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Role of Proximity in Regional Clusters: Evidence from the Software Industry

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In 1990s, the appearance of information and communicational technologies weakened the importance of geographical distance and changed the economic role of proximity, defined as small distance. Geographical proximity plays a crucial role in information and knowledge transfer and in improving the innovative capacity of firms. However, business partners may have successful cooperation in spite of great geographical distances too, due their relational proximity, by using the infocommunication technologies too.

Benefiting from the advantages of geographical and relational proximity, clusters form in less developed regions too. Present paper attempts to explore the special characteristics of cluster formations in the software industry in the 'knowledge isle' of the less developed Southern Great Plain Region, in Szeged subregion. To map the relevance of the e geographical concentration and the industrial base of a potential software industry in Szeged subregion, it is substantial to count location quotient of employees and enterprises. With the purpose of surveying the fields of cooperation and the strength of relational proximity between software enterprises, a questionnaire is made.

Keywords: geographical and relational proximity, cluster, software industry, Szeged subregion

1. Introduction

Today, clusters are one of the most competitive instruments ensuring the future development of the knowledge-based economy, which stimulate a concentration of expertise and knowledge, acting as 'hubs of innovation'. Regional clusters are local systems of production, where companies and institutions in a particular industry create an innovative system of business and non-business relations in a limited geographical area (Porter 1990, 2000). Yet the competitive advantage of clusters rests not only on spatial concentration.

Clusters are considered to be the basis of local, regional and even national politics in many countries. They are the new poles of competitiveness forming the economic map of the world, enhancing the development of the global economy (OECD 2001). The European Union highly supports their formation and growth, and the European Cluster Observatory manages their mapping, providing a wide variety of data on them for all the countries and regions in the EU.

The appearance of modern information and communication technologies (internet, mobile phone etc.) meant the shaping of new channels of information and knowledge transfer, and revealed that business partners might have knowledge-based cooperation with each other in spite of great geographical distances too, due to their common knowledge base, behavior pattern, cultural background etc. The characteristics of 'being close to each other' have changed, the importance of relational proximity increased. In connection with the formation of knowledge-based relations, the examination of different proximity dimensions, beside the geographical one, the 'relational space' and 'networks' also came to the front. The literature of regional science also started to focus on the changed role of the proximity; the concept of proximity has already been examined by many writers and institutions (Kirat–Lung 1999, Boschma 2005).

The phenomenon of the formation of the double meaning of proximity draws attention to create new approaches to examine clusters and the advantages deriving from geographical (physical) and relational (Lagendijk–Lorentzen 2007), in other words used by the French School of Proximity Dynamics, organized proximity too (Kirat–Lung 1999, Torre–Rallet 2005).

Information technology (IT) plays an important role in the development of knowledge-based economy, its role is emphasized in strategic development programs of the European Union. Software industry (as a part of the IT sector), has become an international leading branch, which contributes to the development of information society. It is highlighted to explore the conditions of the development of software cluster, based on the dimensions of proximity. Clusters appear as successful economic development tools in less developed countries in the European Union.

The role of proximity has been changed in the information technology related clusters in Hungary too, although it has yet not been measured. It became reasonable to examine whether cluster formation may occur or not it in the less developed Southern Great Plain Region (NUTS level 2) and in its 'knowledge island', in the city of Szeged and in its subregion. To explore the chances in Szeged, it is worthy to see the example of foreign clusters operating in the field of information technology in other less developed regions, and to adopt the best practices experienced there. The basic question to answer is that does the software industry have the opportunity for strengthening and clustering in a less developed region? What kind of effects of proximity can be observed in the knowledge-based software industry in Szeged subregion?

With a view to demonstrate the future opportunities for clustering in the software industry in the Szeged, the first step is to examine the advantages of geographical concentration of software companies and related institutions in Szeged subregion, by counting location quotient, afterwards to identify the presence and strength of relational proximity to which interconnection can be traced back, by making a questionnaire with the entrepreneur circle of the software industry.

2. Economic role of proximity

In the last decades, the process of globalization shed light on the formation of a new spatial organization of the economy (Lengyel–Rechnitzer 2004). The intensity of global competition revealed the increasing importance of geographical concentration, the co-localization of business actors, ensuring permanent competitive advantages for them.

Proximity is a critical criterion in firms' choice of where to locate its productive units. Location and geographic concentration have become key factors in the diffusion and exploitation of knowledge, especially in the context of innovation, cluster development and knowledge spillover. Proximity reduces uncertainty, solves the problem of coordination, facilitates the interactive learning and thus has a positive impact on the economic performance and growth of a region (Krugman 2000). Most regional, national development programs on regional growth emphasize factors like the nearness of high-tech firms and universities, the proximity of experts and researchers or similar sectors.

Taking a closer look at the notion of proximity in theoretical and empirical approaches, we find that its concept used in many way: we may talk about geographical, cultural, organizational, technological, cognitive and even institutional proximity etc. (Torre–Rallet 2005, Knoben–Oerlemans 2006, Lengyel 2008). All these dimensions are certainly not identical, but refer to 'being close to something' measured on a certain dimension (Knoben–Oerlemans 2006). As Ann Markusen (1999) described, proximity is a 'fuzzy concept'. In many cases companies in proximity, not in the geographical sense, can have successful cooperation due to their common language, common skills, and experiences, social and institutional background.

This is also facilitated by the use of information technology. Twenty five years ago the only way to work with someone at another institution was to talk with them by wired phone or visit in person. But phone calls and travel were expensive in a big distance. The appearance of infocommunication technologies, like internet in the 1990's explicitly changed the value and the necessity of geographical and other dimensions of proximity, and it became much cheaper to collaborate. As the example of Bangalore shows, software companies in India can develop software products and carry out the order of software companies in the USA, due to not to their geographical, but relational proximity.

Literature (Torre–Gilly 2000, Capello–Faggian 2005, Torre–Rallet 2005) usually defines two main types of proximity: geographical and organized proximity. When the proximity concept is used, what is often actually meant is *geographical proximity*, which is signified as spatial, local or physical (Knoben–Oerlemans 2006). Geographical or regional sciences traditionally use the notion of proximity, defined as short geographical distance. Distance basically means shortest way between two points, and refers to 'spatial non-identity', - not being in the same place

(Nemes Nagy 2009) and measures the amount of physical space between two units (individuals, organizations, towns etc.). Short distance brings the individuals together, favours information transfer and facilitates the exchange of knowledge, especially tacit knowledge. Agents in geographical proximity, benefit from positive externalities (Lengyel–Mozsár 2002). The positive effects may appear in the reductions of transfer and transaction costs, in the number of inputs at lower prices (Lengyel 2001). The diffusion of knowledge generates positive externalities, and knowledge flow increases the productivity of activities of research and development (R&D). Empirical studies prove that firms near knowledge (tacit and even in case of codified knowledge) sources can have better innovative performance than firms located elsewhere (Boschma 2005).

For today, it has become clear that it is wrong to associate proximity only with its geographical meaning. *Organized proximity*, which is not geographical but relational, is defined as the ability of an organization to make its members interact. The organization facilitates the interactions within itself between employees and with other entities outside the organization. Organized proximity is built on two types of logic. Firstly, when two members of one organization interact, they are in proximity, because their interaction is facilitated by (common, explicit or implicit) rules, routines and behavior that they use and follow. This is the *logic of belonging* of the organized proximity, which develops cooperation between researchers and engineers in the same firm (Torre–Rallet 2005). Secondly, organized proximity reflects the *logic of similarity*. Two individuals are close to each other, because they are 'alike", they speak the same special language; they share a system of common interests, beliefs and knowledge in the same cultural sphere.

The researchers of the "Dynamics of Proximity" group uses the notion of relational proximity (instead of organized proximity) that includes the spatial dimension of relations. The most frequently examined dimensions in addition to geographical ones, - as the critical assessment of Boschma (2005) underlines, - are the cognitive, organizational, institutional and social proximity. These four categories together are based on the notion of organized proximity.

- The concept of *cognitive proximity* that has been developed by Nooteboom (2006) is generally defined in terms of common knowledge base and expertise among agents. Actors in cognitive proximity have similar knowledge base, thus they transfer knowledge and communicate with each other more effectively.
- The notion of *organizational proximity* means relations in the same space either within or between organizations, and refers to the similarity between individuals sharing the same reference space and knowledge (Boschma 2005). Organizational arrangements are mechanism that coordinate transactions and enable the transfer of information and knowledge.
- Actors are in *institutional proximity*, because they pertain to one institutional framework at macro-level. Relations and interactions between actors and

group of actors are regulated by a set of rules and laws (formal institutional framework) and common habits, routines, (business) practices (informal institutional framework) (Boschma 2005).

- *Social proximity* can be defined in terms of relationship between actors at the micro level embedded in the same social context. Actors share trust based on friendship, kinship and experience (Boschma 2005). If business relations (within an organization) are more socially embedded, the possibility of a better innovative performance is available.

The dimensions of proximity are strongly linked to each other. Even if they operate through different mechanisms, all types increase the effectiveness of learning, have a positive effect on the production of knowledge-based externalities, and facilitates networking and clustering (Albino et al 2007). Firms in cognitive or organizational proximity might be able to communicate without face-to-face interaction using modern communication technologies, overcoming the problems caused by large geographical distance (Knoben–Oerlemans 2006) Taking the new role of information and communication technologies into account, we can state that neither is geographic proximity necessary per se, nor might it not be sufficient in interactions and cooperation. That is reason why literature differentiates permanent and temporary geographical proximity (Gallaud–Torre 2004).

3. Regional clusters in terms of proximity

The concept of proximity provides a framework for analyzing the different spatial organizations, like clusters. Clusters exist, their numbers are increasing and more and more policies are implemented to promote their development, and there are many reasons that describe their success. It became clear that geographical proximity is necessary in innovation and research activities, and facilitates the flow of information and knowledge between actors. Michael Porter (2000) emphasizes the fundamental role of geographical concentration in case of clusters and defines regional cluster as '*geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities'*.

Enterprises have several advantages of acting within a cluster. The proximity of the companies leads to the inflow of skilled people from other regions and sectors. Therefore, the cluster members have better access to employees and suppliers. The cooperation of neighbouring companies can lead to the use of common services and realization of joint projects, processes. In the cluster, the availability of information (formal or informal) and technology (infrastructure, IT services) is generally higher. The main advantage of cluster is the increased level of innovation by using the

informal and formal networking and the pool of resources for research and development.

The existence of clusters rests not only on geographical proximity, but also on several other factors. The economic relations shaped between cluster participants are embedded in the social network and the latter often have strong territorial roots. Synergy between interconnected partners does not form, if they are not in social proximity. Also cooperation may occur between actors from different organizations, but it happens due to the same university origins or social and family network. Social proximity reduces the uncertainty, just like cognitive proximity. This is true in case of cluster members and especially in case of newly entering companies, when they search for new knowledge. As a rule, firms' aim is to find partners in proximity of their own knowledge base. Another important factor is, that geographical context of economic interactions is largely conditioned by the role of institutions.

Cluster members are not only located in the same area, but they form a strong system of innovative relations, and cooperate with each other in their own interest to exchange information and technology, and to transfer knowledge etc.

Lagendijk and Lorentzen (2007) based on the categorization of Torre and Rallet (2005) defined all the combination of geographical and relational (in their own words organized) proximity (Table 1). In terms of proximity, clusters can be described as the intersection of strong geographical and strong organized proximity. For example if organized proximity is strong, but geographical proximity is weak, it characterizes non-localized interactions, like value chain. The geographical and organized proximity are equally more imperceptible in rural, less developed regions, and the agglomeration is an example where the strong geographical proximity is a basic factor, the organized proximity is not.

Table 1. Intersection between geographical and relational proximity

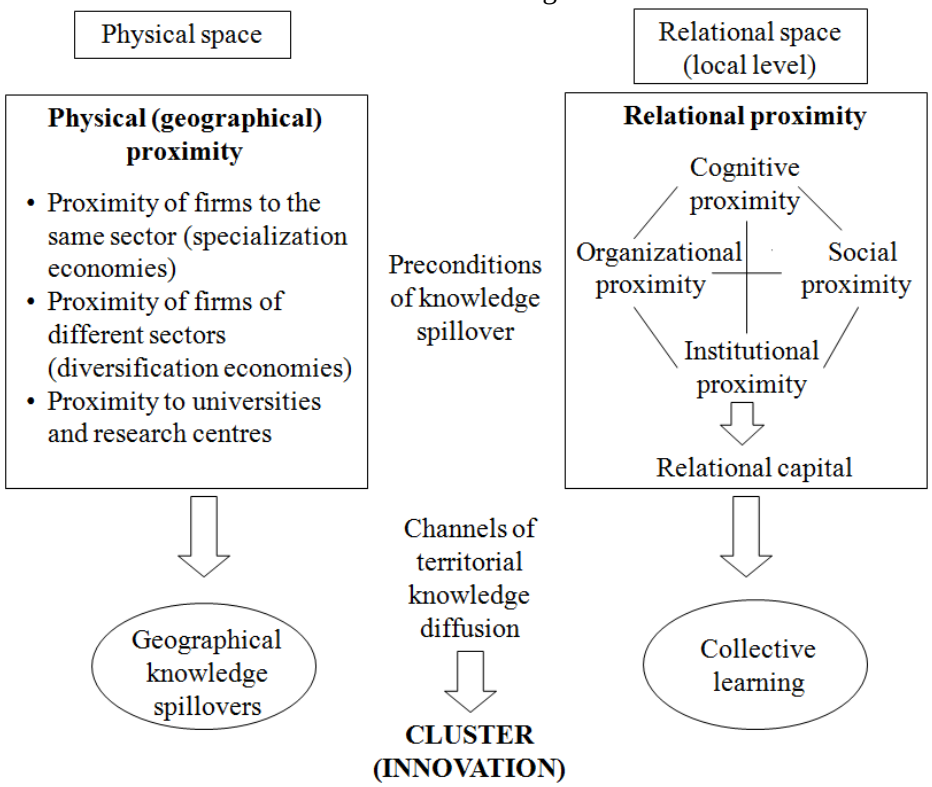
Geographical proximity	**Relational proximity**	
	Strong	Weak
Strong (close)	(1a) Local system of innovation, (milieu) production (*cluster*) (1b) Temporary (face-to-face) co-localization (projects, meetings)	(3) Co-location without interaction or coordination, activities in spatially integrated areas (agglomeration)
Weak (at a distance)	(2) Non localized interaction (e.g.trans-local organizations, value chains, coordination using ICT)	(4) Activities in isolation (e.g. in rural peripheral areas)

Source: own construction on the basis of Lagendijk and Lorentzen (2007)

As noted above, knowledge spillover is an essential element in innovation and in the development of the system of innovative relationship, like in clusters. Although, the high geographical concentration of firms, universities and research

centers in a region belonging both to the same or different sectors, is not enough to explain the innovation capacity of a local area or an organization (network, cluster). It is necessary to define the channels through which the knowledge spreads. Capello and Faggian (2005) introduced the concept of relational space, and explored the connection between *physical and relational space*, as preconditions of knowledge spillover (Figure 1).

Figure 1. Role of physical and relational proximity in innovation and cluster forming



Source: own construction on the basis of Capello–Faggian (2005)

Relational space is created by the set of all relationship (market, power relationships) and cooperation between firms, different agents and individuals, who are characterized by a strong sense of belonging and similarity. The approaches of physical and relational space are outstanding tools to analyze the innovation process and relationships, as in the case of clusters.

On the one hand pure physical space (Capello–Faggian 2005) is formed by the geographical proximity of firms in the same sector (to exploit localization advantages) firms in different sectors (to exploit urbanization advantages) and typical places where

knowledge is produced, like in universities and research centers. Economic actors in physical proximity have the opportunity to contact each other, where the spread of knowledge and the production of geographical knowledge spillovers are managed more easily. On the other hand relational proximity and its dimensions (according to the original notion of the authors it is defined as cultural proximity) are the base of the formation and existence of relational capital (channel of knowledge spread) which is formed by explicit and implicit cooperation among actors. Actors have the capability to interact and to share common values, which is the fundamental element of collective learning.

4. Software industry related clusters in the European Union

The software industry plays a crucial role in the formation of the Information Society. The initiative i2010 (European Information Society 2010) aims to support the Information Society and the media industries within Europe. The software and IT services industry employs more than 1.000.000 European specialist (ISM 2006), and basically every business in all sectors (especially manufacturing, automotive industry, financial services, insurance and retail) in the European Union depends on it, because it facilitates the development, marketing, coordination etc. The European Union fosters the growth of the software industry, the development of the digital economy, especially in research and in partnership building, and support the formation and development of networking and clustering, through the regional policies.

There are many examples for successful IT and even only software clusters in the developed regions in the European Union: Sophia Antipolis in France, the Dublin IT cluster, the Cambridge Network in England, the Technology Cluster Oulu in Finland (ISM 2006). But there are more and more developed and developing cluster in the less developed regions too (e.g. Cork in Ireland, Ostrava in Czech Republic, Tartu in Estonia).

Software companies continue intensive development activities and ICT allows management and coordination from a distance. What is interesting, that there are very few examples for software-only clusters (ISM 2006). The software industry is often included in a bigger regional high-tech cluster (besides for example to the industry of biotechnology, medical etc.) as a 'supporting industry'. The information and communication technology itself plays a special role in the software industry too, and contributes to its characteristics: products (software and teleservices) have an immaterial nature. They can be developed by a geographically dispersed team and directly be delivered to business partners and consumers by using digital network, which leads to the decreasing of the transportation costs too. It is difficult to determine the economic value of software, and the value of the products and activities added by the software related companies, because these usually are built in a complex, final product.

All of the software and IT service related cluster in the European Union have a unique history and structure. One of the factors that determine the process of formation is the level of competitiveness of the region, where the cluster develops. In the less developed regions (contrary to the developed ones) most of the initiatives have been launched by the local or regional government or by the private sector, where the agencies try to engage industry association and individual companies in their efforts.

In order to survey the opportunity of formation and development of a future software cluster in one of the less developed, neofordist type regions (see Michael Porter 2003) in Hungary, it is indispensable to examine the process of clustering in other less developed (neofordist and knowledge transfer) regions in the European Union. The cases of the IT related foreign clusters in Oulu (Finland), in Cork (Ireland), Ostrava (Czech Republic), Tartu (in Estonia) shows the basic role of proximity in practice in the formation of interactions, cooperation, research and development etc. All of the clusters examined hereinafter operate in a less developed region like Southern Great Plain, with similar geographical expansion, social and economic background.

The formation of software industry in Ireland, especially in the area of Dublin, Cork, Galway and Limerick started as an agglomeration of major ICT companies which invested in the regions in business friendly environment (ISM 2006). In the *city of Cork* the software industry is also largely driven by foreign direct investment (FDI) attracted by the low Irish corporate tax rates, subsidies from the EU. In the region innovation policy was key for cluster development, which promoted R&D and innovation, encouraged spillover of knowledge. Due to this, actors created a 'knowledge zone' in Cork, to maximize the advantages derive from the proximity of entrepreneurs, development agencies (e.g. IDA–Industrial Development Agency) and entities of local and central government (CCC 2005). The first factor, which led to the growth of the region, was the financial resources ensured by the government, especially for infrastructure and prosperous business environment development. The second has happened yet due to the bottom-up initiation and empowerment of the IT related companies and the proximity of skilled work force. The success of the cluster in Cork initially derived from the local companies, that could work together with the foreign companies due to the relational proximity, then later to both geographical and relational proximity, making the cooperation and development more easier, with the formation of the innovation park (National Software Center Campus), the University College Cork and the Cork Institute of Technology.

In the *city of Oulu* in Finland, the foundation of cluster was supported by more factors (ISM 2006): the establishment of NOKIA as a regional and national 'champion' company, the strong and consistent regional and local development policies, and the focus on areas where market failures could be identified. IT cluster in Oulu is one of the most competitive ones, be present on the 'cluster map' of Europe (Morris et al 2005). Key preconditions in the formation of the 'Oulu

phenomenon' were also the geographical and relational proximity, size and quality of the local knowledge infrastructure (research center and the science park of Oulu Technolopis Plc.), the access to qualified labour force (educated in the Oulu Polytechnic, the Oulu Region Center of Expertise). In Oulu substantial public policy efforts too were made the ICT cluster flourish: the central government decentralized its agencies in proximity to the region of Oulu, to see and represent the local interest more effectively (Oulu Congress 2006).

By examining further foreign clusters and initiatives too we would observe the well known fact (which is underlined by the literature and many other surveys) that proximity plays a crucial role in the development of software clusters too, (beside the special characteristic that software companies use ICT tools more effectively). In *Ostrava, in the Czech Republic* it is facilitated to form network of business relations between firms and universities by the creation of IT related industrial areas, technology park and innovation centers to utilize not only the advantages of geographical proximity, but to have more effective knowledge based cooperation based on cognitive proximity (CSKI 2002). Conscious steps are taken to attract labour force, university students and firms to the regions from outside areas to increase the home base of the software industry in Ostrava.

The growth of the IT sector in *Tartu region*, in Estonia happened due to the appearance on foreign markets and to the intensive export activities to the direction of Sweden and Finland (Tartu Region 2007). As suppliers, firms from Tartu can join to foreign IT clusters, may receive the most developed technologies and can have common product development, research. This refers to the existence of strong relational proximity between partners from the Scandinavian countries. These types of cooperation can be also formed by the software companies from Szeged subregion.

5. How much proximity still matters in the software industry in Szeged subregion

To investigate the dynamics of proximity, in particular in the high-tech sector, we focus on the case of the software industry in the less developed region of Southern Great Plain, in the city of Szeged and in its subregion.

The Southern Great Plain (NUTS 2) region is situated in the southern-eastern border area of Hungary. The region is 18,000 square kilometers, biggest region in Hungary with its population of 1,4 million. According to the measures revealing the level of competitiveness of its economy, the region is considered as a neofordist type region (Lengyel 2006, Lukovics 2006). The growth rate of the region is the lowest in Hungary, and the GDP per capita was one of the most lowest between the regions of the EU27[1]. All of the three counties (Csongrád, Békés and Bács-Kiskun) included in the region are underdeveloped, have a workforce with low educational level

[1] www.epp.eurostat.europe.ec

(mostly working in agriculture) and yet have not passed the structural change. The county of Csongrád (where Szeged is located) reaches only about 48% of the average of EU 27.

However this figure cannot be applied to the whole region and the county. The city of Szeged is the so called 'knowledge island' of the Southern Great Plain. Szeged is the fourth most densely populated city (with 160,000 people) in the country, almost 40% of the population in the region lives here, and located about 170 kilometers far from capital, Budapest. Together with its subregion, the labour market is approximately 250,000 people. The characteristics of the city and its subregion differentiate from the rest subregions in the region (Lengyel 2003). The two-third of the workforce is employed in the service sector, the entrepreneurial is 'vibrant', and both the number of enterprises and personal income exceeds the average national level. The rate of the employees with higher education degrees is high (24,3%). More than 90% of the researchers in the county of Csongrád live and work in the subregion. Today the three most important factors, which determine the growth of the region are (Lengyel 2009):

1. The university (the University of Szeged), which as we know, operates in the less developed, neofordist region.
2. The function of Szeged and its subregion as a 'knowledge isle', with the high number of enterprises, the high level of education, employment rate and scientific background.
3. Szeged and its subregion is a knowledge transfer region with qualified human resource, high number of people with scientific degrees, R&D units and expenditures and the number of patents.

The city and its subregion have a very strong scientific and human potential that facilitates the subregion to become not only a knowledge transfer, but maybe a knowledge creation region. The endowments of the key region within the Southern Great Plain region (Szeged subregion) underline the necessity of mapping a software cluster. Sufficient knowledge base is available, ensured by the university background, educational and research activities, the big number of university students (around 30.000 students), newly graduates, and finally by the Faculty of Informatics (with nearly 500 newly graduated students annually). These factors ensure the fluent re-production of the labour base annually, and the birth of new enterprises found by qualified, young workforce. A circle of software enterprises is built, and the first initiatives have already appeared to have more efficient cooperation (cluster) between companies, although the effects of these are still hardly perceptible.

Our aim is to understand how geographical and relational proximity and its dimensions determine the process of clustering in knowledge-based activities in less developed regions. The growing application of information and communication technologies appears to indicate that there is a weakening need for geographical

proximity, and it causes the 'death of distance'. This has not triggered a collapse of 'near and far' in the reality of individuals and organizations, not for actors staying in less developed, peripheral regions (Lagendijk–Lorentzen 2007). Usually, these firms depend on knowledge sources deriving both inside and outside from the region, as we will see in case of Szeged too.

The first step to identify the base of a future software cluster is to map the size of the industry in Szeged and its subregion. If the geographical concentration of the software industry is proved in the number of enterprises and employees, it makes reasonable to examine whether the software companies need geographical proximity or not, and how strong is the relational proximity between software companies.

6. The proof of geographical concentration

The software industry is a potential leading branch in the micro-region of Szeged. Mapping the base of a future software cluster, firstly it is necessary to prove the existence and concentration of the basic input factors in the region. We examine whether the software industry has achieved a specialized critical mass in the region using the cluster mapping method of *location quotient* (LQ) (Patik–Deák 2005). The measurements are based on the entrepreneurial databases of KSH Cégkódtár (2007/2) and Opten Cégtár (2008).

LQ compares the distribution of an activity to some base or standard. In this case the selected base is the employment and the number of enterprises. In Szeged and in its subregion more than 200 companies (which have its seat or/and site in the subregion), and about 550 employees work in the software industry. To focus on the most knowledge intensive companies in the region, who have the biggest role in the growth of the industry, we only examine limited liability and public limited companies dealing with software development (NACE Rev.1. 72.21.), software consultancy and supply (NACE Rev.1. 72.22.) whose products have bigger added value. The software industry in limited sense is composed of 91 companies.

As a rule, if the value of LQ is more than 1, it indicates a relative concentration of the activity in the area, compared to the region as a whole. The European Cluster Observatory determines a stricter value limit equal to 2.

According to the value of *LQ based on the number of enterprises*, which is less than 1 in Szeged and in its subregion, we can state that the area has fewer shares in the software activity than in other regions in the country, in the case of other bigger cities in Hungary (Győr, Pécs, Debrecen, Székesfehérvár). It is interesting that if we not measure the number of enterprises in capital, Budapest (where more than 5000 companies work in the software industry from the 9000 companies in the country), and we count the LQ only in the countryside (in the country without Budapest) the LQ is 1,256 (Table 2).

Table 2. Value of LQ for entreprises and employment

	Entrepreneurial LQ		Employment LQ	
	Hungary	Hungary countryside	Hungary	Hungary countryside
Budapest	1,390		2,171	
Szeged	**0,944**	**1,256**	**1,119**	**2,867**
Győr	0,829	1,104	0,431	1,105
Pécs	1,016	1,352	0,557	1,429
Debrecen	0,858	1,142	0,681	1,744
Székesfehérvár	1,173	1,561	0,898	2,300

Source: own calculations on the basis of data from KSH Cégkódtár and Opten Cégtár

We got similar results measuring *employment LQ*. Taking the number of employees in Budapest into account, the LQ is 1,119 in Szeged and its subregion, and without Budapest it is 2,867. None of the other cities in the countryside can reach this relatively high value. According to this figure, the relative concentration of the software industry is secured in Szeged and its subregion in the number of enterprises and employees. The industry may be strong enough to grow as a *potential leading branch*, and also attract related economic activities from the region itself and from other regions too.

The statistical research based on the calculation of location quotients ensured the observable phenomenon, that software industry is specialized in Szeged and its subregion. It is worthy to note, that the number of employees and enterprises in the software industry in Szeged and its subregion cannot be compared to the size of a traditional industries (e.g. agriculture, food industry in the region). But the results suggest surveying the opportunity of software industry as a potential leading branch for clustering with qualitative research.

7. The role and strength of relational proximity

Using the qualitative method of questionnaire, we examine how geographical proximity matters in the software industry, and how strong the relational proximity is between companies. We tried to contact to all of the 91 companies (headquarters) in the software industry (in the restricted sense), but only 74 companies were available. (It cleared out that some of the companies already not exist.) Finally, 31 questionnaires were sent back. It was not representative sampling, but the 31 questionnaire is 34% of the asked ones, so we can have valid, reasonable consequences. The results represent the characteristics of enterprises with the average number of 12 employees. The questionnaire was created based on the studies of European Cluster Observatory, of the questionnaire of Michael Porter and the literature of proximity. The main areas of the questionnaire included basic

characteristics of firms (year of foundation, employment, profile etc.), and the dimension of the proximity (the presence and intensity of proximity) (Table 3).

Table 3. The measurement of the presence and necessity of geographical and relational proximity

	Measurement
Geographical proximity	Presence and amount of partnership in the subregion, region and country (customers, suppliers, industry related companies - SME or large company, university, research center, goverment agencies, competitors, consultant etc.)
	The amount and the utilizing of advantages deriving from the proximity of input factors (qualified workforce, educational and research institutes, technology, business services etc.)
	Lack of input factors and its effects (business and personal, information, workforce, financial resources)
	Amount of products and services produced and supported to other local industries
Cognitive proximity	Participating in the same programmes, and trainigs, have the same educational or working background of the employees,
	The continuity and intensity of R&D activities and cooperations
	Participating in business clubs, forums, organizations, conferences etc.
Organizational proximity	Number and intensity of business relations within the organizations, and between the organizations (projects, consortium, tendering etc.)
	Number and intensity of personal/informal relations within the organizations, and between the organizations (family, friends etc.) and their effects on the operation and development of the organization
Social proximity	Role and evaluation social background in the operation
	Effects of relations with family, friends or other individuals and their role: - to manage the wished market position - to form and reach the adequate market demand - to have and transfer information and knowledge
Institutional proximity	The effect and importance on the operation of organizations, by factors: - laws, rules, regulations, - cultural norms and habits - corporal routines - the effect and evaluation of the economic and enterprise development in the region

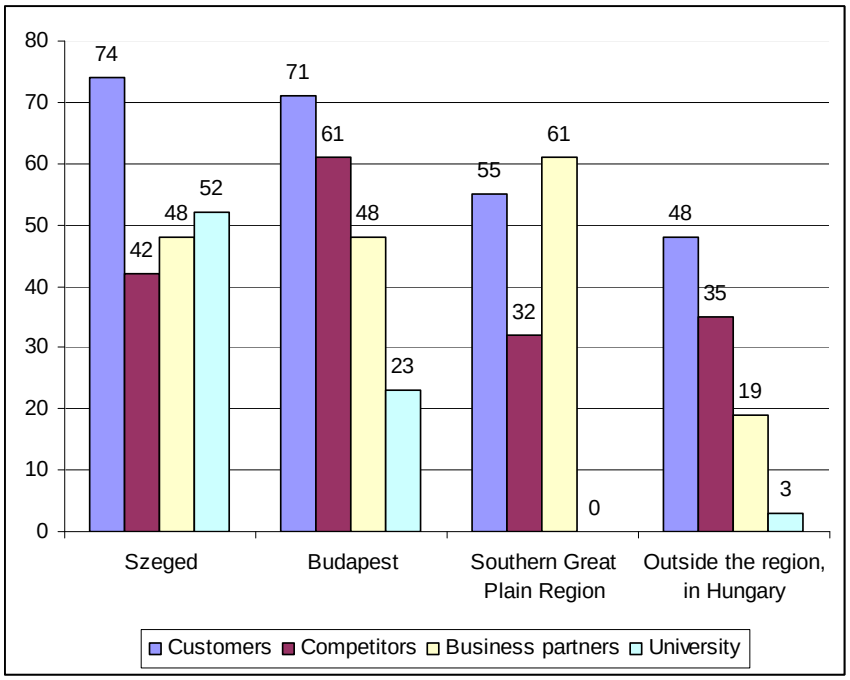
Source: own construction

The questionnaire shows that the role of geographical proximity in the software industry appears in a special way in Hungary. The number and the intensity of business partnership between companies confirm the well known fact, that there are no significant distances within Hungary, and partners in the capital, in Budapest play an important role even in the software industry too of Szeged. More than 70% of the companies have customer relations in Szeged and Budapest too, every second

company have cooperation with the University of Szeged, and only 23% have any kind of connection with universities or research center in the capital (Figure 2).

What is surprising that, about 60% of the companies occasionally work together with their competitors from Budapest. This relatively intensive partnership between the software companies in Szeged and Budapest underlines that they are in relational proximity. Software companies valued geographical proximity as relatively important factor. In a five point scale (1 not important, 5 very important) the average of the answers given to this question is 2,71. Beside the weaker need for geographical proximity there is proved relational proximity between companies. They do see and enjoy the advantages deriving from geographical proximity, but as firms reported, the lack of it does not mean a disadvantage especially in some stages of on-demand software development and services.

Figure 2. Partnership of software companies (%)



Source: own calculations

There are broad market borders among the IT products and activities. Thought many of the distinguished activities can be relocated, but it is quite obvious that at least temporary geographical proximity is necessary in cooperation. The need of permanent geographical closeness depends on the quality of the technical conception of the software being developed. Usually, face-to-face interactions are required in software development, definitely in the initial stage in functional specification, and

in the final stage in integration and technical assistance. Companies in Szeged and in its subregion are solution-orientated. They practice research and development, and focus on design software, instead of making standardized tasks.

The cooperation with *competitors* has special characteristics. Companies in Szeged and its subregion cooperate and compete with each other, like companies in clusters. 78% of companies admitted that the proximity of the competitors inspire them to make developments much faster and more effectively. Almost half of the companies have participated in a project with its rival in Szeged, and about two third in Budapest. Typically the cooperation occurs only occasionally and focuses on research and development, and may be attained by the companies in relational proximity. The software market in Szeged and its subregion is mostly dominated by local partners, no matter we examine the relationship between producers, university, rivals, suppliers or customers.

Mapping a software cluster in the subregion, the survey demonstrates that companies may enjoy the *positive externalities* of geographical concentration, and strive for conscious utilization of its advantages. The need of (at least temporary) geographical concentration depends on the strength of the relational proximity. Relational proximity and its dimensions (cognitive, organizational, social and institutional) are basic inputs in the innovative cooperation. In the questionnaires, companies emphasized three factors, as the most important inputs of innovation: attainment of innovative and professional workforce, ideas and technologies through personal and business relations and finally the proximity to educational and postgraduating programs and institutions. The synergy of partners is substantial to obtain the benefits of innovation-based relationships.

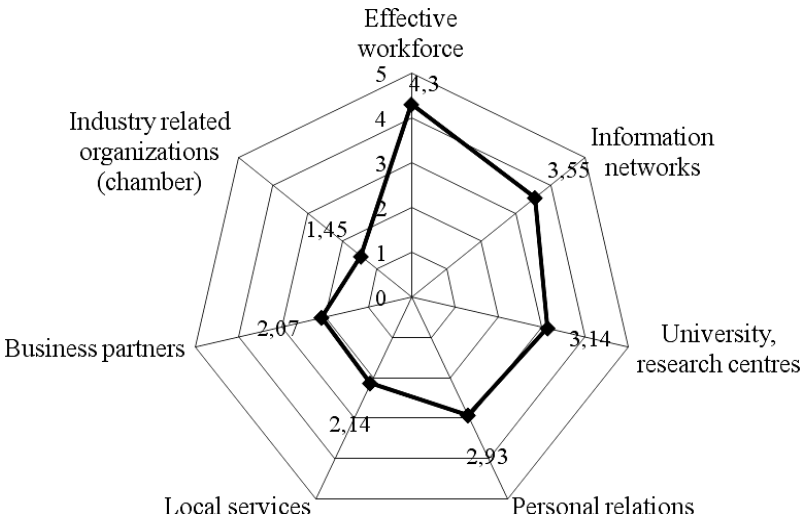
University appears to be an intermediary institution in the flow of knowledge and information, and manages to bring partners to strong relational proximity. It has significant role in the facilitation of collective learning. As the questionnaire revealed, the companies have cooperation usually only with the university. 45% of the companies have regular collaboration with the University of Szeged, and only 5 companies have the relationship with the Budapest University of Technology and Economics or with the Hungarian Academy in Sciences in Budapest. Only one gets in touch with university abroad, within the EU.

Business and personal relations between actors determine an 'industrial atmosphere' in Szeged subregion, where the similarities in knowledge background, experience, practices and routines are natural. Cognitive proximity is a pivotal factor in the software sector in Szeged. More than half of the employees and almost 80% of the headquarters of the companies graduated in the University of Szeged, on the Faculty of Informatics. Companies with the same knowledge background participate in forums and clubs (52%), conferences (39%) and other professional programs together. It is favoured to have interaction between company members, because they share a set of common rules, specific know-how and organizational routines. This points out that they stand in organizational proximity too. Different forms of

interactions play an important role: the lack of personal and business relations (33%), governmental subsidies (29%) is – as the interviewed firms mentioned – factor that hampers their future chance to grow. More than 80% of the companies stated that personal relationships like friendship of employees within and between organizations ensure the flow of information and knowledge. Furthermore they (39%) emphasized the importance of informal relationship between headquarters and employees, - formed in expositions, conferences - as a channel of information flow. This process would not be managed without socially embedded relations. Strong social proximity facilitates the affirmation of links, the development of trust-based relations, hence the formation of innovative cooperation.

Software companies are characterized by *intensive innovative activities,* and do own research and development (65%). In the past 3 years 87% of them have done innovation, basically product (65%) and technology development (48%), appeared in a new market (45%) or participated in professional trainings (42%). 10 companies restructured its organization, and only 7 bought and not developed its technology. The questioned firms valued also the factors, which has the biggest effects on their innovation activities (Figure 3). The results underlined the importance and proximity of qualified workforce, sources of information, personal relationship, university and research center, and the role of local business services and organizations (like chamber of industries and commerce) in case of this too.

Figure 3. Factors influencing the innovative capacity of software industry



Source: own calculations

The *profil*e of the companies is very *heterogeneous*, but there is need to support and inspire them to do innovation together for the local industries. Some

already sell software and IT services to the food, medical, medicine industry and biotechnology, but these kind of cooperation are still less intensive. If the software companies have permanent connectivity to other local industries, it can also decrease the cost of collaboration.

The problem faced by the software industry in Szeged and in its subregion is, that the relations are not results of constant or recurrent cooperation. They are supposed to receive financial sources within a common project or trade development competition. Companies in general are not willing to have regular cooperation, because they fear to loss their market position or to have their good ideas stolen. However, they already stated (68%) that they would be ready to work together within a cluster. Solving the problem, the key is to draw up a conscious development strategy creating the synergy between partners (software companies, university and other knowledge producer institutions and the representatives of local government).

Companies in macro-level are embedded in one institutional background. They are in strong institutional proximity; they are applied to the same laws, rules and regulations. However actors' satisfaction in connection with institutions is a very different question. Interviewed companies valued some related factors with a 5 point scale (1 not satisfied, 5 very satisfied). They are discontent with the administrative obligatory (1,57), legal environment (2,03) and with the representation of their interests (1, 72). Local government does not have the sufficient tools to promote relation e.g. with industrial parks, cluster building, the foundation and registration of new firms, the appearance in external markets, the organization of trainings, clubs and the development of technological infrastructure.

These experiences can be traced back to the lack of a conscious cluster development policy in Hungary. Some policy tools are already included in the central economic development programs, but only a few steps were made to focus only on clusters, not only on national, but even in regional level, in harmony with the bottom-up initiations of enterprises in different sectors (Grosz 2006). By drawing up adequate cluster development orientated plans, and having a consensus made by the private and public sector, the default may eliminate. The process of cluster development may speed up due to an effective institutional and governmental background. Governments contribute to diminish market barriers, control market competition, ensure inputs (eg. infrastructure, technology etc.) for economic actors and mediate between companies and institutions, which produce knowledge and labour force. Thus, government may facilitate the cooperation of companies in clusters too.

8. Conclusion

In Szeged subregion it became reasonable to explore the opportunity of the formation of a potential clusters in the software industry. The existence of the

relative geographical concentration and the home base of the software industry in the amount of enterprises and employees in the ‘knowledge isle’ of the Southern Great Plain were proved.

Findings ensure the importance of both geographical and relational proximity between the actors in the software industry in Szeged and in its subregion. Proximity has a positive effect on the innovative capacity, the development of corporate skills and the decreasing of transaction costs. The pool of researchers and qualified labor force has been built-up; companies are motivated to deepen their existing business relations, which determine the formation of the critical mass of a cluster.

Qualitative survey revealed that geographical concentration is necessary, but not sufficient to create business and non-business relations in practice. At least temporary geographical proximity and strong relational proximity of the partners is needed to create cooperation with the aim of software development.

There are two main reasons, which explain the intersection of the weakness or strength of geographical and relational proximity between software companies. Firstly, the number of collaboration of software companies in the region and between regions in Hungary (mainly in Budapest) reveals the need to access knowledge sources formed outside the region too, especially in case of a less developed regions. Secondly the software industry cannot be compared to a traditional industry. There are immaterial products, which may be developed in bigger geographical distances too, and can be transferred to anywhere by the information and communication technologies. Furthermore the necessity of face-to-face interactions depends on the stage of the cooperation with the aim to develop new products or technologies.

Relational proximity and its dimension together and separately define cluster formation. Software companies are in cognitive proximity sharing the same knowledge background, having the same or similar university origins, and participating in conferences, clubs and forums. They have an extensive system of business and personal relations, determined by the same behaviour patterns, cultural and social values, rules and regulations, which underline the existence of organizational, social and even institutional proximity between them. Each dimension of relational proximity separately and also together affects the capacity of innovation and collective learning.

There is a lack of more trust-based relations and partnership of companies, local government and knowledge producer institutions, but it can be counteracted by not only occasional, but also frequent cooperation, and by conscious economic and enterprise development, which is absolutely important in a less developed region.

References

Albino, V. – Carbonara, N. – Petruzzello, A. M. 2007: Proximity as a Communication Resource for Competitiveness: A Rationale for a Technology Cluster. *International Journal of Learning and Intellectual Capital*, 4, pp. 430-452.

Boschma, R. A. 2005: *Proximity and Innovation: A Critical Assesment. Regional Studies*, 1, pp. 61-74.

Capello, R. – Faggian, A. 2005: *Collective Learning and Relational Capital in Local Innovation Processes Regional Studies*, 1, pp. 75-87.

CCC 2005: *Strategic Cork. Guide to the city's investment opportunities, quality of life, plans for the future*. Cork City Council, Cork, Ireland.

CSKI 2002: *ICT in the Czech Republic: Institutions, Regulations, Challenges and Apllications in Academia, Industry and the Public Sector*. Czech Society of Cybernetics and Informatics.

Gallaud, D. – Torre, A. 2004: *Geographical Proximity and Circulation of Knowledge through Inter-firm Cooperation*. Academia-business links, Palgrave, Macmillan, London.

Grosz, A. 2006: Klaszterek és támogatásuk az Európai Unióban és Magyarországon. In Lengyel, I.–Rechnitzer, J. (eds) *Kihívások és válaszok: A magyar építőipari vállalkozások lehetőségei az Európai Uniós csatlakozás utáni időszakban*. NOVADAT Kiadó, Győr, pp. 159-188.

ISM 2006: *Study into the strategies, policies and other conditions needed to allow teh European-based Software and Service industries to take global platform leadership.* Information Society and Media. Directorate General, Berlin.

Kirat, T. – Lung, Y. 1999: Innovation and proximity. Territories as loci of collective learning processes. *European Urban and Regional Studies*, 6, pp. 27-38.

Knoben, J. – Oerlemans, L.A.G. 2006: Proximity and inter-organization: A literature review. *International Journal of Management Reviews*, 8, pp. 71-89.

Krugman, P. 2000: The Role of Geography in Development. *International Regional Science Review*, 2, pp. 142-161.

Lagendijk, A. – Lorentzen, A. 2007: Proximity, Knowledge and Innovation in Peripheral Regions. On the Intersection between Geographical and Organizational Proximity. *European Planning Studies*, 4, pp. 457-466.

Lengyel, I. 2001: Iparági és regionális klaszterek: tipizálásuk, térbeliségük és fejlesztésük főbb kérdései. *Vezetéstudomány*, 10, pp. 19-43.

Lengyel, I. 2003: *Verseny és területi fejlődés: térségek versenyképessége Magyarországon.* (Competition and Territorial Development: The competitiveness of regions in Hungary) JATEPress, Szeged.

Lengyel, I. 2006: A regionális versenyképesség értelmezése és piramismodellje. (Interpretation of Regional Competitiveness and the Pyramid Model). *Területi Statisztika*, 2, pp. 131-147.

Lengyel, I. 2008: A közelség alakváltozásai a tudásalapú helyi gazdaságfejlesztésben. (The metamorphosis of proximity in the knowledge-based local economic development) In Lengyel, I.–Lukovics, M. (eds) *Kérdőjelek a régiók gazdasági fejlődésében*. JATEPress, Szeged, pp. 109-129.

Lengyel, I. 2009: Knowledge-based local economic development for enhancing competitiveness in lagging areas of Europe: the cases of the University of Szeged. In Varga, A. (ed.) *Universities, Knowledge Transfer and Regional Development: Geography, Entrepreneurship and Policy*. Edward Elgar, Cheltenham-Northampton, pp. 322-349.

Lengyel, I. – Mozsár, F. 2002: A külső gazdasági hatások (externáliák) térbelisége. *Tér és Társadalom*. 2, pp. 1-20.

Lengyel, I. – Rechnitzer, J. 2004: *Regionális gazdaságtan*. Dialóg-Campus Kiadó, Budapest–Pécs.

Lukovics, M. 2006: A magyar megyék és a főváros versenyképességének empirikus vizsgálata. (Empirical study of competitiveness of the counties and capital). *Területi Statisztika*, 2, pp. 148-166.

Markusen, A. 1999: Fuzzy Concepts, Scanty Evidence, Policy Distance: The Case of Rigour and Policy Relevance in Critical Regional Studies. *Regional Studies*, 9, pp. 869-884.

Morris, D. – Donnelly, T. – Hyry, M. 2005: *The Oulu Phenomenon*. Regional Association International Conference, Aalborg, Denmark.

Nemes Nagy, J. 2009: *Terek, helyek, régiók: A regionális tudomány alapjai*. (Spaces, places, regions: Bases of regional science.) Akadémiai Kiadó, Budapest.

Nooteboom, B. 2006: Innovation, learning and cluster dynamics. In Cooke, P.–Martin, R. (eds): Clusters and Regional Development. Critical reflections and explorations, *Regional Studies Association*, Routledge, New York, pp. 137-163.

Oulu Congress 2006: *Oulu–a five start technology cluster*. Meet Oulu Hitech.

Patik R. – Deák Sz. 2005: Regionális klaszterek feltérképezése a gyakorlatban. (Mapping regional clusters in practice) *Tér és Társadalom*, pp. 139-170.

Porter, M. E. 1990: *The Competitive Advantage of Nations*. The Free Press, New York.

Porter, M. E. 2000: Locations, Clusters, and Company Strategy. In Clark G. – Gertler, M– Feldman, M. (eds) *Oxford Handbook of Economic Geography*. Oxford University Press. pp. 253-274.

Porter, M. E. 2003: Building the microeconomic foundations of prosperity: findings from the microeconomic competitiveness index. *In The Global Competitiveness Report 2002-2003*, World Economic Forum, pp. 23-45.

OECD 2001: *Innovative Clusters. Drivers of National Innovation Systems*. OECD Proceedings, Paris.

Tartu Region 2007: *IT Sector overview. Information Technology: Smartware from Tartu, Estonia.* Tartu City Goverment, Tartu.

Torre, A. – Gilly, J-P. 2000: On the Analytical Dimension of Proximity Dynamic. *Regional Studies*, 2, pp. 169-180.

Torre, A. – Rallet, A. 2005: Proximity and Localization. *Regional Studies*, 1, pp. 47-60.