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The role of geographical proximity in innovation: Do regional and local levels really matter?

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The Role of Geographical Proximity in Innovation: Do Regional and Local Levels Really Matter?

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Abstract

Globalisation and the advent of information and communication technology (ICT) change the role of spatial distance in innovation activities. Geographical proximity used to be seen as a necessary condition to share tacit knowledge and to enhance trust between innovators; now this approach is being challenged by claiming that the role played by spatial distance diminishes with time. The aim of this paper is to present territorial innovation models as examples of theories based on assumptions of a crucial role of local environment and spatial distance in innovation processes and to present arguments against the said assumption. The paper concludes advocating the encouragement to cooperate both within the local network area and with distant partners and the creation of territorial innovation models as open systems engaged in interactive learning by global connectivity.

1 Introduction

Innovation has become of great importance to entrepreneurs, governments, and scientists, since it has been recognized as the key factor to the growth and competitiveness (Neely/Hill 1998). This growing significance of innovation has resulted in more research on the locus of innovation. Scholars try to determine the most suitable scale to sustain innovation-based learning economies (local, regional, national, international levels etc.).

Over the last twenty years, scientists have emphasised the local character of innovation processes and have perceived the region as a locus of innovation (Isaksen 2001). This belief is supported by Porter, who states that "competitive advantage is created and sustained through a highly localized process" (Porter 1990: 19). One of the outcomes of the aforementioned approach to innovation was the emergence of territorialised innovation theories (innovative milieu, industrial districts, regional innovation systems etc.) in which local institutional dynamics play a meaningful role (Moulaert/Sekia 2003). Spatial proximity is perceived as a competitive advantage.

An opposite approach to knowledge, learning processes, and innovation – questioning the embeddedness of innovation – has emerged recently. This concept aims to redefine the role of a region in innovation processes, to abandon the political focus on local and regional innovation networks (Lorentzen 2008) and to bring territorial innovation theories up to date (Crevoisier/Jeannerat 2009). Calling into question the hypothesis that permanent geographical proximity in knowledge transfer and learning processes is

necessary is also one of signs that the question of the role of spatial proximity in innovation processes remains open (Torre 2008).

The objective of this paper is to analyse the role of regional scale in innovation, to review territorial innovation theories and to provide better understanding of the role of regions in the context of the globalisation of the world economy. The paper presents arguments for and against the statement that geographical proximity matters.

The first section presents the arguments for viewing geographical distance as beneficial for innovation processes and the transfer of tacit knowledge. The second section describes territorial innovation models which emphasise the role of local environment, face-to-face relations and collaboration in the innovation process. The third section contains the arguments that undermine the statement that geographical proximity facilitates knowledge exchange and is crucial for innovation activities. Finally, the summary tries to balance the arguments for and against geographical proximity in the process of innovation.

2 The role of geographical proximity in innovation

In terms of proximity, a fundamental contribution to the literature on innovation was made by the French School of Proximity Dynamics in the 1990s, according to which there are different forms of proximity's dimensions (cognitive, organisational, social, institutional, geographical (Boschma 2005)). In this paper, we consider proximity in the geographical sense, defined as the spatial distance between actors.

The studies dedicated to innovation proved that innovation and knowledge capital are highly concentrated in a minority of urban regions. It is established that essential elements of the innovation became regionalised and proximity boosts the occurrence of innovation (Doloreux/Parto 2005). Simmie (2003) believes that the reasons for this are tacit knowledge and experiences which are concentrated in a particular place and have low mobility. Sharing them requires socials networks.

We can identify two types of knowledge – the tacit one and the codified (explicit) one. Polanyi (1966) developed the notion of tacit knowledge. He summarised the essence of tacit knowledge in the phrase "we can know more than we can tell" (Polanyi 1966: 4). Tacit knowledge is difficult to articulate and is shared through interactive social networks (face-to-face relations). Codified knowledge can be formally articulated and easily transmitted to others without the need of direct social interactions (e.g. by books, documents, procedures etc.). One of the reasons why geographical proximity matters

in innovation is because tacit knowledge can be shared easier when actors of the innovation process are in appropriate distance to each other. Simmie also argues that the strengthening of trust between participants of innovation requires frequent interactions which can be facilitated by proximity (Simmie 2003). This localised interactions can likewise be reinforced by socio-cultural values such as routines and norms which are embedded in a geographical area. Sharing and understanding tacit knowledge demand common social and cultural comprehension – without it, relations between actors involved in the innovation process can be blocked (some types of information would be hard to interpret (Doloreux 2002)).

The next reason why proximity influences innovation is the economy of agglomeration. Agglomeration forces contribute to knowledge infrastructure by concentrating universities, research centres and their facilities; easier access to rules, standards, regulations. The shorter geographical distance between participants, the less the cost of exchanging knowledge and information and the faster communication between actors (Doloreux 2002).

A number of concepts, allowing better understanding of the role of proximity in the innovation process, emerge from the research on the locus of innovation. These include: innovative milieu, industrial districts, clusters, regional innovation systems and the learning region. Moulaert and Sekia (2003) called these concepts "territorial innovation models"[1].

3 Territorial innovation models: identifying the locus of innovation

Territorial innovation models were developed from the 1980s throughout the 1990s as a response to the crisis in traditionally prosperous industrial regions and the success of several regions, e.g. the "Third Italy"[2]. In this section, we shall present the main characteristics of some related territorial innovation models.

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1 Some scholars use terms "territorial innovation models" and "territorialised innovation theories" interchangeably (see Lorentzen 2008).

2 The Third Italy consists of the following regions: Emilia-Romagna, Friuli-Venezia-Giulia, Marche, Trentino-Alto Adige, Tuscany and Umbria.

Innovative milieu

The notion of an innovative milieu has been introduced by the *Groupe de Recherche Européen sur les Milieux Innovateurs* (GREMI; French for the European Research Group into Innovative Milieu) founded in 1986 by Philippe Aydalot, a professor of the University of Paris. The main hypothesis states that the functioning of firms could not be considered separate from a milieu, their existence has to be rather perceived as a product of a milieu (Ache 2000). An innovative milieu is to be seen as an incubator of innovations and innovative companies within a given region.

The approach of an innovative milieu pays attention to the means of exchanging information and knowledge between regional actors. One of GREMI researchers defines an innovative milieu as "the set or the complex network of mainly informal social relationships on a limited geographical area, often determining a specific external 'image' and a specific internal 'representation' and sense of belonging, which enhance the local innovative capability through synergetic and collective learning processes" (Camagni 1991: 3). According to this definition, the following key elements constitute the concept of an innovative milieu: cooperation and information exchange between regional actors, repeated face-to-face contacts, engagement of actors from different branches of economy (companies, universities, local authorities etc.), the awareness of actors of belonging to a coherent unity and regional culture. The meaningful feature of an innovative milieu is also the necessity of openness to the outside world in order to obtain the specific information or resources and to be up to date with changes occurring outside (Maillat 1995).

As reported by Crevoisier, a scholar from GREMI, the innovative milieu concept views a territory as an organisation connecting firms, institutions and local community within an economic development process (Crevoisier 2004).

Industrial districts

The notion of an industrial district (ID) began with the classical contribution of Alfred Marshall in his work "Principles of Economics" (Marshall 1920). The economist showed the possibility of achieving the advantage of a large scale production by a group of small-sized companies located in a given area. It was mainly possible due to the benefits coming from agglomeration economies, such as: reduction of transaction costs, accumulation of skills among workers, creation of "an industrial atmosphere", promotion of innovation processes.

Taking the assumptions of Marshall into account, a region is a place where a business framework consists of small, locally owned firms – which is why the decisions on investment and production become local – and employees identify themselves more with a district than with a particular company. Entrepreneurs and labour force living in the same community take advantage of the fact that "the secrets of industry are in the air" (Markusen 1996: 299). The further features of an ID, considered by Marshall, are as follows: long-term contracts and commitments between local buyers and suppliers, low degree of cooperation or linkage with firms outside the district, specialised sources of finance, good long-term prospects for growth and employment (Markusen 1996).

The renewed interest in the notion of an industrial district took place in the 1970s and 1980s when the world economy suffered from recession. Despite growing unemployment and general economic stagnation, there were some well prospering regions, e.g. the Third Italy. The concept of the Third Italy occurred in the late 1970s when the poor South (the Second Italy) made little economic progress, the prosperous Northwest (the First Italy) faced a deep crisis, whereas small companies from the Northeast and the Centre of Italy developed in a successful way (Schmitz/Musyck 1994).

The rapid growth of the Third Italy (mostly the growth of small and medium-sized enterprises) was linked to the concentration of companies in specific sectors and geographic areas. These firms were able to gain a significant worldwide market share when it came to traditional products (shoes, leather handbags, furniture, musical instruments etc.) and industrial ones. Humphrey and Schmitz point out that sectoral specialisation, proximity of suppliers, component producers, subcontractors and producers, together with strong competitiveness between companies based on innovation, cooperation in associations of producers and socio-cultural identity enhancing trust were factors responsible for the ID phenomenon of the 1970s and the 1980s (Humphrey/Schmitz 1995).

Clusters

The origin of clusters dates back to the aforementioned work "Principles of Economics", just as the concept of industrial districts. The idea of clusters was developed by Porter in the 1990s. He investigated the concept of a regional cluster of firms from the point of view of a business strategy. Porter defines a cluster as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities" (Porter 2000: 254). Furthermore, another definition of clusters coming from the OECD (the Organization for Economic Co-operation and Development) states that industrial clusters are "networks of produc-

tion of strongly interdependent firms (including specialised suppliers), knowledge producing agents (universities, research institutes, engineering companies), institutions (brokers, consultants), linked to each other in a value-adding production chain" (OECD 1999: 315).

Porter and other scholars (like Harrison) express the belief that companies in a cluster are meant to be more innovative because of the following reasons: taking advantage of agglomeration economies, observing the competitors directly, benefiting from collective knowledge and network-based effects as well as strengthened social interactions (Bell 2005). Moreover, the companies inside clusters generally have better chances to meet the needs of customers than outside firms because major buyers are often part of a cluster. Participation in clusters also helps to learn early about new technologies or a new approach to marketing and service.

Porter stresses several origins of clusters (Porter 1998). The beginnings might come from research done at universities (e.g. clusters in Massachusetts initiated by research at the Massachusetts Institute of Technology or Harvard University) and could also be determined by a geographic location (e.g. Dutch transportation clusters driven by the central location of the Netherlands in Europe). Other factors initiating a rise of clusters could originate from a need to solve some problems, as it was in the case of Finland, where the environmental cluster has appeared in response to pollution problems. Clusters could also be created due to one innovative firm stimulating the growth of the others.

Regional innovation systems

The notion of a regional innovation system (RIS) appeared as a territorially-oriented approach to innovation processes from a broader concept of a national innovation system (NIS) in the early 1990s. The concept of an NIS was established to explain the economic performance of nations and their international competitiveness. The NIS approach was developed by Freeman (1987), who analysed the technology policy and economic performance of Japan. His study showed how the interaction of diverse factors and actors (e.g. government) could influence technological infrastructure. The concept of an NIS views innovations as dynamic and interactive learning processes between companies and other organizations whose activities lead to initiation, diffusion, modification of new technologies and determine the innovative performance of national firms (Freeman 1995). To a great extent, the concept of an RIS was inspired by the work of the aforementioned scholars.

The regional innovation systems approach is a relative young concept, having appeared in the early 1990s (Braczyk et al. 1998; Cooke 1992; 1998). The establishment of the RIS literature, as Asheim et al. (2011) emphasise, took place in the first decade of the XXI century (Asheim 2007; Cooke/Memedovic 2003; Doloreux 2003; Tödtling/Trippl 2005; Uyarra 2010).

The majority of definitions pertaining to a RIS generally considers this notion as a number of elements (actors) and the relationships between them. For example, Doloreux (2003: 70) defines an RIS as "a set of interacting private and public interests, formal institutions, and other organizations that function according to organizational and institutional arrangements and relationships conducive to the generation, use, and dissemination of knowledge". The multitude of actors participating in an RIS is also stressed by Cooke and Memedovic (2003: 10) who states that "a strong regionalized innovation system is one with systemic linkages between external as well as internal sources of knowledge production (universities, research institutions, and other intermediary organizations and institutions providing government and private innovation services) and firms, both large and small".

Asheim (2007: 229) defines an RIS as "the institutional infrastructure supporting innovation within the productive structure of a region" and identifies two subsystems of actors constituting an RIS. The first subsystem is called *the regional production structure – c*onsisting of companies for the most part. The second subsystem is called *the regional supportive infrastructure* (institutional infrastructure) and it comprises: public and private laboratories, higher education organizations, technology transfer agencies, business associations, finance institutions and vocational training organisations. A different set of elements constituting the notion of an RIS is described by Gunasekara (2006), who distinguishes its four components: regional agglomeration (spatial clustering and networking among companies), proximity capital (proximity of infrastructures supporting the innovation activities, such as: skilled workforce, venture capital, business support service and hard infrastructure), associative regional governance (bodies shaping regional innovation strategy, e.g.: local authorities, regional development agencies, industry, labour groups) and cultural norms (openness to learning, trust and cooperation).

The literature provides several classification of RISs. One of them, established by Asheim and Isaksen (1997), identifies three types of RISs with regard to the number of connections between the production structure to the "institutional set-up" of a region. The first type is called *territorially embedded regional innovation system* – examples include networking small and medium-sized enterprises in industrial districts building

their competitive advantage on localised learning processes. This form reflects a market-driven non-systemic model of innovation processes, which means that demand factors influence the scale and paths of innovation (Asheim 2007). The second type is a *regionally networked innovation system,* whose aim is to influence the public–private cooperation by intensifying the institutional infrastructure. This system represents a supply-demand interaction and is typical for German, Austria and the Nordic countries. The third type is called *regionalized national innovation system.* In this case, some parts of the production structure and institutional infrastructure, located in a given region, are combined with national or international innovation systems. It is regarded as a science-supply model of innovation processes, where exogenous organisations and regular interactions are essential. Examples of this form include science parks and high-tech centres located close to regional actors of innovation processes (e.g. close to universities), but having weak interactions with them.

Regions in the concept of an RIS cannot be considered as alone and separate islands in the world-wide economy; close connections with other spatial levels – namely national and supra-national innovation systems – are indispensable. This global connectivity allows companies to remain competitive in the globalising economy.

The learning regions

The learning regions approach has been developed by Richard Florida, who claims that the new age of global, knowledge-intensive capitalism demands a new type of regions being defined by similar standards as companies: permanent improvement, original ideas, learning processes and formation of knowledge. The scholar stresses the necessity of accepting the rules of knowledge formation and permanent learning by regions – they have to evolve into learning regions in the process. He regards learning regions as "collectors and repositories of knowledge and ideas that provide an underlying environment or infrastructure which facilitates the flow of knowledge, ideas and learning" (Florida 1995: 528).

As in the concept of regional innovation systems, a learning region cannot be a single island ignoring other spatial levels – the awareness of being opened to the national and international dimensions is crucial for companies. Due to the fact that the suitable environment for innovation occurs only in part in a single region, cross-regional activities are crucial and provide better support for innovation management and enhance the competitiveness of local and regional companies (Koschatzky 1998).

Some scholars stress two main factors influencing learning processes: certain degree of business-economic intelligence, which would activate the demand for new knowledge, and access or availability of that knowledge (Landabaso et al. 1999). The major role of a regional government, which triggers learning processes in a regional economy, is also emphasised. This actor does so through a regional innovation system, which aims to create a learning region. The aforementioned role is called *collective intelligence*, because a regional government, through an RIS, activates the creation and transfer of knowledge among different actors of an RIS, such as: companies, business consultants, technology centres, research and development centres, universities, development agencies etc. (Landabaso et al. 1999).

4 Downplaying the role of geographical proximity in the innovation process

Boschma (2005) puts forth critical remarks towards the role of geographical proximity in learning and innovation processes, stating that geographical proximity is neither a necessary, nor a sufficient condition for interactive learning. He assumes that other forms of proximity may substitute for geographical proximity. Besides geographical proximity, his model includes four other types of proximity, viz.: cognitive, organisational, social and institutional proximity.

Boschma (2005) defines *cognitive proximity* as the gap in competencies and skills needed to transfer knowledge, which could also be understood as the necessity of similarity of shared knowledge base between firms to exchange and understand information. Too little of cognitive proximity leads to misunderstanding, while too much may cause the problem of a lock-in (the lack of openness and flexibility), which results in not noticing possibilities on new technologies and markets because of routines within an organisation. Lorentzen summarised the concept of cognitive proximity stating that in order to be able to take advantage from each others knowledge, companies are in a need of being into the same technology field (Lorentzen 2005).

Organisational proximity denotes the extent within relations taking place between actors in an organisational setting (it refers either to the relationships within an organisation or between organisations (Boschma 2005)). This type of proximity depends on the rank of the autonomy which the cooperating actors acquire (examples of high organizational proximity with strong ties include a hierarchically organised company or networks (Lang 2005)). A hierarchical organisation with too close organisational proximity may suffer form bureaucratic barriers and the lack of flexibility, which limit learning and in-

novation processes. Too remote organisational proximity may go with the increasing risk of opportunism caused by the lack of control. Proximity with flexible organisational arrangements is beneficial because it allows controlling uncertainty and opportunism in knowledge creation.

Social proximity is defined by Boschma as socially embedded relations between actors at the micro-level, where socially embedded relations are meant to be understood as relationships based on trust constituted of friendship, kinship and past experiences. Social proximity may support interactive learning due to trust and commitment between actors, however too little or too much of it causes the shift from positive to negative effects. Too little social proximity may result in a decline of the innovation capacity of companies caused by the lack of trust and commitment, whereas too much of it can inhibit innovativeness, caused by the existence of cliques which are not open to new ideas.

The distinction between the terms "organisations" and "institutions" should allow better understanding of the term *institutional proximity*. Cooke (1998) compares institutions to the rules of the game and the organisations to the teams that play the game in accordance with these rules. He also emphasises the organisations' embeddedness in institutions. More precisely, institutions mean laws, rules (formal institutions), routines, habits, cultural standards (informal institutions) which are common for networking actors. The notion of institutional proximity encompasses both formal and informal institutions providing conditions for interactive learning. Boschma (2005) stresses disadvantages of this institutional system, which can lead to institutional inertia (not all institutions are able to become an enabling factor for interactive learning and innovation), which constitutes obstacles impeding the formation of new or the reorganisation of old institutional structures.

Boschma (2005), drawing from the work of Rallet and Torre (1999), shows that organisational and cognitive proximity may substitute for geographical proximity. The reasons for this are seen in the declining role of spatial distance when, in terms of the organisational proximity, the job is precisely divided and coordinated by a central authority and furthermore, it terms of cognitive proximity, actors are in the same technology field and have a common knowledge base.

The development of information and communication technologies is another reason why the role of geographical distance in knowledge transfers and innovation processes is perceived by some scholars as diminishing (Torre 2008). The appearance of ICT changed the methods of generating, absorbing, storing and diffusing information and

knowledge. Hence, face-to-face communication (crucial when it comes to tacit knowledge) could be substituted by communication via virtual proximity thanks to the technological evolution. Moreover, ICT increases the chances of changing tacit knowledge into codified knowledge (e.g. changing tacit knowledge into expert systems and know-how databases, the usage of removable media to store organisational knowledge (Rallet and Torre 1999)). The technological evolution also resulted in the increase in mobility of people which facilitates temporary geographical proximity (Torre/Rallet 2005).

Torre and Rallet (2005) assumes that the need of innovators for geographical proximity is seldom permanent and can be easily fulfilled by travelling. He gave some examples of temporary geographical proximity: travelling of a sales representative, a visit of a financial consultant to a firm to conduct an audit, a trip to solve technical problems, a temporary visit to a university with whom a firm collaborates. Torre (2008) stressed that the need for geographical proximity depends on the stage in the life cycle of a product or industry. Dividing the life cycle into three stages – the market introduction stage, the growth stage and the maturity stage – the first and the last stage are characterised by the need for spatial concentration beside other actors. This phenomenon applies mainly to small firms, as big ones are less susceptible to spatial obstacles.

Critical comments with regard to sharing of knowledge, shared knowledge base and knowledge networks within regional context have been voiced by Lorentzen (2005). She questions the assumption that the sharing of knowledge in a region is easy and cheap. Furthermore, the validity of a shared knowledge base has been challenged. According to Lorentzen, firms are not willing to share knowledge for it determines their competitive assets; moreover, companies are specialised and need individual combinations of knowledge from diverse sources. She also disagrees with the basic premise of territorialised innovation theories stating that a region affects the innovativeness and competitiveness of firms, claiming that it is firms who have a hold on their capabilities and network environment, not regional networks and institutions (Lorentzen 2008).

5 Conclusions

The idea behind the territorial innovation models, stating that the key factor of the growth and competitiveness is to be seen in local environment and geographical proximity is beneficial for the transfer of knowledge and innovation processes, is often challenged these days. Some authors go as far as to proclaim *the death of distance* (Cairncross 2001). The reasons for this are to be seen in the growth of global markets and in the advent of information and communication technologies. The development of ICT facilitated the transfer of knowledge over long distance at low cost and accelerates the

codification of knowledge. ICT is also perceived as means of replacing face-to-face relations, whereas virtual proximity is viewed as a surrogate for physical proximity. Scholars also stress the idea that other forms of proximity may substitute geographical proximity.

Nevertheless, the claim that geographical proximity and regional and local levels still matter also has proponents. The argument defending the position that geographical proximity stays crucial for knowledge transfer is that virtual proximity is not able to be a surrogate for geographical proximity concerning transactions characterised by ambiguity, tacitness and complexity (whereas for standardised transactions scholars admit that it is possible). Moreover, while development of digital technologies may contribute to maintaining social relations which were previously established and formed by face-to-face communications and relations, the establishment of social relations and communities development from scratch cannot be done relying on new technologies in the initial stages of this process (Morgan 2004).

The idea of turning tacit knowledge into codified knowledge and, as a result, reducing tacit knowledge via ICT is also criticised. Four reasons are given why this is impossible: the conversion of tacit knowledge into codified one is an expensive process; constant development of science causes the creation of new tacit knowledge which cannot be directly codified; tacit and codified knowledge are complementary, hence the transmission of codified knowledge is based on the appearance of tacit knowledge and vice versa; the ability to take advantage of facilities coming form development of ICT requires the use of common tacit codes and tacit practices of communication (Rallet/Torre 1999).

The role of geographical proximity in a company's innovation performance depends on the industry, the size of a company, as well as on the target to which the distance is considered (e.g. distance to customers, partners, suppliers, knowledge sources, investors). Studies show that spatial proximity is more relevant for small firms than for large ones (Sternberg 1999). Geographical proximity positively influences the propensity of small firms to collaborate with universities, whereas for large firms the distance is less important because the collaboration with world-class science is more valuable for them. Therefore, large firms are eager to collaborate on local as well as on a global level – thigh-quality partnership being priority. Studies also provide evidence that distance to knowledge sources is particularly substantial for pharmaceutical industries, which locate their R&D activities next to high quality chemistry departments (Abramovsky et al. 2007; Abramovsky/Simpson 2011). While territorial closeness to other firms improves innovation productivity of software firms, closeness to their customers does not matter

for their innovation performance (Weterings 2006; Weterings/Boschma 2009). In contrast to software industries, customer proximity as well as suppliers proximity is essential for "time-based competition" which denotes a strategy where "companies compete on time compress the time required to manufacture and distribute their products and significantly cut the time required to develop and introduce new products" (Demeter 2012: 1). With regard to distance to investors, the research conducted on the relevance of spatial proximity of companies to investment decisions of venture capitalists reveals that spatial proximity impacts the likelihood of investments and is especially important for less experienced venture capitalists (Lutz et al. 2012).

To conclude, the theory of territorial innovation models stressing the local and regional potential is still valid and the development of ICT cannot eliminate the need for geographical proximity. Technological evolution has facilitated communications between actors of innovation processes, for example by making low-cost, temporal geographical proximity possible. The needs of companies for geographical proximity are not the same in particular stages in the life cycle of their products, therefore temporal geographical proximity can be more suitable to fulfil the need of face-to-face relations in the growth stage. However, the first stage of the life cycle requires frequent face-to-face contacts which means that local environment is crucial for this period. Geographical proximity alone is not a sufficient factor to encourage collaboration and enhance knowledge transfer. As Rallet and Torre (1999: 375) sum up: "it is well know that individuals can be closely located and nevertheless behave like foreigners", hence organisational relationships and other forms of proximity are also essential.

Globalisation and technological evolution influence the role of spatial distance in innovation processes, however, local environment is still important for local companies due to the presence of close knowledge networks and institutional support, which is especially important in the initial stages of a company. Changeable conditions of innovation activities have implications for regional development policy, which should encourage cooperation both within the local network area and with distant partners. To create these non-local interactions, territorial innovation models cannot take the form of isolated islands but become open systems engaged in interactive learning by global connectivity.

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