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Edited by

Anna Ujwary-Gil & Marta Gancarczyk

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Development of cooperation in localized cooperation networks: A comparative study of cluster organizations and technology parks

Anna Maria Lis[1]

Abstract

The main aim of the paper is to analyze the level of development of cooperative relationships in localized cooperation networks – among enterprises associated with cluster organizations and park tenants. The author reports the findings from the quantitative study carried out in the selected cluster organizations and technology parks functioning in Poland. The basic method of data collection was a survey questionnaire. The research sample included 132 respondents from cluster enterprises and 137 from park tenants. In addition, a comparative analysis was conducted. The research is based on the original concept of the trajectory of development of cooperative relationships in cluster organizations. The current study focused on three main areas of inter-organizational cooperation: motivation, effectiveness, and commitment. The effectiveness of the surveyed enterprises in both groups should be assessed as quite low, while their attitude as passive. The study shows that the most common forms of cooperation are those assigned to the lowest level of cooperation – the surveyed enterprises achieved level I, regardless of their initial motivation. At this level, the surveyed enterprises also showed the greatest commitment. In contrast, it was the most difficult for them to achieve the highest level IV, which requires the highest level of commitment. The knowledge of the identified relationships among motivation, effectiveness, and commitment in cluster and park structures can help these organizations to take conscious actions aimed at developing cooperation among their members/tenants. The findings add to the state-of-the-art knowledge in the concept of industrial clusters, as they shed new light on cooperation developed within formally established organizations, based on geographical proximity, focused on the networking of their constituent companies.

Keywords*: cluster, cluster organization, science and technology park, industrial park, cooperation, commitment*

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1. Introduction

Geographical proximity is conducive to the development of inter-organizational cooperation. This is confirmed in many concepts of regional development, both the older ones, such as Marshall's industrial district (Marshall, 1890), as well as contemporary ones. These include Italian industrial district (Becattini, 2002; Bellandi, 2002; Pyke, Becattini, & Sengenberger, 1990; Sforzi, 2002), an innovative milieu (Aydalot, 1986; Maillat, 1998), learning region (Florida, 1995; Morgan, 1997), regional innovation system (Cooke, Uranga, & Etxebarria, 1997; Braczyk, Cooke, & Heidenreich, 1998), ecosystem of innovations (Adner & Kapoor, 2010; Autio & Thomas, 2014) as well as the concept of a cluster (Porter, 1998; 2000; 2008). The development of cooperation among companies in industries that exhibit a high degree of regional concentration is stimulated by agglomeration externalities. These are the benefits described by Marshall (1890), and confirmed by Arrow (1962) and Romer (1986), which include access to a rich pool of specialized workers, the emergence of specialized suppliers, providing easy access to intermediate inputs, as well as knowledge spillovers. Agglomeration externalities are – according to Schmitz and Nadvi – benefits that companies have without the intended effort to achieve them (Schmitz & Nadvi, 1999). They can be included in the category of passive collective efficiency, in contrast to intentional actions aimed at their creation through the cooperation of the involved entities, understood in the category of active collective efficiency (Schmitz & Nadvi, 1999; Caniels & Romijn, 2003). Active agglomeration benefits arise as a result of direct relationships among enterprises, developing within a value chain (Porter, 1985) or – looking even wider – within a value network (Nalebuff & Brandenburger, 1996). Coexistence in geographical proximity especially facilitates the development of relationships based on trust, which further encourages companies to enter into various systems of a formal and informal nature, facilitating the generation and transfer of tacit knowledge, which is difficult to transfer over long distances. Therefore, active cooperation among entities operating in geographical proximity is perceived as the main factor for achieving lasting competitiveness of the cluster and the region in which it develops.

The cluster concept, developed since the early nineties of the last century, is much more grounded then cluster organization (CO). In comparison to the cluster concept, the concept of a cluster organization is at an earlier level of development and the degree of its prevalence is incomparably smaller. The literature especially lacks publications that would describe the development of cooperation in COs. Given the existing research gap, the main aim of the paper is to analyze the level of development of cooperative relationships among companies grouped in localized cooperation networks. The main

research objects are selected cluster organizations and their members – cluster enterprises. However, to expand the research field, the study included entities from an additional comparative sample – technology parks and companies located there (park tenants). Parks have now become a global phenomenon. Their development began in the 1950s, first in the USA, then in other countries. The first parks in Europe began to appear in the 1980, while in Poland, the intensive development of these institutions occurred after 1989. In practice, there are many different forms of park structures, which is reflected in the variety of definitions presented in the literature (Link & Link, 2003).Various terms are used (often interchangeably) in the literature to describe this kind of institutions: science park, science and technology park, research park, industrial park, technopole. Although many authors highlight their distinctiveness (Chordá, 1996; Sternberg, 2004) and the disproportions of their dynamic nature (Phan, Siegel, & Wright, 2005), it is possible to distinguish a particular set of their common characteristics. These include the sophisticated cutting-edge infrastructure of the parks, formal and operational relations with R&D institutions, support for the creation and development of knowledge-based enterprises, and a management model that actively strengthens the transfer of technology and business skills of the park tenants (Colombo & Delmastro, 2002; Hommen, 2006).

The choice of technology parks for comparative analysis is due to their high similarity to cluster organizations. Park structures, like cluster organizations, are formally established organizations that operate in geographical proximity, in which clustering processes take place. Both concepts emphasize the significance of geographical proximity for the development of cooperation among entrepreneurs, who undertake their operations in conditions characteristic not only of the particular localization but also of the particular industry. Analyzing the development of cooperation among the enterprises being cluster members and park tenants can help increase knowledge of the mechanisms governing the cooperation of entities in geographical proximity. The additional cognitive value comes from the possibility of comparing both groups of entities.

The paper is organized in the following manner. At the beginning, a literature review concerning cooperation in cluster and park structures was carried out, which allowed the identification of a huge research gap. In the next step, the paper includes details with regard to the methodology. Then, it reports the empirical results. Finally, a discussion and conclusion are provided.

2. Literature review

2.1. Concept of cluster and cluster organization

The thread of cooperation is strongly emphasized in the concept of the cluster popularized by Porter. Porter defines clusters as "[…] geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also cooperate" (Porter, 2008, p. 213-214). This definition includes the most important cluster attributes, namely, geographical and sectoral concentration. Thus, the similarity of cluster enterprises results from the common location and sectoral affiliation. They share the same vision of regional and industrial development and, facing similar problems and threats, and they follow a common development trajectory. Geographical proximity is also the basis for the development of cooperation in clusters. The small distance between enterprises, but also other factors of common location (for example, cultural community, common language) favors establishing informal contacts with other entities. Numerous and repetitive interactions between partners can turn into lasting, trust-based business relationships. In turn, sectoral concentration facilitates the creation of various relationships, both vertical, along the value chain, and horizontal, often based on coopetition, which means cooperation and at the same time competition (Dagnino, Le Roy, Yami, & Czakon, 2008; Czakon, 2009; Cygler, 2009; Jankowska, 2012).

The issue of development of cooperation in industrial clusters is well described in the literature, taking into account the additional theories explaining the reasons for the development of inter-organizational relationships. These include the agglomeration theory (Scitovsky, 1954; Perroux, 1950; Krugman, 1998), the theory of transaction costs (Williamson, 1985), the theory of flexible specialization (Piore & Sabel, 1984; Sabel, 1989), the network approach (Cooke & Morgan, 1993; Johanson & Mattson, 1993), and the resource-based view (Wernerfelt, 1984; Mahoney & Pandian, 1992; Barney, 1991).

In the literature, much attention has been devoted to discussing the development of cluster cooperation through the prism of the cluster's evolution or life cycle, which perfectly reflects the complex nature of the processes occurring within the cluster, among its elements. In typologies based on an evolutionary approach (van Dijk & Sverrisson, 2003), several development phases of the cluster are distinguished, from the lowest (local clusters) to the highest, and thus the most mature, focused on the development of innovation and cooperation (industrial district). In turn, according to the second approach based on the life cycle, the cluster changes with the observed

growth phases (Swann, 1998; Braunerhjelm & Feldman, 2006). The transition through particular phases in the life cycle is the result of the evolution of its components (Menzel & Fornahl, 2009). Various approaches used to describe the life cycle of clusters can be found in the literature. The differences are evident in the number of developmental phases – from three and four (m.in., Maskell & Kebir, 2005; Pouder & John, 1996; Rosenfeld; 2002; Bergman, 2008; Lorenzen, 2005; Maggioni, 2002), and even to five-six (m.in., Martin & Sunley, 2011; Sonderegger & Täube, 2010; Malakauskaite & Navickas, 2011; Isaksen & Hauge, 2002) – and in their names. In simplification, three main phases can be distinguished in the cluster's life cycle: embryonic (initial) stage, growth (expansion), and maturity combined with decline.

However, the vast majority of publications refer to the cluster viewed in geographical or economic categories. Meanwhile, the development of a cluster-based policy in Europe, implemented at various levels (from supernational to regional) and caused by the incredible popularity of the cluster concept, has contributed to the emergence of new forms of organization related to the cluster. This refers to cluster organizations or – using the nomenclature of Sölvell, Lindqvist, and Ketels – cluster initiatives, which are defined as "organized efforts to increase the growth and competitiveness of clusters within a region, involving cluster firms, government and/or the research community" (Sölvell, Lindqvist, & Ketels, 2003, p. 15). Cluster organizations have separate life cycles, only partially overlapping with the life cycle of clusters. To emphasize the attributes of the organization of cluster initiative (the cluster, due to its definitional and practical indeterminacy and ambiguity, does not have such features), Lis uses the term "cluster organization" (CO). Lis defines CO as a "formally established organization which function at a higher level of aggregation, composed of institutional members that have joined it purposefully and act actively in order to achieve some collective objectives (related to the development of a specific cluster) or individual objectives (aimed at developing their mother organizations)" (Lis, 2018, p. 86). Managing a cluster organization means coordinating the actions undertaken by the collective entities (the institutional members) and individuals engaged in activities undertaken within such an organization.

2.2. Cooperation in clusters structures – results of a systematic literature review

To check how often the thread of cooperation appears in publications devoted to clusters, a systematic analysis of the literature was conducted using two databases: Web of Science Core Collection and Scopus. This analysis also includes categories related to cluster organizations and cluster initiatives (used

interchangeably with clusters and COs), which are the main research objects in this paper (Table 3.1 and 3.2).

Table 3.1. The results of the literature review on cluster structures based on the Web of Science Core Collection

Search criteria	"Cluster"	"Cluster organization"	"Cluster initiative"
Topic or title (all years)	494,912	216	73
Document types: article, book chapter	399,503	156	38
Categories: Business; Management; Economics; Geography	6,634	9	26
„collaboration"	281	1	4
„cooperation"	311	1	3
„trajectory"	55	0	3
„life cycle"	147	0	3

Table 3.2. The results of the literature review on cluster structures based on the Scopus

Search criteria	"Cluster"	"Cluster organization"	"Cluster initiative"
Article title, Abstract, Keywords (all years)	864,353	353	206
Document types: article, book chapter	685,651	268	162
Subject area: Business, Management and Accounting; Economics, Econometrics and Finance; Social Sciences	41,634	67	145
„collaboration"	3,310	18	41
„cooperation"	3,375	26	56
„trajectory"	2,224	5	13
„life cycle"	1,912	15	31

At the beginning, it is worth emphasizing the large disproportion in the number of selected publications devoted to clusters and cluster organizations/ initiatives, given the first three adopted categories. The results of a systematic literature review, based on the abovementioned databases, showed that the share of publications containing the keyword "cluster organization" or "cluster initiative" for publications with the keyword "cluster" does not exceed 0.4% (in the case of WoS) and 0.35% (in the case of Scopus). In the second step, four additional categories related to cooperation were considered. In the WoS

database, only a few publications have been found by using the keyword "cluster organization" or "cluster initiatives" in conjunction with "collaboration," "cooperation," "trajectory," "life cycle," while for the keyword "cluster" the number of identified publications was from 55 (for "trajectory") to over 300 (for "cooperation"). The Scopus database provided slightly different data – the number of publications devoted to cluster organizations (or cluster initiatives) in combination with four additional categories reaches even several dozen items (least for "trajectory", most for "cooperation"), while the number for "cluster" reaches over 3,300 (for both "cooperation" and "collaboration").

An in-depth analysis of the identified items showed that none of the selected publications describes the trajectory of development of inter-organizational cooperation in cluster organizations. Furthermore, in the case of some publications that, according to the used keyword, were to describe cluster organizations or cluster initiatives, they referred to clusters in economic rather than organizational terms.

The same review of the literature was carried out, taking into account the categories related to entities from the comparative sample, i.e. various types of parks. Compared to the cluster concept, the number of publications on park structures is also relatively small, but larger than in the case of cluster organizations and initiatives (Table 3.3 and 3.4). Most publications were identified with the term: "industrial park" and "science park" and the least for "science and technology park." Considering the same four additional cooperation-related keywords that were used in the analysis of the literature on cluster structures, the number of identified publications regarding all park types included in the analysis decreased significantly. This applies particularly to the database WoS, in which for almost all types of parks, only a few publications were found, except for "science park," for which 21 items were found in conjunction with the keyword: "collaboration." The number of publications found in the Scopus database is higher – the largest for keywords: "collaboration" and "cooperation."

Referring to Polish literature, it is important to emphasize the multithreading of the issues raised in it regarding both the concept of the cluster and the cluster organization. Porter's concept, popularized in Poland in the early 21st century, became an inspiration for many research teams. However, it should be noted that due to the universality of the interchangeable use of the terms "cluster," "cluster initiative," and "cluster organization" in Polish (but also world) literature, it is difficult to clearly divide scientific publications into only one or the other concept.

Table 3.3. The results of the literature review on park structures based on the Web of Science Core Collection

Search criteria	"Technology park"	"Science park"	"Science and technology park"	"Industrial park"
Topic or title (all years)	263	546	129	1700
Document types: article, book chapter	124	351	59	1057
Categories: Business; Management; Economics; Geography	50	180	32	107
„collaboration"	5	21	4	8
„cooperation"	8	9	6	8
„trajectory"	1	3	1	0
„life cycle"	0	4	0	2

Table 3.4. The results of the literature review on park structures based on the Scopus

Search criteria	"Technology park"	"Science park"	"Science and technology park"	"Industrial park"
Article title, Abstract, Keywords (all years)	691	1,057	295	3,370
Document types: article, book chapter	478	761	214	2,255
Subject area: Business, Management and Accounting; Economics, Econometrics and Finance; Social Sciences	320	544	148	809
„collaboration"	92	155	59	93
„cooperation"	84	120	53	123
„trajectory"	7	28	4	29
„life cycle"	12	28	8	144

Publications on cooperation in clusters (or in cluster organizations) can be divided into several thematic groups. The first publications on the concept of the cluster appeared in Poland at the beginning of the 21st century and focused on presenting the specifics of the cluster (Olejniczak, 2003; Gorynia & Jankowska, 2007a; Gancarczyk, 2010). The publications in this period also raised issues related to the impact of clusters on the competitiveness and innovation of the economy (Gancarczyk & Gancarczyk, 2002; Gorynia & Jankowska, 2007b, Poznańska, 2010; Wojnicka, 2002; Kowalski, 2013; Lis & Romanowska, 2015). Along with the development of a cluster policy in

Poland and the launch of support programs for clusters, the scientists began to focus on the functioning of cluster organizations (Olesiński & Predygier, 2002; Włosiński & Szerenos, 2006; Lis & McPhillips, 2016). Publications after 2010 have presented the experience and good practices in the application of the cluster concept in Poland (Wojnicka, 2003; 2005; Knop, 2013; Lis & McPhillips, 2016; Bojar, Bojar, & Bojar, 2016), focusing on selected areas of the functioning of COs. These include the development of cooperation among cluster members, relationships and trust (Jankowska, 2012; Gotz & Jankowska, 2014; Olesiński, 2010; Wasiluk, 2013), cooperation within the supply chain (Frankowska, 2016), and capital conversion (Lis & Lis, 2014a; 2014b). On the basis of the conducted analysis, however, it was found that there are no publications in the Polish literature that would be characterized by a dynamic and holistic approach to cooperation in cluster organizations.

2.3. Commitment in clusters structures

The model that most comprehensively describes the issue of developing cooperation in cluster initiatives was presented by Sölvell, Lindqvist, and Ketels in "The Cluster Initiative Greenbook" (Sölvell, Lindqvist, & Ketels, 2003; Lindqvist, Ketels, & Sölvell, 2013). They described the life cycle of a cluster organization by indicating four stages of its development: antecedence, formation, cluster initiative, and cluster-based institution for collaboration (IFC). Antecedence refers to earlier industry initiatives focused on the implementation of similar goals, affecting the launch of a given cluster organization. What the authors of "the Greenbook" particularly emphasized in the concept of the cluster initiative is the involvement of various entities (both from within and outside the CI), which is a condition for the success of the cluster initiative. In their view, the basis for the functioning of each CI lies in the active participation of three elements of the Triple Helix: enterprises, R&D institutions, and public authorities. Cluster initiatives are an example of private-public cooperation and an expression of a new model of economic policy organization. Therefore, CIs should be treated as a result of joint activities of various government structures, the private sector, universities, trade associations, and other entities, aimed at developing joint solutions beneficial both from the point of view of a given industry and the region. These jointly developed solutions are intended to lead to the improvement of the broadly understood business environment and, thus to higher competitiveness (both at the level of individual enterprises and on the scale of the entire region). This common goal motivates each party to engage actively in cluster initiatives. However, the model proposed by Sölvell, Lindqvist, and Ketels does not reflect the development of cooperative relationships in cluster

organizations – the high level of generality significantly weakens the potential of this concept to solve the defined research problem.

In selected Polish publications, the importance of involvement in cluster organizations is also emphasized. This applies above all to entities that are part of COs, i.e. coordinators and members. It is a prerequisite for the implementation of the goals set by the COs and their associated entities. Involvement, both at the level of the institution (institutional members of the cluster) and at the level of individuals, has been recognized as one of the success factors of the cluster organization (Lis & McPhillips, 2016). The importance of commitment in the development of cluster connections is also confirmed in other scientific publications (Ropuszyńska-Surma & Węglarz, 2012; Bembenek, 2015; Cieślak, 2015; Krawiec & Kutak, 2016; Moszkowicz & Bembenek, 2017), as well as in popular science studies devoted to the concept of a cluster and cluster organization (Koszarek, 2011; Palmen & Baron, 2011; Frankowska, 2012). Commitment in cluster cooperation leads to strengthening the competitive advantage, not only of business entities, but also the region in which a given cluster organization operates (and the cluster it supports). The involvement of entities in COs generates a number of benefits related to the development of a culture of innovation and entrepreneurship, and the concentration of knowledge resources and human capital in a given region, which leads to an increase in its location attractiveness (Nowak, 2013).

Research shows that three levels of involvement can be distinguished: large, medium, and small (or none) (Lis & McPhillips, 2015). Full involvement is most often manifested at the strategic and operational level, while medium or small only at operational level. Engagement at the strategic level refers to active co-creation of the CO's development strategy, while at the operational level, it involves participation in regular meetings and other events (fairs, training and workshops, conferences), participation in working groups, initiation and implementation of joint projects, participation in the incubation of new ventures and activity in the area of internationalization and export expansion. There are also specific benefits associated with the level of commitment, and the greater the commitment, the greater the pool of benefits that can be gained from participating in CO (Lis & McPhillips, 2015).

3. Methodology

The paper includes the outcomes of the quantitative study aimed at analyzing the level of development of cooperative relationships in localized cooperation networks using the example of cluster organizations and technology parks. The study focused on three main areas: motivation, effectiveness and commitment. The questions the study attempted to answer were as follows:

RQ1) What was the main motivation (expressed in the form of objectives to be achieved) of enterprises when making decisions about joining a cluster organization or locating in a park?
RQ2) What was the effectiveness of enterprises in achieving the set objectives?
RQ3) How did cluster members and park tenants get involved in activities undertaken as part of being in a CO or park?
RQ4) What was the motivation to get involved and how did commitment translate into achieving specific objectives?

Table 3.5. Levels of the development of cooperation in cluster organizations

Level	Level name	Motivation [M] / Achieved objectives [AO]	Commitment [C]
I	"Integration at the unit level"	M/AO1. Creating a base network of relationships among cluster partners	C1. Systematic participation in regular meetings C2. Participation in events (e.g. fairs, conferences, integration meetings).
II	"Allocation and integration at the process level"	M/AO2. Facilitating access to the increased pool of resources M/AO3. Increasing the quality of products and services and / or reducing the business costs	C3. Participation in subgroups - formal and informal (eg working groups) C4. Participation in training
III	"Impact on the environment"	M/AO4. Impact on the external environment of the organization	C5. Cooperation with other companies, aimed at creating more favorable legal and administrative conditions for running a business C6. Cooperation with other companies, aimed at adjusting the educational profile in the region to the needs of companies
IV	"Creation and integration at the organizational level"	M/AO5. Setting up conditions to create common added value by pooling resources of the cluster entities	C7. Participation in project groups and consortia C8. Participation in teams focused on the development of permanent cooperation, launching joint ventures

The study is based on the concept of the trajectory of the development of cooperative relationships in cluster organizations, developed as a result of previous qualitative research conducted by the author (Lis, 2018; 2019). As part of this concept, four main levels of cluster cooperation were identified, with regard to "the main objectives," indicating the key type of activity in COs (Table 3.5). At levels, I, III, and IV, one main objective was defined,

while at level II two objectives were identified. In addition, eight basic forms of commitment were distinguished and assigned to specific levels of cluster cooperation (two forms per each level).

The research was conducted in cluster and park structures functioning in Poland. In the case of the first group – cluster organizations – the study was carried out in 2017 in four COs representing both the ICT industry (Mazovia Cluster ICT [MC ICT] and Interizon: Pomeranian Region ICT Cluster) and the metal industry (Metal Cluster of Lubuskie Province [MCLP] and Metal Working Eastern Cluster [MWEC]). The research covered 132 respondents from cluster enterprises: 51 from metal COs (38 from MWEC and 13 from MCLP) and 81 from ICT COs (45 from MC ICT and 36 from Interizon). The study of the second group was carried out in 2019 in three parks: Pomeranian Science and Technology Park Gdynia [PSTPG], Gdańsk Science and Technology Park [GSTP], and Bydgoszcz Industrial and Technological Park [BITP]. The research sample includes in total 137 respondents from park tenants (PSTPG – 81, GSTP – 39, and BITP – 17).

The basic method of data collection was a survey questionnaire. The questions in the questionnaire concerned the three above-mentioned areas: motivation, effectiveness, and commitment and were formulated in such a way as to faithfully reflect the elements of the created concept (Table 3.6), using a 5-point Likert scale. Data analysis included descriptive statistics and the interdependence of variables (using Kendall's tau-b coefficient).

4. Research results

4.1. Cluster organizations

The results obtained for the CO group show that almost all objectives (except M3) defined at distinguished levels of cooperation were recognized by the respondents as significant (they approached or reached 4.0 points), although each to a different degree (Table 3.6). The most important objective that was the main motivation to join the cluster organization was creating a base network of relationships with other cluster members [M1]. Just behind it came the objectives defined at levels IV and III – related to the possibility of undertaking various acts of cooperation with other cluster entities [M5] and exerting greater influence on the environment [M4]. The final places included the objectives defined at level II, regarding access to a wide pool of resources [M2] and increasing the quality of products, and reducing costs [M3]. In each case (M1–M5), the mean exceeded 3 points – the lowest value (3.4) was for M3 and the highest (4) for M1. The two most important objectives related to the

possibility of building a relationship network in the CO [M1] and cooperation with other cluster entities [M5] and were priority areas for the vast majority of respondents (for almost 80% and about 73% of respondents, respectively). In turn, two objectives at the end of the list, related to gaining access to various resources [M2] and increasing quality or reducing costs [M3] were considered significant by half of the respondents.

Table 3.6. Descriptive statistics for cluster organizations (N=132)

Variable	Symbol	N	Mean	Median	Mode	Standard deviation	α-Cronbach
Motivation	M1	131	4.02	4	4	0.83	0.75
	M2	132	3.55	4	4	0.86	
	M3	132	3.44	3	3	1.01	
	M4	132	3.71	4	4	1.02	
	M5	132	3.85	4	4	0.94	
Achieved objectives	AO1	132	2.82	3	1	1.49	0.83
	AO2	132	2.14	2	1	1.23	
	AO3	132	2.02	2	1	1.14	
	AO4	132	2.31	2	1	1.38	
	AO5	131	2.17	2	1	1.30	
Commitment	C1	132	2.87	3	4	1.28	0.93
	C2	132	2.53	2	2	1.26	
	C3	131	2.17	2	1	1.18	
	C4	132	2.46	2	2	1.21	
	C5	132	2.33	2	1	1.14	
	C6	132	2.36	2	2	1.19	
	C7	132	2.26	2	1	1.18	
	C8	132	2.04	2	1	1.14	

Despite the importance that cluster enterprises attached to specific objectives, their expectations in none of the analyzed areas were fully met. The average values of the respondents' answers may testify to the unsatisfactory level of objectives achievement. The average values in all cases did not exceed 3 points, reaching the highest value (2.8 points) at level I in connection with the implementation of the objective related to the possibility of building a network of relationships with other cluster members (previously recognized as the most priority) [AO1]. Low results achieved two objectives relating to areas considered quite important: the possibility of exerting greater influence on an external environment [AO4] and undertaking cooperation with other

cluster entities [AO5] (respectively: 2.3 and 2.2 points). In turn, the lowest average values (2.1 and 2 points) were obtained in connection with achieving the objectives assigned to level II: AO2 and AO3. In each case, the answer most frequently typed by the respondents was definitely negative (meaning no achievement of a given objective). The objective AO1 (building a network of relationships) was not achieved by approx. 45% of the respondents, and by a slightly smaller group (approx. 41%) was considered to be achieved. For the remaining four objectives, the distribution of responses was very similar. Extremely negative answers dominated (over 40% of votes in each case). On the other hand, when counting together, moderate, and definitely positive responses were from approx. 24% [AO4], through approx. 18% and 17% ([AO5] and [AO2]) to approx. 14% [AO3]. The percentage of respondents who could not clearly determine whether a given objective was achieved was also similar (between 17% and 20% of the given answers).

The research results showed that cluster enterprises showed low activity at each level of cooperation – in six out of eight distinguished forms of commitment the mean did not exceed 2.5 points. The highest involvement of the surveyed entities was at level I, especially in the first distinguished area, which was systematic participation in regular meetings organized in CO [C1] (2.9 points). However, taking into account the relatively small effort associated with the above activity, the obtained results cannot be considered evidence of even moderate involvement of the surveyed entities. The more so because the research shows that the percentage of members not involved at all, or weakly involved, in this kind of cluster activity (44%) was higher than those showing above-average activity (39%). However, the smallest commitment of cluster members could be observed at level IV. Over 1/3 of respondents admitted that they did not participate in project groups or consortia launched as part of the CO at all [C7], and more than 44% did not show any activity aimed at developing permanent cooperation within the CO (e.g., cooperation in the value chain or launching a joint business) [C8]. After adding in the above group of respondents who were engaged in each of the above areas only sporadically, it turned out that the vast majority of the surveyed entities (respectively: 62% – project cooperation, 67% – permanent cooperation) did not get involved at all, or hardly at all, in these areas of cluster activity. At each of the cooperation levels discussed above, there was also a group of cluster members not able to assess their involvement in the indicated areas – that is, about 1/5 of all respondents.

The study showed that between the variables commitment and motivation there were relationships, which were identified on the basis of previous qualitative research. This is most evident at levels III and IV (Table 3.7). At level III, both forms of commitment assigned to this level, i.e. engaging in activities related to creating more favorable legal and administrative conditions [C5] and

adjusting the educational profile in the region to the needs of companies [C6], correlated the most with the objective assigned to this level – the possibility of exerting greater influence on public authorities and other institutions [M4]. In turn, both forms of commitment defined at level IV, i.e. participation in project groups and consortia [C7] and teams focused on the development of permanent cooperation, as well as launching joint ventures [C8], correlated to the highest degree with the objective set at this level, i.e. setting up conditions to create common added value by combining resources of cluster entities [M5]. Furthermore, there was also a strong correlation at level I, especially between variables C1 and M1. The analysis does not allow one to determine the direction of dependence, but based on logical arguments it can be assumed that the desire to build a network of relationships with other cluster members [M1] translated into systematic participation in regular meetings organized within the CO [C1]. It is worth noting that the motivation associated with building relationships in CO is more evident at lower than higher levels of cooperation, as evidenced by the strength of correlation with the forms of commitment defined at these levels. Level II commitment (participation in subgroups [C3] and training [C4]) is correlated with all objectives set for the implementation of CO (M1-M5), but the largest relationships occurred in the case of the variable M5.

Table 3.7. The results of the correlation analysis in cluster organizations: [C] - [M] (N=132)

		M1 (I)	M2 (II)	M3 (II)	M4 (III)	M5 (IV)
C1 (I)	Cc	**.328****	.285**	.172*	.285**	.216**
	p	0.000	0.000	0.017	0.000	0.003
C2 (I)	Cc	.183*	.243**	.202**	.245**	.208**
	p	0.014	0.001	0.005	0.001	0.005
C3 (II)	Cc	.170*	.176*	.194**	.326**	**.368****
	p	0.025	0.019	0.009	0.000	0.000
C4 (II)	Cc	.184*	.241**	.291**	.266**	.279**
	p	0.014	0.001	0.000	0.000	0.000
C5 (III)	Cc	0.144	.219**	.219**	**.331****	.296**
	p	0.055	0.003	0.003	0.000	0.000
C6 (III)	Cc	.192*	.178*	0.106	**.302****	.291**
	p	0.010	0.016	0.146	0.000	0.000
C7 (IV)	Cc	0.144	.162*	.162*	.223**	**.365****
	p	0.057	0.029	0.027	0.002	0.000
C8 (IV)	Cc	0.145	.168*	.199**	.249**	**.364****
	p	0.057	0.025	0.007	0.001	0.000

Taking into account the second variable related to the degree of achievement of the objectives [AO], it is clear that at all four levels of cooperation, in relation to each form of commitment defined there, more intensive dependencies occurred with the objective of AO1, referring to building a network of relationships with other members in the cluster (Table 3.8). Although the obtained values are similar, it is worth emphasizing that the lowest occurred at level II and the highest at level IV. Strong correlations were also noted in the case of two variables AO4 and AO5 in the context of the forms of commitment assigned to them. The AO4 variable, associated with exerting greater influence on the external environment of the organization (level III) was most strongly correlated with the form of involvement assigned to the same level – C5 – related to cooperation with other companies, aimed at creating more favorable legal and administrative conditions for running a business (level III). The AO5 variable related to setting up conditions to create common added value by pooling resources of the cluster entities (level IV) was most strongly correlated with one of the forms of involvement at the discussed level: C7, referring to the participation of members in project groups and consortia. However, no correlation (with any distinguished form of commitment) was found in the case of the AO3 variable, corresponding to the objectives related to increasing quality / reducing costs.

Table 3.8. The results of the correlation analysis in cluster organizations: [C] – [AO] (N=132)

		AO1 (I)	AO2 (II)	AO3 (II)	AO4 (III)	AO5 (IV)
C1 (I)	Cc	**.361****	0.064	0.015	.186**	0.053
	p	0.000	0.374	0.839	0.010	0.466
C2 (I)	Cc	**.310****	0.092	0.082	.188**	0.009
	p	0.000	0.203	0.261	0.009	0.898
C3 (II)	Cc	**.312****	.160*	0.117	.239**	0.135
	p	0.000	0.030	0.116	0.001	0.068
C4 (II)	Cc	.250**	0.136	0.039	0.133	0.071
	p	0.000	0.062	0.596	0.065	0.326
C5 (III)	Cc	**.302****	.191**	0.085	.270**	0.138
	p	0.000	0.009	0.246	0.000	0.059
C6 (III)	Cc	**.383****	.177*	0.084	**.343****	.193**
	p	0.000	0.015	0.250	0.000	0.008
C7 (IV)	Cc	**.369****	.252**	0.139	**.312****	**.347****
	p	0.000	0.001	0.059	0.000	0.000
C8 (IV)	Cc	**.362****	.281**	0.126	.279**	.284**
	p	0.000	0.000	0.091	0.000	0.000

The analysis of the correlation between the variables corresponding to the motivation (objectives to be achieved) and the achieved objectives as a result of participation in CO showed the correlations occur at almost all expected points (M1-AO1, M2-AO2, M4-AO4, M5-AO5) (Table 3.9). The exceptions were the variables M3 and AO3 (increases in quality/reduction in costs), between which there was no statistically significant correlation. Considering abovementioned pairs, the strongest relationship between variables occurred at level III (M4-AO4), referring to exerting greater impact on the external environment, and the lowest in the case of level IV (M5-AO5), regarding cooperation based on combining the resources of cluster members to create common added value in the CO. The obtained results show that the AO1 variable is correlated with almost all variables regarding motivation (except M3).

Table 3.9. The results of the correlation analysis in cluster organizations: [M] - [AO] (N=132)

		AO1 (I)	AO2 (II)	AO3 (II)	AO4 (III)	AO5 (IV)
M1 (I)	Cc	**.205****	-0.017	-0.079	0.084	0.034
	p	0.006	0.817	0.298	0.261	0.653
M2 (II)	Cc	.259**	**.185***	0.096	0.086	0.060
	p	0.000	0.013	0.203	0.244	0.425
M3 (II)	Cc	-0.031	0.047	**0.110**	-0.049	-0.004
	p	0.671	0.525	0.137	0.503	0.954
M4 (III)	Cc	.250**	-0.003	-0.006	**.295****	0.118
	p	0.001	0.968	0.931	0.000	0.111
M5 (IV)	Cc	.178*	0.118	0.059	.147*	**.170***
	p	0.015	0.112	0.433	0.047	0.023

4.2. Technology parks

The study conducted in the group of park tenants has shown that the assessment of the significance of five distinguished objectives is quite similar to that obtained in the group of cluster companies. However, some differences were noted. The biggest difference is that the objective defined at level II, related to obtaining higher quality and reducing costs [M3], the lowest rated in the group of cluster enterprises, received the highest marks in the group of park tenants. Most respondents (around 60%) rated it as important or very important. In turn, all four other objectives were assessed as medium significance (Table 3.10). A very large difference in assessment occurred especially in the case of the objective assigned to level I, related to building the relationship network [M1].

Cluster companies considered it important, while park tenants perceive it as moderately significant (3.2 points).

Table 3.10. Descriptive statistics for technology parks (N=137)

Variable	Symbol	N	Mean	Median	Mode	Standard deviation	α-Cronbach
Motivation	M1	137	3.25	3	3	0.96	0.79
	M2	137	3.38	3	3	0.96	
	M3	137	3.57	4	4	1.03	
	M4	137	2.94	3	3	1.06	
	M5	137	3.24	3	4	1.01	
Achieved objectives	AO1	137	3.36	4	4	1.04	0.77
	AO2	137	3.15	3	4	0.98	
	AO3	137	3.23	3	3	0.88	
	AO4	137	2.64	3	3	1.01	
	AO5	137	3.07	3	3	1.04	
Commitment	C1	137	2.76	2	2	1.11	0.90
	C2	137	3.01	3	2	1.10	
	C3	137	2.62	3	3	1.18	
	C4	137	3.13	3	4	1.03	
	C5	137	2.69	3	3	1.17	
	C6	137	2.54	3	3	1.11	
	C7	137	2.61	3	3	1.19	
	C8	136	2.58	3	3	1.14	

The research has also indicated that park tenants were slightly more effective in achieving all defined objectives compared to cluster companies – in almost all cases the mean exceeded 3 points (except for the AO4 - 2.6 points), while in cluster companies the above value was not achieved in any case. The highest average value was achieved for level I, related to building the relationship network [AO1] (3.4 points). The above objective was achieved in more than half of the surveyed park tenants. Second place was taken by the objective assigned to level II, related to increasing quality/reducing costs (3.2 points), which was achieved by about 36% of respondents.

As in the group of cluster companies, the commitment of park tenants in the activities undertaken in the park should be assessed as rather low (the mean value fluctuated between 2.5-3.1 points). Relatively the largest involvement was observed at levels I and II. This applies especially to participation in training

and participation in additional events (e.g., fairs, conferences, integration meetings), but even in these cases the mean barely exceeded 3 points.

In the case of parks, there is no such large relationship between the forms of commitment and the objectives to be achieved, assigned to individual levels of cooperation. The levels at which the anticipated contact points are most noticeable are I and IV (Table 3.11). Variables regarding participation in regular meetings [C1] and events [C2] organized as part of CO are most correlated with the objective defined at level I – creating a relationship network. In the case of forms of commitment regarding participation in project groups and consortia [C7] and teams focused on the development of permanent cooperation [C8], the highest positive correlation occurred with the variable M5, and thus creating conditions for creating common added value by combining resources of the cluster members. Compared to the results obtained in the CO group, in the parks, the desire to build a relationship network was more marked. The above variable [M1] was correlated with all identified forms of commitment assigned to levels I-IV, especially those assigned to the first two levels (I-II). It is worth noting that there is no correlation between the variable referring to the desire to increase quality or reduce costs due to participation in CO [M3] and any form of involvement [C1-C8].

Table 3.11. The results of the correlation analysis in technology parks: [C] - [M] (N=137)

		M1 (I)	M2 (II)	M3 (II)	M4 (III)	M5 (IV)
C1 (I)	Cc	**.261****	.250**	0.110	.201**	.241**
	p	0.000	0.001	0.128	0.005	0.001
C2 (I)	Cc	**.243****	0.127	0.113	.245**	.235**
	p	0.001	0.077	0.113	0.001	0.001
C3 (II)	Cc	**.297****	.230**	0.113	.196**	.228**
	p	0.000	0.001	0.114	0.006	0.001
C4 (II)	Cc	**.258****	.176*	0.136	.229**	.197**
	p	0.000	0.015	0.059	0.001	0.007
C5 (III)	Cc	.273**	.166*	0.034	.215**	.171*
	p	0.000	0.020	0.634	0.002	0.016
C6 (III)	Cc	.228**	.209**	0.080	**.290****	.160*
	p	0.002	0.004	0.265	0.000	0.026
C7 (IV)	Cc	.264**	**.327****	0.119	.181*	**.304****
	p	0.000	0.000	0.094	0.011	0.000
C8 (IV)	Cc	.193**	.165*	0.032	.195**	.221**
	p	0.007	0.021	0.650	0.006	0.002

A study conducted in parks showed that the highest values of the correlation coefficient occurred in the case of variables reflecting the objectives achieved at levels III and IV: AO4 and AO5 (Table 3.12). Both variables were highly correlated with all distinguished forms of involvement, but the strongest relationships were observed between the variables AO and C assigned to the same levels. In the case of level III, these were variables AO4 and C5 and C6, while in the case of level IV - C7. There was also a significant correlation between the variables AO1 and C1 and C2, defined at level I.

Table 3.12. The results of the correlation analysis in technology parks: [C] - [AO] (N=137)

		AO1 (I)	AO2 (II)	AO3 (II)	AO4 (III)	AO5 (IV)
C1 (I)	Cc	.339**	.243**	.243**	**.413****	**.370****
	p	0.000	0.001	0.001	0.000	0.000
C2 (I)	Cc	**.420****	.192**	0.112	.317**	**.364****
	p	0.000	0.007	0.123	0.000	0.000
C3 (II)	Cc	.281**	.290**	.188**	**.456****	.258**
	p	0.000	0.000	0.009	0.000	0.000
C4 (II)	Cc	.321**	.280**	.184*	**.353****	**.369****
	p	0.000	0.000	0.012	0.000	0.000
C5 (III)	Cc	.171*	.174*	0.140	**.509****	.222**
	p	0.016	0.015	0.053	0.000	0.002
C6 (III)	Cc	.191**	.197**	0.110	**.434****	.188**
	p	0.008	0.006	0.131	0.000	0.009
C7 (IV)	Cc	.245**	.299**	.191**	**.367****	**.365****
	p	0.001	0.000	0.008	0.000	0.000
C8 (IV)	Cc	0.136	.213**	0.056	**.352****	**.297****
	p	0.056	0.003	0.438	0.000	0.000

The analysis carried out in the group of parks showed relationships between all analyzed M-AO variables. The highest values were obtained between the corresponding pairs of variables, especially at level IV (M5-AO5) and II (M3-AO3) (Table 3.13).

Table 3.13. The results of the correlation analysis in technology parks: [M] - [AO] (N=137)

		AO1 (I)	AO2 (II)	AO3 (II)	AO4 (III)	AO5 (IV)
M1 (I)	Cc	**.465****	.339**	.279**	.316**	.288**
	p	0.000	0.000	0.000	0.000	0.000
M2 (II)	Cc	.377**	**.460****	.367**	.215**	.370**
	p	0.000	0.000	0.000	0.003	0.000
M3 (II)	Cc	.286**	.244**	**.575****	0.076	.298**
	p	0.000	0.001	0.000	0.289	0.000
M4 (III)	Cc	.274**	.251**	.326**	**.459****	.282**
	p	0.000	0.001	0.000	0.000	0.000
M5 (IV)	Cc	.472**	.429**	.293**	.268**	**.554****
	p	0.000	0.000	0.000	0.000	0.000

5. Discussion

Referring to the three areas analyzed in the study: motivation, effectiveness and commitment, the conducted research reveals a rather unfavorable picture of the functioning of both cluster and park companies. The research shows that the surveyed companies had various reasons when making decisions about joining a cluster organization or locating in a park. In the case of cluster enterprises, the main motivation was creating a base network of relationships with other cluster members, while park tenants were guided by reasons that are more pragmatic, focusing on achieving higher quality and reducing costs.

The effectiveness of the surveyed entities, assessed on the basis of achieving the objectives assigned to the four distinguished levels of cooperation, however, should be assessed as quite low (based on the subjective opinions of respondents). Although in principle, all the presented objectives were considered by most of the respondents to be significant, they were achieved only by a small group of entities. In the case of cluster enterprises, the greatest effectiveness occurred in relation to building relationships with other cluster members, i.e. the objective recognized in this group as the most priority. Compared to cluster companies, park tenants were slightly more effective. Also, in this group, it was easiest to achieve the objective related to building a network of relationships, as well as the objective of increasing quality and reducing costs, considered the most important in this group.

Turning to the issue of commitment, the attitude of the surveyed enterprises can be assessed as passive. The studied entities in both groups showed low activity at each distinguished level of cooperation, despite the fact that cooperation in both the surveyed cluster organizations and parks was

free from restrictions related to geographical distance. Relatively, the largest involvement in both groups occurred at level I. However, taking into account that in such basic activities, such as regular meetings or additional events, a small number of surveyed enterprises were involved, the obtained results should be interpreted as not satisfactory. At higher levels of cooperation, the involvement of enterprises was even smaller (slightly higher in the case of park tenants). Particularly low commitment was observed at level IV, in relation to participation in project groups and consortia as well as in teams oriented on the development of permanent cooperation.

The research also shows that enterprises from both groups were involved in those areas that they considered important. However, the commitment demonstrated by the surveyed entities at all distinguished levels of cooperation was most correlated with the achievement of the objective relating to building a relationship network. On the basis of the research, one can also logically conclude that the surveyed entities achieved the above-mentioned objective, regardless of their initial motivation.

It is particularly important to note that the literature has not yet examined how cluster organizations can develop cooperation among their component companies. In the literature, it was limited only to the analysis of the consequences of cooperation undertaken within clusters (considered in economic categories). Therefore, it is difficult to compare the obtained results with the previous findings in the analyzed area. However, due to the fact that the specificity of cluster organizations, as well as technology parks, is quite similar to clusters (cooperation in the geographical proximity of enterprises from the same or complementary industries), the results can be anchored in the broadly understood area of clustering. From this perspective, the study supports the thesis that geographical proximity contributes to the development of relationships among cooperating entities (thus, development of social proximity) (Boschma, 2005; Porter, 2008; Hansen, 2015), especially if this cooperation is aimed at achieving common goals.

6. Conclusions

6.1. Contribution and practical implications

The findings add to the state-of-the-art knowledge in the concept of industrial clusters by exposing broader view on cluster cooperation based on geographical proximity, focused on the networking of their constituent companies. Furthermore, the results add both theoretically and empirically to the state-of-the-art knowledge in the still underdeveloped literature on

cluster organizations and technology parks. They show how cooperation within formally established organizations can develop, with particular emphasis on three factors: motivation, efficiency, and commitment. In addition, the conducted quantitative research allowed the pre-testing of some of the assumptions adopted in the created concept of the trajectory of the development of cooperative relationships in cluster organizations, developed on the basis of the author's previous qualitative research (Lis, 2018). It was found that the correlations between the variables (C-M, C-AO, M-AO) confirm the assumptions of the developed concept. However, it turned out that this applies only to cluster organizations, i.e. those entities that were used as research objects in the development of this concept. In the group of parks, the expected relationships between the analyzed variables are not so visible.

Furthermore, the obtained research results indicate that the cooperation among cluster companies and among park tenants is far from the expectations arising from the specificity of the cluster structure. Only a small group of enterprises managed to reach level IV and develop mature forms of cooperation. Therefore, it seems that the potential resulting from the idea of "clustering" is not sufficiently used in the surveyed entities. It should also be emphasized, however, that in both studied groups there was a very large dispersion of the results (this applies to all analyzed variables). This shows that the surveyed cluster enterprises and park tenants achieve different levels of cooperation at different times, which is consistent with the assumptions underlying the aforementioned concept of the trajectory of developing cooperative relationships.

The knowledge of the identified relationships among motivation, effectiveness, and commitment in cluster organizations and technology parks can help these organizations to take conscious actions focused on the development of inter-organizational cooperation, i.e. among cluster enterprises or park tenants. In particular, persons representing cluster coordinators/park management should skillfully shape the levels of cluster cooperation and motivate cluster members/park tenants to be more involved in joint activities to achieve new objectives, and thus climb to higher levels of cluster cooperation.

6.2. Limitations and further research

The study has several limitations related primarily to the relatively small and little diversified research sample. In addition, the study was based on the subjective opinions of respondents. This limits the ability to generalize the results. Nevertheless, the sample size was sufficient to perform the planned analyzes, and the study can be considered as initial work on developing cooperation in localized cooperation networks that are formally established organizations

operating to achieve both collective and individual goals from the perspective of their members/tenants. The study may be of particular interest to countries with an innovation policy similar to Poland, in which both cluster organizations and technology parks are considered an instrument of innovation policy to support the development of companies and regions via networking.

Future research should focus on developing a conceptual model that deepens the relationships among motivation, efficiency, and commitment in cluster organizations. Based on the study results, two propositions can be put forward for a further quantitative investigation (Figure 3.1). In the presented model, the "commitment" [C] variable can play the role of mediator:

P1: The motivation of cluster members (focusing on achieving specific objectives) affects their commitment (form and intensity) in cluster cooperation.

P2: The commitment of cluster members (form and intensity) in cluster cooperation affects the effectiveness in achieving the objectives.

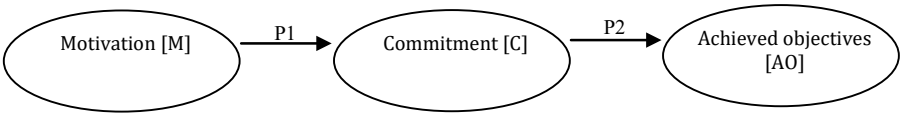

Figure 3.1. The propositions for further quantitative research

The research should be repeated on a representative, large, random sample, using additional comparative groups (other forms, apart from parks, of formal inter-organizational cooperation), which will increase the universality of the tested relationships.

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