The proximity dimension

As discussed above there are many various dimensions of proximity that influence interactive learning and innovative activities. The degree of similarities and sharing regarding social, —cultural— and institutional factors is very important (see e.g. Gertler, 2003; Boschma, 2005), but these factors can just as well act as barriers to TNIS integration. The lack of common identity, cultural distance, various forms of institutional mismatch, and low levels of social capital, knowledge interactions, and innovation networks are barriers for the emergence of TNIS (Trippel, 2008).

This mismatch has proven to halter TNIS integration to a certain point if there have been too much differences (and/or similarities) between the adjacent regions from the very beginning. Although transport infrastructure can reduce the physical distance and various institutional barriers are relatively easy to abolish, mental and cultural factors (e.g. different language and trust issues) which are related to social and organizational proximity, remain much longer and are often tricky to erase (Tripl, 2008).

Moreover, reducing the cognitive distance requires, in many cases, substantial investments in education and research capabilities which are a burden for countries with scarce financial resources. Furthermore, the cognitive distance is not only about increasing capabilities but also about ensuring that those capabilities are complementary. A good indicator of the existence of complementarities is when there is an industrial cluster that crosses across various frontiers for example, the Medicon Valley in the Oresund TNIS.

2. Barriers regarding the components of TNIS

As discussed above, the main components of all innovation systems are institutions (rules of the game) and organizations (players and actors) as well as their linkages. It is therefore straightforward to say that if some parts of the necessary components or some of the links among them in an evolving TNIS is missing, and/ or also if there is a mismatch between the two adjacent regions in that respect, it can hamper regional integration. This could be if some of the important support organizations (e.g. universities, R&D institutes and intermediary organizations) are either missing or are relatively weak. The same goes for laws and regulations, but they can both hamper and stimulate regional integration as mentioned above.

The lack of components or the weak nature of the components of the system is, precisely, one of the major problems in innovation systems in developing countries. This can constitute a great barrier in the formation of a TNIS. For the emergence of a TNIS the very basic components of an innovation system need to be in place: organizations with the capacity to innovate, a certain degree of linkages among the actors of the individual (country) systems of innovation and some common institutions that support knowledge creation and knowledge diffusion. Without this minimal S and T infrastructure, the TNIS is doomed to fail. From a policy perspective it is thus fundamental to invest in the development of S and T organizations with innovation capabilities, the creation of some common institutions that, for example, guarantee IPR protection or facilitate the mobility of qualified human resources between the integrated countries as well as facilitate the establishment of linkages across the countries. This implies that the integration of national innovation system should not be considered a substitute of national efforts to strengthen the national innovation system. On the contrary, the integration is more likely to succeed if the cognitive distance between the NIS integrating is low and the capabilities of the national systems are high, as the cases suggest.

3. Barriers for the evolution of TNIS

Moving from an emerging TNIS to a semi-integrated TNIS is far from easy. There are some obvious barriers to move from stage one (weak TNIS) to stage two (semi-integrated). The benefits gained from interaction with the neighboring region on this stage might be called a 'low road' strategy, and is often apparent and appropriate when one of the regions is still in a catch-up situation (compared to the other region(s)) and trans-border flows may be used to exploit differentials in wages, prices and institutional norms, rather than to create and share knowledge (Anderson and O'Dowd, 1999: 959).

The appropriate infrastructure for mutually beneficial innovative activities and interactive learning is often not available in the initial stages of the TNIS, which is obviously a barrier for further integration. *"Embarking on a 'low road' strategy might represent a sound undertaking for these regions at the beginning of the integration process, enabling them to attract foreign direct investment and create income on the basis of existing resources. In the long term however, these areas face the challenge of switching to the innovation path in order to increase wages and income and to sustain competitiveness in the age of globalization"* (Tripl, 2008: 153). TNISs based on these asymmetrical relations are obviously somewhat problematic when it comes to transnational interactive learning.

Box 1 provides some example of policies in Europe that have supported the creation of a European Research Area.

BOX 1
POLICY INITIATIVES SUPPORTING THE CREATION OF THE EUROPEAN RESEARCH AREA

The development of European institutions has been incremental, based on various institutional experimentation, but also radical innovations, such as the Single European Act and The Treaty on the European Union (Caracostas and Soete, 1997). Other factors have also greatly influenced innovative activities, such as the Erasmus program, the Framework programs of the EU and the Interreg III EU programs. The Erasmus program has proved important regarding the internationalization of educational policies at the national, —European— and international level. One example is the Bologna Process which has stimulated higher education in Europe, e.g. through student exchange over national borders which has increased transnational knowledge interaction and learning (see e.g. European Commission and others, 2008). The Framework programs have played an important role for research activities in Europe, but one of its main purposes is to enhance innovative capacities. This has been done by the provision of a common structure of research efforts and with the provision of research funding (see e.g. European Commission, 2007). The Interreg III⁷ EU programs have been very influential regarding the development of transnational regions in Europe, e.g. by subsidizing transnational projects through collaboration with local authorities and organizations with the purpose to create economic —and social centers, which could prove beneficial for all actors and enhance economic— and social cohesion.

Source: Caracostas and Soete (1997).

⁷ For deeper understanding, see Regional Policy –Inforegio at: <http://ec.europa.eu/regional_policy/interreg3/index_en.htm>.

V. Conclusions and policy recommendations

The various levels of governance that influence the emergence and development of TNIS, i.e. the regional, —national— and supranational levels, call for a vertical policy co-operation and co-operation (Cooke and others, 2000).

For the formation of a TNIS, there is a need for an additional governance level in order to form and develop the necessary mechanism to enhance the transnational policy co-operation. From a policy making perspective, a supra-national policy body (like a transnational innovation system initiative) needs to facilitate the dialogue and consensus building between the different policy organizations involved in the TNIS (like national ministries of education or S and T) (Trippel, 2008). Furthermore, past lessons have showed that where the local level is characterized by a strong political autonomy and responsibility, i.e. as a contrast to the centralized national government, the integration of TNISs have been more successful (Perkmann, 2003). This has proven to be the case in countries such as Germany and Sweden, which are characterized by a strong federalist political system. When the integration is an integration between the two (or more) NISs, things are usually more complicated and complex (see e.g. Lundquist and Winther, 2006). This is clearly the case in the Central American initiative under scrutiny.

The experience hitherto in the formation of TNIS show that initiatives that have a strong bottom-up governance approach on the regional level, are more successful than those that start from the top. In other words, it is better to start by identifying already existing transnational initiatives that involve some degree of innovation and

supporting them, than to start creating new ones following a top down approach. Cooperation seldom starts as a top down approach as the abundant literature on clusters has shown up, and top down initiatives tend to fail.

A strong commonly shared knowledge infrastructure (e.g. cooperation between educational, research, and transfer units) is very important for the emergence and development of TNISs, and especially an active flow of knowledge between universities and industries to stimulate innovative activities. Particularly important is the creation of brokering organizations that promote cooperation between the partners, as the examples of the Öresund region as well as the CENTROPE are have shown.

While this is important in all RISs, TNISs face an additional challenge due to what can be called a 'institutional distance' (Trippel, 2008). One important factor is the fact that innovative competencies are often ill-equipped to cross national borders. In order to overcome this institutional distance, it is important to create more flexible structures for transnational institutional learning to be able to establish some sort of bridging organizations and the necessary mechanisms to enhance the diffusion of knowledge, technologies, skills and expertise across national borders (Trippel, 2008).

Building awareness on the importance of the creation of a transnational innovation system is also fundamental to increase institutional proximity. This involves both informing the society on the advantages of such cooperation as well as promoting the emergence of a common identity (Trippel, 2008: 157).

Cognitive proximity can be enhanced by increasing the level of competences in the partnering countries as well as ensuring a certain level of variety and complementarity between the actors. This calls for *“policy actions geared towards the promotion of knowledge flows and spillovers between different but related sectors to stimulate related variety at the transnational level (Trippel, 2008; 157).”*

While Central American countries share many borders, the S and T hubs in each of the countries are not geographically closed. In the absence of geographical proximity, building other forms of proximity becomes crucial. It is fundamental to create or reinforce common scientific and technological organizations (like a Central American research council or university) and governance bodies (such as a Central American transnational innovation initiative) that could contribute to reduce the cognitive distance and institutional distance. Common policies supporting mobility of human capital across borders, cluster initiatives across borders, training of human capital, or research projects across borders can contribute to reduce the cognitive distance and social distance. Policies to increase awareness and the creation of a common identity as well as common policies in S and T or IPR can reduce the institutional distance.

Bibliography

- Anderson, J. and L. O'Dowd (1999), "Borders, Border Regions and Territoriality: Contradictory Meanings, Changing Significance, *Regional Studies* 33, pp. 593-604.
- Boschma, R. (2005), "Proximity and innovation. A critical assessment", *Regional Studies* 39, pp. 61-74
- Caracostas, P. and Soete, L. (1997), "The Building of Transnational Institutions in Europe: Towards a European System of Innovation?", in Edquist, C. (ed.), *Systems of Innovation – Technologies, Institutions and Organizations*. Pp. 1-35, London: Pinter.
- Chaminade, C., J. Vang (2008), "Globalisation of knowledge production and regional innovation policy: Supporting specialized hubs in the Bangalore software industry", *Research Policy* 37, 1684-1696.
- Chaminade, C., B. A. Lundvall, J. Vang-Lauridsen, K. Joseph (2009), "Innovation policies for development: towards a systemic experimentation based approach", in Lundvall, B. A., K. J. Joseph, C. Chaminade, J. Vang (eds.), "Handbook of Innovation Systems and Developing Countries", Edward Elgar, Cheltenham.
- Cooke, P., P. Boekholt and F. Tödtling (2000), *The Governance of Innovation in Europe*, London: Pinter.
- Edquist, C. (1997), "Systems of Innovation Approaches – Their Emergence and Characteristics", in Edquist, C. (ed.), *Systems of Innovation – Technologies, Institutions and Organizations*, pp. 1-35. London: Pinter.
- European Commission (1980), "European Outline Convention of Transfrontier cooperation between Territorial Communities or authorities", Madrid.
- European Commission (2007), *FP7 in Brief – How to get involved in the EU 7th Framework Program for Research*, Luxembourg: Office for Official Publications of the European Communities.
- European Commission (2008), *The Impact of ERASMUS on European Higher Education: Quality, Openness and Internationalization*. European Commission: Directorate-General for Education and Culture.

- Eurostat (2010a), Tertiary education statistics, (http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Tertiary_education_statistics. Accessed June 2011).
- Eurostat (2010b), Eurostat Regional Yearbook 2010 (http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-HA-10-001), accessed on June 2011.
- Galli, R. and M. Teubal (1997), "Paradigmatic shifts in national innovation systems", in: Edquist, C. (ed.), *systems of innovation - Technologies, Institutions and Organization*, London: Pinter
- Garlick, S., P. Kresl and P. Vaessen (2006), "The Oresund Science Region: A transnational partnership between Denmark and Sweden", Peer Review Report, Paris: OECD.
- Gertler, M. (2003), "Tacit knowledge and the economic geography of context" or "The undefinable tacitness of being (there)", *Journal of Economic Geography* 3, pp. 75-99.
- Gilly, J. P. and A. Torre (2000), "Proximity relations. Elements for an analytical framework", in Green, M. B. and R. B. McNaughton. (eds.), *Industrial Networks and Proximity*, pp. 1-16. Ashgate, Aldershot.
- Granovetter, M. (1885), "Economic action and social structure: the problem of embeddedness", *American Journal of Sociology* 91, pp. 481-510.
- Gregersen, B., B. Johnson and A. Kristensen (1994), "National Systems of Innovation and European Integration", paper presented to the EUNETIC Conference on Evolutionary Economics of Technical Change: Assessment of Results and New Frontiers, European Parliament, Strasbourg, 6-8 October.
- P. Huber and P. Mayerhofer (2006), Structural Change in the CENTROPE Region, in Mooslechner, P. and E. Gnan (eds.), *Regional Economies in Central European Economies: The Future of CENTROPE*, pp. 144-179.
- Huber, P., K. Nowotny and D. Pennerstorfer (2010), "Economic Integration in Central Europe. An Evaluation with the CENTROPE Region as a Case in Point", *Wifo-Monatsberichte* 83(2), pp. 179-189.
- Lundquist, K. J. and L. Winther (2006), "The Interspace between Denmark and Sweden: The Industrial Dynamics of the Öresund Transnational Region", *Geografisk Tidsskrift, Danish Journal of Geography* 106(1), pp. 125-129.
- Lundquist, K. J. and L. O. Olander (2007), "Omvandlingens geografi: En studie I svensk ekonomi och regioners roller femom tre decennier" Region Skåne, Lunds Universitet, Malmö Stad.
- Lundquist, K. J. and M. Trippel (2009), "Towards Transnational Innovation Spaces: A theoretical analysis and empirical comparison of the Öresund region and the Centrope area", *SRE-Discussion 05* (Institute for the Environment and Regional Development), Vienna University of Economics and Business.
- Lundvall, B. A. (ed.) (1992), "National Systems of Innovation; towards a theory of innovation and interactive learning", London: Pinter.
- Löfgren, O. (2008), "Regionauts: the Transformation of Cross-Border Regions in Scandinavia", *European Urban and Regional Studies* 15, pp. 195-209.
- Moodysson, J. and O. Jonsson (2007), "Knowledge Collaboration and Proximity: The Spatial Organization of Biotech Innovation Projects", *European Urban and Regional Studies* 14(2), pp. 116-131.
- Moodysson, J. (2008), "Principles and Practices of Knowledge Creation: On the Organization of "Buzz" and "Pipelines" in Life Science Communities", *Economic Geography* 84(4), pp. 449-469.
- Nelson, R R (ed.) (1993), *National Innovation Systems. A Comparative Analysis*. Oxford: Oxford University Press.
- Nooteboom, B. (2000), "Learning and Innovation in Organizations and Economies", Oxford: Oxford University Press.
- North, D. C. (1990), *Institutions, Institutional Change and Economic Performance*, Cambridge University Press: Cambridge.
- Öresund Committee (2009), "Annual Review 2009", The Öresund Committee: Copenhagen.
- Otghaar, A., L. Van Den Berg and C. Speller (2008), *Empowering metropolitan regions through new forms of cooperation*, Aldershot: Ashgate.
- Palme, G. and M. Feldkircher (2006), "Economic Challenges in the CENTROPE Region", in Mooslechner, P. and E. Gnan (ed.), *Regional Economies in Central European Economies: The Future of CENTROPE*, pp. 88-100.
- Perkmann, M. (2003), "Transnational Regions in Europe: Significance and Drivers of Regional Transnational Co-Operation", *European Urban and Regional Studies* 10(2), pp. 153-171.
- Scott, W. S. (1999), "European and North American Contexts of Transnational Regionalism". *Regional Studies* 33(7), pp. 605-617.
- Sternberg, R. (2007), "Entrepreneurship, Proximity and Regional Innovation Systems", *Tijdschrift voor Economische en Sociale Geografie* 98, pp. 652-666.

- The Öresund Committee (2010), Map of the Öresund Region. Can be seen at: <http://www.oresundskomiteen.dk/Facts-and-Publications/Map-of-the-oresund-Region>.
- Torre, A. and J. P. Gilly (2000), "On the Analytical Dimension of Proximity Dynamics", *Regional Studies* 34(2): pp. 169-180.
- Trippl, M. (2010), "Developing cross-border regional innovation systems: key factors and challenges", *Tijdschrift voor Economische en Sociale Geografie* 101, pp. 150–160.
- Trippl, M. (2008), "Developing Transnational Regional Innovation Systems. Key Factors and Challenges", *Tijdschrift voor Economische en Sociale Geografie* 101(2), pp. 150-160.



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