ROLE OF PROXIMITY IN INFORMATION TECHNOLOGY CLUSTERS (IN SZEGED AND ITS SUBREGION)

Zsófia VAS

University of Szeged, Faculty of Economics, HUNGARY

Abstract:
Geographical proximity plays a crucial role in improving the innovative capacity of firms, but today by using infocommunication technologies, knowledge-intensive firms can have successful co-operation in spite of great geographical distances. Benefiting from geographical and organized proximity, cluster form.
Utilizing the advantages of proximity, cluster development appeared in the city of Szeged and in its subregion. Empirical research shows that all the facilities are provided in the software industry for clustering, where further development can be reached by the strengthening of the dimensions of proximity.
Keywords:
geographical proximity, organized proximity, knowledge-intensive cluster, software industry

1. INTRODUCTION

Clusters are today considered to be the basis of local, regional and even national politics in many countries. They are the new poles of competitiveness dominating the economic map of the world, serving as major tools of development in the global economy. Regional clusters are local systems of production, where companies and institutions in a particular industry in one place create an innovative system of business and non-business relations. Yet the competitive advantage of clusters rests not only on spatial concentration. The appearance of modern information and communication technologies (internet, mobile phone etc.) revealed that innovative companies and laboratories might cooperate with each other thanks to the common knowledge base, professional language, behaviours, cultural background etc. in spite of geographical proximity. New channels of information and knowledge transfer shaped, influencing the process of production and development. This phenomenon draws attention to create new approaches to examine clusters and the advantages deriving from physical and relational, in other words, organized proximity too.

Information technology (IT) plays an important role in the development of knowledge-based economy. IT and this way software industry, has become an international leading branch, which contributes to the development of information society. Clusters appeared as successful economic development tools in less developed countries after the developed ones in the European Union. The formation of a software cluster based on the dimensions of proximity has yet not been measured in Hungary, but it became reasonable in the less developed region (NUTS level 2) of the South Great Plain and in its 'knowledge island', Szeged and its subregion.

With a view to realize future opportunities for clustering in the software industry, the first step is to examine the advantages of geographical concentration of software companies and related institutions in Szeged and in its subregion, afterwards to identify the presence and strength of other factors of proximity to which interconnection can be traced back. To explore the chances of cluster development is Szeged, it is indispensable to see the example of foreign clusters operating in the field of information technology.

This paper has one purpose: to demonstrate and analyze the relevance of proximity in clustering. Firstly, we introduce the concept of proximity, and describe the notion of geographical and organized proximity, then we define clusters in terms of proximity. Finally, we propose to examine cluster formation in practice, in case of the knowledge intensive software industry in Szeged and in its subregion.

2. INNOVATION AND DIMENSIONS OF PROXIMIT

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 [6]. 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 use 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, institutional proximity [5, 8, 15] etc. All these dimensions are certainly not identical, but refer to 'being close to something measured on a certain dimension [5]. As Ann Markusen [9] described, proximity is a "fuzzy concept". In many cases companies in proximity, but in the geographical sense, can have successful cooperation due to the common language, common skills, experience, social or institutional background, as we can see in the example of software companies in Bangalore, in India, which develop software products and carry out the order of software companies in the USA. The appearance of infocommunication technologies in the 1990s explicitly changed the value and the necessity of geographical and other dimensions of proximity. Literature [2, 12,14,15] 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 either spatial, local or physical [5]. Geographical or regional sciences traditionally use the notion of proximity, defined as short geographical distance. Distance basically means 'spatial non-identity', - not being in the same place - [10] 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 knowledge externalities. The diffusion of knowledge generates positive externalities if 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 [1].

For today, it has become clear that it is wrong to associate proximity 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 so-called 'logic of belonging' of organized proximity, which develops cooperation between researchers and engineers in the same firm [15]. 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 so-called "Dynamics of Proximity" group have developed the notion of relational proximity that includes the spatial dimension of relations. The most frequently examined dimensions in addition to geographical ones,- as the critical assessment of Boschma [1] 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 [11] 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 [1]. 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 common habits, routines, (business) practices, rules and laws. 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 [1]. 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. All types increase the effectiveness of learning, and have a positive effect on the production of knowledge-based externalities.

As noted above, knowledge spillover is an essential element in the development of innovation process. Although, the high geographical concentration of firms, universities and research centres in a region belonging both to the same or different sectors, is not enough to explain the innovation capacity of a local area. It is necessary to define the channels through which the knowledge spreads. Capello and Faggian [2] introduced the concept of relational space, and explored the connection between physical and relational space, as preconditions of knowledge spillover (Figure 1.). Relational space is

created by the set of all relationships (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.

On the one hand pure physical space is the geographical proximity to firms in the same sector (to exploit localization advantages) and to firms in different sectors (to exploit urbanization advantages) and to typical places where knowledge is produced, like in universities and research centres. 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 organized 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, which is formed by explicit and implicit cooperation among actors. Actors have the capability to interact and to share common

Figure 1. : Physical and relational space

values, which is the fundamental element of collective learning [2].

Firms in cognitive or organizational proximity might be able to communicate without face-to-face contact using modern communication technologies (which have spread since the 1990s), thereby overcome the problems caused by large geographical distances [5]. Taking the new role of information and communication technologies into account, we can state that geographical proximity is necessary, but not sufficient in interactions and cooperation. That is why literature differentiates permanent and temporary geographical proximity [3].

3. 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 [13], too, emphasizes the fundamental role of geographical concentration in case of clusters and defines cluster as '*geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities*'.

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 vicinity 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 technology, to transfer knowledge. In terms of proximity, clusters are described as the intersection of strong geographical and strong organized proximity [7]. For example if organized proximity is strong, but geographical proximity is weak, it characterizes non-localized interactions, like value chain.

4. HOW MUCH PROXIMITY MATTERS IN THE SOFTWARE INDUSTRY
IN SZEGED AND IN ITS SUBREGION

To investigate the dynamics of proximity, in particular in the high-tech sector, we focus on the case of the software industry in Szeged and in its subregion. The endowments of the key region of development 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
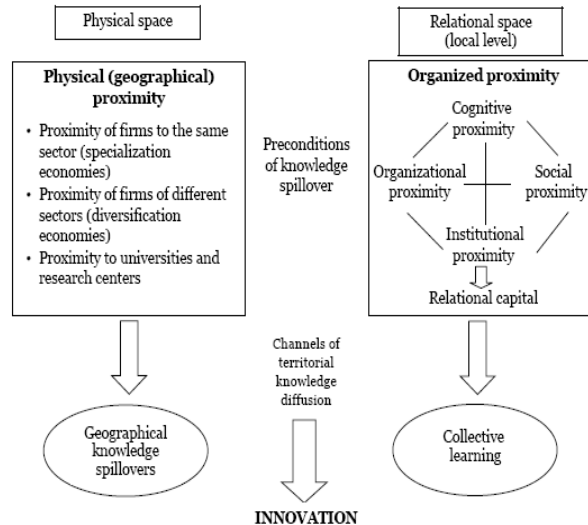
university students (around 30.000 students), newly graduates, and finally by the Faculty of Informatics (with nearly 500 newly graduated students annually). These factors ensure the fluent re-production of the labour base annually, and the birth of new enterprises found by qualified, young workforce. 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 organized proximity and its dimensions determine the process of clustering in knowledge intensive 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 cause 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 [7]. Usually, these firms are dependent on knowledge resources from outside the region too, as we will see in case of Szeged too.

ICT plays a special role in the software industry too, and contributes to its characteristics: products (software and teleservices) have an immaterial nature, and their transportation to business partners and consumers can happen directly through modern ICT tools, which reduces transportation costs. Software companies continue intensive development activities and ICT allows its management and coordination from a distance. Software companies form different business associations like clusters, which operating separately or connected to other high-tech industries (e.g. biotechnology).

5. 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 methodology of location quotient (LQ) [12]. 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, and about 550 employees work. 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, software consultancy and supply (NACE Rev.1.:72.2.) whose products have bigger added value. The software industry in limited sense is composed of not more than 90 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 equal to 2 or more. 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 share in the software activity than in other regions in the country, comparing it to values calculated in case of other bigger cities in Hungary. It is interesting that if we measuring the number of enterprises in the capital, in Budapest (where more than 5000 companies work in the software industry), the LQ is 1,256. We got similar results measuring employment LQ. Taking the employment in Budapest into account, the LQ is 1,119 in Szeged and its micro-region, and, it is 2,867 without Budapest, and none of the other rural cities 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, and 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. The results suggest surveying the opportunity of software industry as a potential leading branch for clustering with qualitative research.

6. THE ROLE AND STRENGTH OF PROXIMITY

Using the qualitative method of questionnaire, we examine how geographical proximity matters in the software industry, and how strong the organized proximity is between companies.

The role of geographical closeness in the sector of information technology appears in a specific 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 play an important role even in the software sector of Szeged. Software companies valued geographical proximity as relatively important factor. Beside weaker geographical proximity there is proved organized proximity between companies. They do see and enjoy the advantages deriving from geographical proximity, but the lack of it does not mean a disadvantage especially in some stages of

on-demand software development and services.

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 micro-region cooperate and compete with each other, like companies in clusters. Almost half of the companies have participated in a project with its rival in Szeged, and about two third in Budapest. Typically the cooperation occur only occasionally and focus on research and development, and shall be attained by the companies in organized proximity. The IT market in Szeged and its subregion is mostly dominated by local partners, no matter we examine the relationship between producers and university, rivals, suppliers or customers. More than 70% of the customers, 50% of business partners stay in Szeged and in its subregion. In addition, every second organization participates in product and technology development cooperating with the University of Szeged.

Mapping a software cluster in the analyzed area, the research demonstrated that companies do enjoy the positive externalities of geographical concentration, and strive the conscious utilization of its advantages. The need of (at least temporary) geographical concentration depends on the strength of the organized proximity. Organized proximity and its dimensions (cognitive, organizational, social and institutional) are basic inputs in the innovative cooperation. In the interviews, companies emphasized three factors, as the most important inputs in innovation: attainment of innovative and professional workforce, ideas and technologies through personal and business relations and finally the vicinity of educational and postgraduating programs and institutions. The synergy of partners is substantial to obtain the benefits of innovation-based relationships. Within partners, university appears to be an intermediary in the flow of knowledge and information. It has significant role in the facilitation of collective learning.

Business and personal relations between actors determine an 'industrial atmosphere', where the similarities in knowledge, 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 directors of these companies graduated in the University of Szeged, on the Faculty of Informatics. Companies with the same knowledge background participate in forums, clubs, conferences 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 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. 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.

The problem that faces the software industry in Szeged and in its subregion, that the relations are not consequences of constant or recurrent cooperation. They are supposed to obtain financial sources within a common project or trade development competition. Companies in general are not willing to have regular cooperation, because they fear to loose their market position or to have their good ideas stolen. However, they already stated that they would be ready to work together within a cluster. Solving the problem, the key should be 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).

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.

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 story. Interviewed companies are discontent with the administrative work, legal environment and with the representation of their interests. Local government does not have the sufficient tools to promote relation and also cluster

building, the foundation and registration of new firms, the appearance in external markets, the organization of trainings, clubs.

Companies in the questionnaires admitted the importance of business services and governmental subsidies. The great advantages of these factors are seen in the example of foreign, information technology and software related clusters too, which operate also in less developed regions. In the city of Cork in Ireland software industry is largely driven by foreign direct investment (FDI) attracted by the low Irish corporate tax rates. In the region innovation policy was key for IT cluster development, which promoted R&D and innovation, encouraged spillover of knowledge. Due to this, actors have already created a 'knowledge zone' in Cork. 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. In the city of Oulu in Finland, substantial public policy efforts were made the ICT cluster flourish. The key preconditions in cluster development were the size and quality of the local knowledge infrastructure (technical university, science park), and the existence of a 'champion' company (NOKIA). IT cluster in Oulu is one of the most competitive ones, be present on the 'cluster map' of Europe.

7. CONCLUSION

Our findings ensure that, both geographical and organized proximity exists between the actors in the software industry in Szeged and in its subregion. These have positive effect on its innovative capacity, on the development of corporate skills and on the decreasing of transaction costs etc. The base of researchers and qualified labor force has already been built-up; companies are motivated to deepen their existing business relations, which determine the base of a future cluster.

The relative, national concentration of software industry in Szeged and in its subregion is proved, and in practice, as the qualitative survey revealed, geographical concentration is necessary, but not sufficient to create business and non-business relations. At least temporary geographical proximity and strong organized proximity of actors is needed in the software industry. Companies share the same knowledge background; they are in cognitive proximity, due to the university origins, and the participation in conferences, clubs and forums. They have an extensive system of relations, determined the same behaviour patterns, cultural and social values, rules and regulations, which underlines the existence of organizational, social and even institutional proximity between them. Each dimension of organized 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.

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