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DOES PROXIMITY MATTER FOR INNOVATION? EVIDENCE FROM ICT CLUSTER IN POLAND

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Purpose: The purpose of this paper is to explore different aspects of proximity that are most important for fostering innovation within ICT firms located in clusters.
Design/methodology/approach: To achieve the research objectives, semi-structured interviews were conducted with ICT firms in the Pomeranian region's Interizon cluster. The theoretical scope of the paper is based on the concept of proximity, specifically as it relates to the spatial organization of clusters and their effect on innovation.
Findings: The study shows that cognitive and social proximity are the key factors driving collaboration and innovation within the ICT firms in the Pomeranian cluster. Cluster membership plays a lesser role, suggesting that geographical proximity and cluster initiatives do not play as big a role as one might expect for supporting ICT sector innovation. The same applies to institutional proximity.
Research limitations/implications: The primary limitation of this research is the small sample size, which restricts the ability to generalize the findings. The study's focus on one ICT cluster in Poland limits its broader applicability, although the conclusions can offer insights for policymakers and cluster organizers. Future research with a larger, more representative sample is recommended to validate the findings and further investigate the role of proximity in different regions/sectors/countries.
Practical implications: Policymakers and business leaders can apply the findings of the paper to foster innovation in the ICT sector by creating environments that encourage collaboration through shared knowledge and social ties rather than just relying on spatial closeness.
Originality/value: This paper contributes new insights into the role of different types of proximity in innovation, specifically within the context of ICT firms in a cluster.
Keywords: ICT clusters, spatial proximity, non-spatial proximity, innovation, Poland.
Category of the paper: research paper, case study.

1. Introduction

Innovation is an interactive collaborative process involving a network of actors. Despite many empirical studies, evidence on geographical patterns of collaboration and knowledge spillovers is still fragmented. Most studies focus on advanced regional economies.

Sectoral trends or differences across industries are overlooked. The concept of proximity provides a framework for analyzing the different spatial organizations, like clusters.

The paper aims to answer the question of which aspect of proximity is most important for the innovation process in ICT firms. The study is based on semi-structured interviews conducted in one of the ICT clusters in Poland located in Pomeranian region. Section 1 provides an overview of the relevant literature on proximity and clusters and review of empirical research. Section 2 presents the methodology used in the research. Section 3 presents case studies of firms interviewed. The last section concludes.

2. Theoretical framework

Proximity is a key factor in determining where firms choose to establish their production units. In the 1990s, the French School of Proximity Dynamics made a notable impact on knowledge on innovation, by suggesting that proximity encompasses several dimensions (Boschma, 2005). Short distances bring people closer together, facilitate the transfer of information, and foster the exchange of knowledge. Boschma suggests that the significance of geographical proximity should not be considered in isolation, but rather in conjunction with other proximity dimensions that may offer alternative solutions (Boschma, 2005). In many cases, companies that are not geographically close can still collaborate successfully due to shared skills, experiences, social or institutional backgrounds. There are different typologies of proximities in the literature. Some of them are presented below. Among others, there is a distinction between:

- geographical proximity, referring to the spatial location of the partners; institutional proximity, referring to the proximity of the partners' institutional framework: including norms and routines; and cognitive proximity, i.e. the similar and complementary knowledge of the partners (Rynes, Bartunek, Daft, 2001; Nooteboom, 2000).
- geographical, cultural, organizational, technological, cognitive and institutional proximity (Torre, Rallet, 2005).
- spatial and non-spatial proximity, in case of the latter: organized proximity (Torre, Rallet, 2005), socio-economic proximity (Bouba-Olga, Grossetti, 2008) and institutional and organizational proximities (Boschma, 2005).

All the dimensions of proximity are certainly not identical but refer to ‘being close to something’ measured on a certain dimension (Knoben, Oerlemans, 2006). The dimensions of proximity are strongly linked to each other. What unites the different dimensions of proximity is that they reduce uncertainty and solve the problem of coordination. Geographical proximity is a key factor in cluster dynamics, facilitating knowledge spillovers and interactive learning among local networks (Bell, Zaheer, 2007). However, the benefits of proximity depend on

a firm's position within the network, and proximity's impact on innovativeness changes over time (Presutti et al., 2019). Due to Boschma (2005), geographical proximity alone is neither a necessary nor sufficient condition for effective learning to take place. The author proves that its importance arises only when it facilitates the development of non-geographical proximities. Han and Xu (2024) found that cognitive and social proximities are crucial factors driving green technology innovations. Presutti et al. (2019) confirmed the positive effect of cognitive proximity on innovation performance of small- and medium-sized high-tech industrial clusters in Italy. Royo-Vela and Mazandarani (2022), based on an analysis of 99 European clusters, confirmed the lack of significant links between all dimensions of non-geographical proximity. In some cases, geographical proximity is not necessary for innovation. Studies show that once networks are established, other forms of proximity, like social and organizational, become more important than geographic closeness (Rallet, Torre, 1999). The findings of a study based on an analysis of four cluster organisations from the metal and the ICT industries in Poland confirmed that geographical proximity is crucial in the early stages of cluster collaboration, as it lays the foundations for the development of other forms of proximity. As the collaboration progresses, the importance of geographical proximity decreases in favour of social and competence proximity due to access to resources such as knowledge and information (Lis, 2020). Overall, proximity is a complex and multifaceted factor in innovation, with non-geographical forms often playing a greater role as cooperation deepens.

3. Methodology

ICT is one of the most dynamically growing industries in Pomerania. Already, IT and R&D centers account for more than half of the companies in the Tri-City's modern business services sector. The region has a total of 129 companies employing more than 10 employees, most of which are located in the Tri-City. Pomeranian ICT cluster Interizon was established in 2009 to create a strong network of ICT companies and institutions in the Pomeranian region. The cluster has an open character: firms can join it on an ongoing basis. It is located in Gdańsk, a city within the Tri-city area. Interizon consists of 95 participants (mostly from ICT sector): 6 large companies, 12 medium-sized companies, 22 small companies, 32 micro-companies, 14 educational and scientific institutions, 9 other entities.

The results presented in the paper are based on semi-structured interviews (face-to-face conversations, online interviews) conducted with cluster member firms. It is treated as pilot study due to sample size. Purposive sampling approach framework was applied (selection of people who obtain required experience or knowledge). In the selection of the sample, there was close cooperation with the Interizon board (Jarosław Parzuchowski) and the member of the Programme Board of the Pomeranian Science and Technology Park (dr Andrzej Poszewiecki).

The companies selected differ in size, type of business and the specifics and intensity of cooperation. The result is 5 case studies.

The following typology of proximity was used in the study:

- geographical: spatial distance between actors, both in an absolute and relative meaning, (Boschma, 2005),
- cognitive: the extent to which two actors share the same knowledge base (Nooteboom, 2000),
- social: associated with personal relationships between actors (Uzzi, 1996), for example, resulting from past collaboration, friendship etc. (Breschi, Lissoni, 2009),
- institutional: high when actors operate under the same set of norms and incentives, for example, when co-located in the same country (Hoekman, Frenken K., Van Oort, 2009), or operating in the same social subsystem in particular within academia, industry, or government (Etzkowitz, Leydesdorff, 2000),
- organisational: refers to the membership to the same organizational entity, for example cluster, or for two subsidiaries of the same parent company (Balland, 2012).

4. Results

Case study 1. Visionx

Person interviewed: Tomasz Michalski, founder and CEO.

The firm, established in 2018 (11 employees) is located in Gdańsk. It implements automation for industry. It provides quality control systems and camera-based vision systems. It also supplies machines based on vision systems. Visionx joined the cluster in 2022. Joining the cluster resulted from the application for EU subsidies conditioned by the company's affiliation with smart specializations, the presence of the company's customers in the cluster and the desire to attract new partners. According to the person interviewed „the cluster does not initiate cooperation on a wider scale". The company expected partner matchmaking actions and actions to attract buyers, however, the latter (factories) do not belong to the cluster. In case of Visionx, no permanent business cooperation was established with either research units or institutions. The company carries out research activities and develops new products on its own, without partners. The barrier to cooperation is low product quality of local and domestic companies.

The current model of cooperation is subcontracting. The collaboration results in a new product where the company provides the software and the rest is up to the partner. Most often such a combination occurs in electronics, furniture, automotive, food, cosmetics (interdisciplinary partnership). Ready-made components are ordered and integrated. Electronic components are imported from abroad: China, Japan, Korea, metal components from

Pomerania. Occasionally there is cooperation, for example, in the case of automation companies. If they cannot operate the camera systems, they ask the company to cooperate.

Table 1.
Importance of proximity to the company

Type	Role of proximities
Geographical	Matters, but there are a lot of barriers here, there are intentions to cooperate.
Cognitive	No cooperation.
Social	Based on long-term cooperation.
Organizational	No cooperation.
Institutional	Industrial background, but open to academia.

Source: own elaboration.

Case study 2. ISS RFID

Person interviewed: Alicja Starnawska, Operational Director.

The firm, established in 2016 (11 employees) is located in Gdynia. It builds on the more than 30 years of experience of its parent company in the security and packaging sector. Intelligent Security Solutions RFID (Radio-Frequency Identification) is a technology company working in the field of intelligent systems using radio technology. ISS is used in the supervision of production, delivery, inventory and logistics systems. Joining the cluster was motivated by the desire to attract industry partners, to establish partnerships but also to find customers for services. According to the person interviewed, Interizon has fulfilled these hopes. All this allows the company to reach a wider range of recipients of services. The cluster has allowed the company to find not only service recipients but also partners.

The company cooperates with domestic and foreign companies, research and development centers, domestic and foreign scientific units. It works in consortia, carries out innovative projects co-financed by EU funds. There are two models of cooperation with partners. Universities support the firm with knowledge and technical know-how, partnership companies provide complementary solutions.

Table 2.
Importance of proximity to the company

Type	Role of proximities
Geographical	Local cooperation is considered the easiest, which is due to proximity and physical contact, personal contacts very important for the company.
Cognitive	Related to the company's cooperation model and very important.
Social	Social proximity is very important for the company. At the same time, the company is not afraid to establish new cooperation by, for example, participating in trade fairs.
Organizational	Partners within the cluster are very important but not the only ones. Cooperation with the parent company is not leading, another important geographic scope of cooperation is the national one.
Institutional	Mixed environments: academic and commercial, not necessarily from the same area of knowledge (interdisciplinary cooperation).

Source: own elaboration.

Case study 3. WiRan

Person interviewed: Maciej Król, Co-founder and President of WiRan.

The firm, established in 2002 (27 employees) is located in Gdynia, in the Pomeranian Science and Technology Park. WiRan, specializing in radio and electronic equipment design, offers proven solutions in RF technology, telemetry, and EMC testing. Its designs serve industries such as space, military, rail, industrial, and IoT. WiRan carries out two activities on the commercial market: 1. preparation of a new design, the intellectual property rights of which are finally received by the contracting company and then produced, and 2. preparation of a solution used in a particular company, e.g. for a production line, to be integrated in the company.

It has been a member of the cluster since 2009. The role of the cluster is seen as informational. The firm is pursuing multi-faceted cooperation with the Marine Technology Center. WiRan has already proven itself as a supplier. At the same time, there was a proposal to prepare a solution in consortium with the Military University of Technology, for which MTC has a client. The third level of cooperation is the test platform. The company makes commercial use of a well-equipped test lab in its R&D activities.

Research and development activity represents the company's largest turnover. It intends to become a research and development centre in the future.

Table 3.

Importance of proximity to the company

Type	Role of proximities
Geographical	It cares about partners located close by, both solution partners and suppliers. The proximity and personal contacts make it possible to understand the needs. With 10 years of experience in the military industry, particularly providing naval solutions for Pomerania, geographical closeness is crucial.
Cognitive	The second most important.
Social	Relationships and trust are hugely important to the company. It seeks to work with proven companies with which the company has relationships.
Organizational	Considered secondarily.
Institutional	Companies and universities (Gdansk University of Technology, University of Gdansk).

Source: own elaboration.

Case study 4. TMA Automation

Person interviewed: Marek Łangowski, Co-founder and President of TMA Automation.

The firm, established in 2010 (35 employees) is located in Gdynia, in the Pomeranian Science and Technology Park. The majority shareholder is the Austrian company ENGEL (since 2022). TMA Automation provides solutions for the automation of manufacturing processes. It designs and implements modern solutions in the areas of robotics, automation, mechanics and vision systems (robots, dedicated automation and vision systems). The company designs, manufactures, programmes and delivers automation and robotics. The firm is present in the cluster since its establishment. According to the person interviewed, Interizon participates in numerous regional, national and European bodies defining the development directions of the industry. Currently, Marek Łangowski is on the Cluster Council. It plans to develop networking

towards the development of product and service sales between cluster member companies. TMA Automation cooperates with companies from the cluster.

The company has specialized in design, programming and assembling (assembly). The company does not perform non-critical activities such as welding, painting, sheet metal bending. This is done by cooperators sourced mainly on the local market. TMA Automation has permanent cooperation with 2 universities: Gdansk University of Technology and Gdynia Maritime University, 10 companies and 3 companies from the cluster. The cooperation mostly concerns subcontracting.

Table 4.
Importance of proximity to the company

Type	Role of proximities
Geographical	Distance is no longer a barrier for cooperation or clients; specialized needs make geographical proximity less important.
Cognitive	The most important.
Social	The second most important.
Organizational	Cooperation with cluster companies. TMA benefits from the market experience of its Austrian partner and its 85 years of development, focusing on adapting its solutions to the Polish market, rather than imitating them.
Institutional	Companies and universities.

Source: own elaboration.

Case study 5. OKE SOFTWARE/POLAND

Person interviewed: Artur Pytlasinski, Co-owner, CEO.

The firm, established in 2004 (70 employees, including b2b employment) is located in Gdańsk. Company has 28 years of experience in the IT industry specializing in software for hybrid TV systems, Big Data and AI. In outsourcing, TV solutions are the core of the company's business. OKE focuses on the development of Apps, software for smart TVs, software for boxes, etc.

It entered the cluster in 2014. The company initiated various activities but received no support from the cluster. In business activities, OKE initiated a group on smart city solutions (20 companies). The company became the leader of the group. This venture has proved successful in talks with cities. One example is Gdańsk, which has agreed to launch a test district for smart city solutions.

The company carries out 3 types of activities:

- Outsourcing and Nearshoring: The company has always focused on outsourcing, and now essentially nearshoring.
- In February 2022 the firm merged with the Dutch company Triple to jointly execute projects. The company is responsible for software development and provides a comprehensive service for establishing an online presence.
- Products for Public Administration, currently for cities. The company has developed an artificial intelligence system that analyzes video and audio. The AI analyzes what is happening in the city and signals alarming situations.

Table 5.
Importance of proximity to the company

Type	Role of proximities
Geographical	Does not matter much.
Cognitive	The second most important.
Social	„If there is no trust and social proximity, no one starts cooperation". Cooperation with towns: social proximity is very important. For large contracts, trust is essential.
Organizational	Group on smart city solutions within cluster as an example.
Institutional	Cooperation with national universities is based on the principle of gaining a partner for a project application.

Source: own elaboration.

The ranking of the importance of proximity types for innovative project collaboration shows that most respondents consider cognitive and social proximity to be the most important, while spatial proximity, cluster membership and organizational proximity are of lesser importance. (see Table 6).

Table 6.
Ranking of the importance of proximity types

Case studies	Proximity				
	geographical	cognitive	social	organizational	institutional
VISIONX	3	1	2	4	5
ISS RFID	4	1	2	3	5
WiRan	1	2	3	5	4
TMA	3	1	2	4	5
OKE	4	2	1	5	3

Source: own elaboration.

5. Discussion

Interviews in the Pomeranian ICT cluster Interizon reveal that cognitive and social proximity are key for collaboration. Geographical proximity is less important. Cluster membership (organizational proximity) plays a lesser role, suggesting that geographical proximity and cluster initiatives do not play as big a role as one might expect for supporting ICT sector innovation. However, it should be noted that the ICT industry differs from traditional industries. Its products can be developed over larger geographic distances and sent anywhere using information and communication technologies. Cluster members seeking synergies should build informal relationships to foster proximity in other areas. Although the study was conducted for Poland, its results may also be applied in cluster policies of other countries. It would be worthwhile to consider the role of different types of proximity, which may not create innovation "but serve as an enabling factor for it to happen" (Runiewicz-Wardyn, 2024). The study's small sample limits generalization, but its aim is to verify theory in practice. Further research with a larger, representative sample is recommended.

6. Summary

The concept of proximity provides a framework for analysing different spatial organisations such as clusters. The aim of the paper is to answer the question of which aspect of proximity is crucial for innovative projects carried out in ICT firms located in clusters. The study is based on interviews conducted in the Pomeranian cluster Interizon. The results confirmed that cognitive and social proximity are crucial for collaboration, while geographical proximity plays a lesser role in the innovation process.

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