Folia Oeconomica
Acta Universitas Lodzensis
ISSN 0208-6018 e-ISSN 2353-7663
www.czasopisma.uni.lodz.pl/foe/
1(327) 2017

DOI: http://dx.doi.org/10.18778/0208-6018.327.13

Wojciech Dyba
Adam Mickiewicz University in Poznan, Institute of Socio-Economic Geography and Spatial Management, wojtek@amu.edu.pl

# Regional closure of knowledge transfer in cluster organisations in Western Poland[1]

**Abstract:** In many studies of clusters – currently a topical subject matter of many regional analyses – authors indicate that the spatial proximity of economic agents positively influences the possibility of cooperation and knowledge exchange (both spontaneous and purposeful). However, geographical proximity can be understood differently: it depends on conditions characteristic of countries and regions. In this paper I investigate to what extent knowledge transfer links, created by agents of clusters during formal cooperation, appear within, or reach outside, the administrative regions of Western Poland. To that end, I create an operational definition of "regional closure" with an equation for measuring it. The results prove that although most links in cluster organisations are created within regions (on NUTS-2 and NUTS-3 level), their spatial range depends on the line of business and type of projects implemented by a cluster.

**Keywords:** clusters, cluster organisations, knowledge transfer, regional closure

**JEL:** C20, D83, D85, R12

[1] The research was supported financially from the means of the Polish National Science Centre granted by the decision no.: 2015/17/N/HS4/00205

# 1. Introduction

Clusters are currently an object of many spatial and economic analyses and an element of regional innovation policies (Benneworth, Henry, 2004; Cruz, Teixeira, 2010). They are an economic phenomenon in which firms and institutions representing a certain line of activity are geographically concentrated and interconnected by a network of relations and dependencies (Porter, 1990). Clusters emerge and evolve over a longer time, but recently public authorities tend to help formalising cooperation agreements between cluster agents to foster positive externalities that boost regional economic development (Lindqvist, Ketels, Sölvel, 2013).

Today clusters are among the main concepts necessary to understand the influence of geographical proximity on cooperation and knowledge spillovers leading to the innovativeness and competitiveness of companies, and in consequence, of regions. Although many authors indicate that it is proximity that matters – that geographical concentration helps to create links between cluster agents – there is no consensus on what spatial level is sufficient to create such links: subregional, regional or national. As cluster policies are very often part of regional policies and regional innovation strategies, there appears the question of what role regions play in generating cooperation and knowledge transfer. This paper has three main objectives. The first objective is to suggest an operational definition of "regional closure" of links between economic agents. The second is to examine if knowledge transfer links, being a result of cooperation between firms and research institutions in the most active cluster organisations in Western Poland, are closed within administrative regions (NUTS-2 and NUTS-3 level) or if they cross their borders. Finally, the third aim is to investigate whether the regional closure of cooperation and knowledge links depends of the line of business in which cluster cooperation agreements operate.

# 2. Role of geographical proximity in knowledge transfer in clusters

Among the positive processes taking place in clusters, at the forefront are cooperation and knowledge flows between cluster agents. Several studies in developed countries have proven that contacts of entrepreneurs, scientists, representatives of business environment units and policy-makers lead to purposeful knowledge transfer and a spontaneous knowledge diffusion (Lissoni, 2001; Dahl, Petersen, 2004; Storper, Venables, 2004; Dyba, 2016). Other authors claim that the more mature the cluster and the more advanced the cooperation between agents, the

more informal relations, including knowledge exchange, may occur inside it (Bergman, 2008; Swann, 2009; Stough, 2015). Knowledge is exchanged between agents in a process referred to as the "local buzz", but it is also delivered to a cluster from outside (for example by consultants or cooperating researchers). As a consequence, it may create new knowledge and therefore lead to various positive knowledge externalities (Karlsson, Gråsjö, 2014; Bathelt, Cohendet, 2014).

In Poland, market conditions for creating cooperation agreements and developing relations inside clusters were difficult before 1990, and actually it was only after the state joined the EU in 2004 that many cluster initiatives and organisations such as new forms of networks could be and were created (Stryjakiewicz, 2005). An important factor that helped cluster associations was the EU's regional policy and financial support for regional economic development (Churski, Stryjakiewicz, 2006). There appeared ever new possibilities to gain funding for cooperation agreements in clusters (e.g. Jankowska, 2012; Kowalski, 2013). An assumption was that in specific regional conditions geographical proximity would foster cooperation and knowledge flows between firms and other agents (as in the concept of a geographical cluster – Maskell, 2001; Vorley, 2008)[2].

Although Porter, who created the term 'cluster', claimed that there were many geographical levels at which clusters could be identified and analysed: local, regional and national (1990), the authors investigating Regional Innovation Systems (RIS) state that clusters are an example of local innovation assets that unite actors in innovation processes taking place in regions (Cooke, 2005). In such systems cluster firms report their demand for new knowledge, and universities and research institutes transfer the knowledge and technology to them (Benneworth, Dassen, 2011).

In Poland, regions (or sometimes subregions or larger cities) seem to be the most appropriate territorial level for creating and analysing clusters, cluster initiatives and cluster organisations (Micek, 2008; Stryjakiewicz, Dyba, 2014). Therefore regional authorities have recently included clusters and cluster policies in many regional development strategies. Research on the spatial range of cooperation and knowledge flows can therefore be important not only from a cognitive perspective, but also for authorities that determine public policies.

[2] Certainly geographical proximity is not the only type of proximity that matters for cooperation and knowledge exchange between economic agents. Boschma (2005) indicates also organisational, technological, institutional and cognitive types of proximity. All of them may be significant for interactions to happen, leading to collective learning and innovation. However, according to actor, when proximity between actors is too high, it can also discourage from interacting (see also: Sokołowicz, 2013).

# 3. Regional closure: definition and method of calculating

The idea of a regional closure of links, including cooperation and knowledge transfer links, comes from classical works in economic geography, authored by Isard (1960), and in the Polish literature – Domański (1972). These authors described and examined to what extent relations of dependence in some economic aspects (including exogenous and endogenous functions, flow of goods) were contained (enclosed) within a region, and how far they went beyond it. Investigated aspects included transportation, migration of people and goods, but also transmissions of information – trials were made to designate conditions necessary for them to happen in homogeneous or nodal regions.

In order to examine the range of knowledge transfer to firms in cluster organisations, I worked out a conception of the regional closure. Regional closure is a term that specifies to what extent links created by a group of agents are closed within a certain administrative unit, for example region or subregion. In my case, closure is the extent to which firms in cluster organisations make use of knowledge from cooperating institutions located in close geographical proximity, i.e. in the same region or subregion. It is counted as a proportion of knowledge links between firm of a cluster organisation and cooperating institutions located within certain administrative unit, out of all knowledge links, comprising also connections to institutions lying further. A region is understood here as an administrative unit of the NUTS-2 level (self-governing voivodeships) and a subregion is a unit of the NUTS-3 level (a special division for statistical purposes in which each unit embraces several poviats). An analysis comprises exact geographical location of universities, higher and vocational schools (academies), as well as public business environment institutions (scientific units like technology transfer centres; agencies, foundations, associations; economic self-government units: economic and industrial-commercial chambers) with which firms in cluster organisations cooperate on common projects. It is assumed that in the course of those projects there is an intentional transfer of knowledge in various forms from cooperating entities to firms.

The regional closure of knowledge transfer is calculated using the following formulae:

$$[1]\ C = \frac{N\,u\,(r) + N\,bei\,(r)}{N\,u + N\,bei} \cdot 100\% \quad \text{and} \quad [2]\ C = \frac{N\,u\,(r)}{N\,u} \cdot 100\%$$

where:
*C* – closure of knowledge transfer to a cluster organisation on regional or subregional level ([1] – from all cooperating institutions, [2] – only from universities and academies);
*N u (r)* – number of universities and academies in the region (subregion) with which projects were conducted by firms in the cluster organisation;

*N bei (r)* – number of business environment institutions in the region (subregion) in the given line of business (agencies, foundations, associations, and economic self-government organisations, e.g. economic and industrial-commercial chambers) with which projects were conducted in the cluster organisation;
*N u* – number of all universities and academies in the given line of business with which projects were conducted in the cluster organisation;
*N bei* – number of all business environment institutions in the given line of business with which projects were conducted in the cluster organisation.

The formula [1] allows to calculate how many of all universities and academies and business environment institutions cooperating with firms in cluster organisations on common projects are located in the region or subregion where the given cluster organisation is situated. The formula [2] serves to calculate how many of cooperating universities and academies are located in the region or subregion of a cluster organisation and how many outside of it. The regional and subregional closure of knowledge transfer in cluster organisation is examined in this way (i.e. with the help of formula [2]) because it can be assumed that it is especially universities and education facilities that usually take part in the transfer of the necessary knowledge to firms in clusters or cluster organisations. Interpretation of results in both formulae is as follows: the greater the closure, the more cooperating entities can be found in the nearest proximity of firms in cluster organisations (the smaller the range of links).

## 4. Selection of case studies and methodology

For the purpose of this research, I analysed data and publications available on the Internet site of Polish Agency for Enterprise Development (PARP), as well as on the Internet pages of various agreements that used the term "cluster" in their names. Finally for the analysis I selected 17 cluster organisations located in five administrative regions – voivodeships in Western Poland: West Pomerania, Wielkopolska, Lubuska Land, Lower Silesia and Opole Region. All of them were actively operating between 2011 and 2014, in all of them members had realized at least 3 common projects, were led by a coordinator and had formalized, written status of cooperation[3]. Firms represented 3 sections of the International Standard Industrial Classification of All Economic Activities (ISIC)[4]: J – information and communication (ICT) services, M – professional, scientific and technical services (esp. biochemistry), C – industrial processing/manufacturing, including C:L – low-tech manufacturing (food, furniture), C:ML – medium low-tech manufacturing (metallurgy) and C:MH – medium-high manufacturing (machines, aviation industry).

[3] A full list of investigated cluster organisations is in the appendix.

[4] The sections are identical as in the 2007 Polish Classification of Economic Activities (PCEA, 2007).

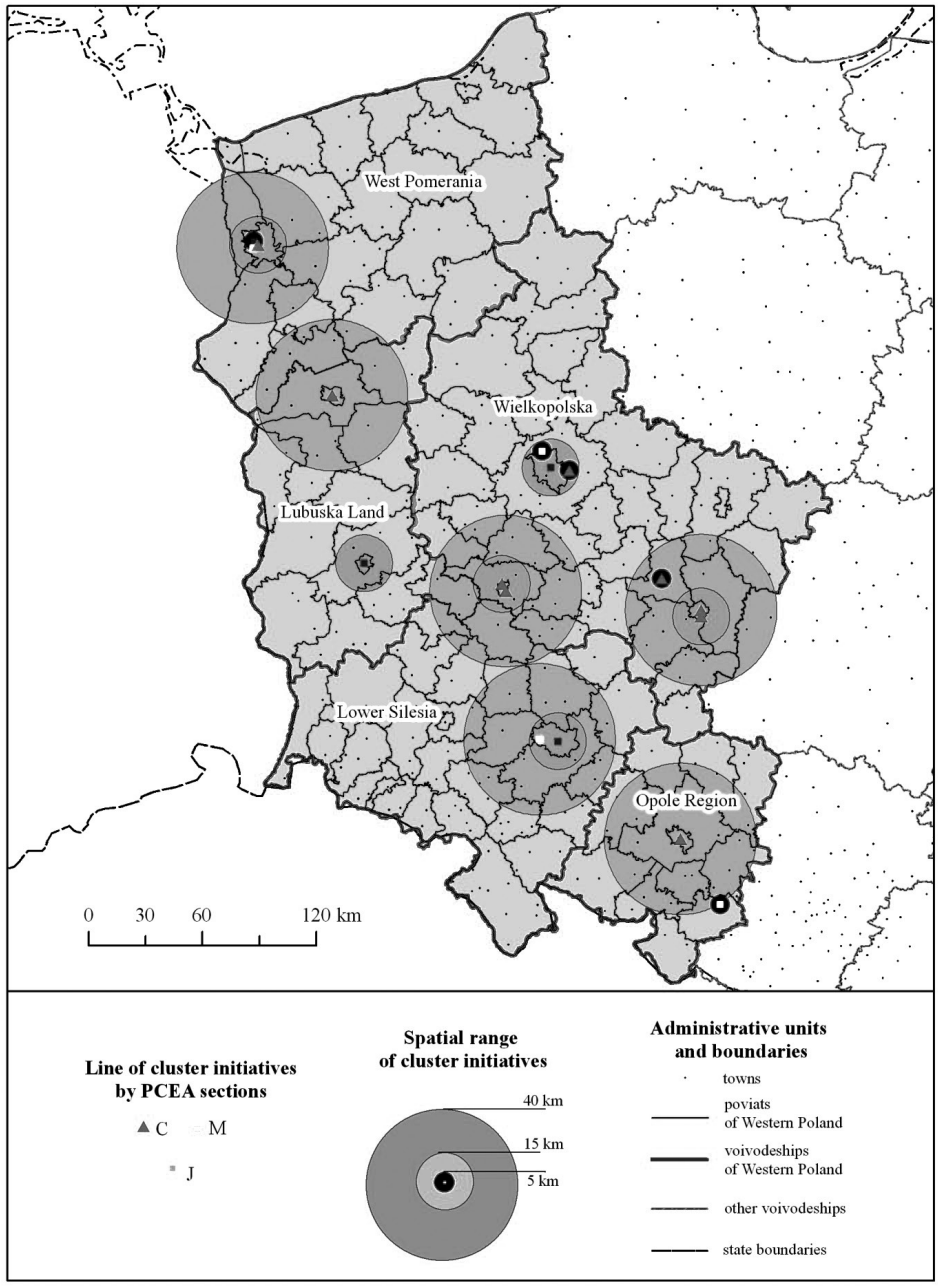


Fig. 1. Distribution and spatial range of investigated cluster organisations in Western Poland

Source: own compilation

I analysed precise, geographical location of firms as well as cooperating universities, higher and vocational schools and business environment units (agencies, foundations, associations, and economic self-government organisations, e.g. economic and industrial-commercial chambers). The data gathered allowed me to distingish three categories of the organisations: (1) highly compact, in which a minimum of 90% of firms were situated at a distance of up to 5 km from the seat of a cluster organisation (in a circle with a diameter of 10 km, which corresponds to a medium-sized town or a part of a large city like Poznań, Wrocław or Szczecin); (2) local, in which a minimum of 90% of firms were located at a distance of up to 15 km from the seat of a cluster organisation (in a circle with a diameter of 30 km, which corresponds to large cities (poviat-ranking towns) or non-municipal poviats, and (3) subregional, in which a minimum of 90% of firms could be found at a distance of up to 40 km from the seat of a cluster organisation (in a circle with a diameter of 80 km, which corresponds in size to about three or four neighbouring poviats, i.e. on average to a greater part of a NUTS-3 subregion) (Fig. 1).

When analysing the spatial distribution of cluster organisations, it can be observed that their seats are located primarily in the capitals of voivodeships of Western Poland (Szczecin, Wrocław, Poznań, Opole, Gorzów Wielkopolski, Zielona Góra), but also in some medium-sized towns of this macroregion (Leszno, Kalisz, Swarzędz, Kędzierzyn-Koźle, Pleszew). The number of sub-local, local and subregional cluster organisations distinguished was 5, 6 and 6, respectively.

## 5. Regional closure of knowledge transfer in cluster organisations

The results of the analysis, by voivodeship and by line of business in terms of sections of ISIC, are presented in Fig. 2 (in a spatial approach), and in Tables 1 and 2.

Both fig. 2 as well as tables 1 and 2 served to make conclusions concerning regional closure of knowledge transfer within regions of Western Poland in a spatial perspective and taking into account selected lines of business.

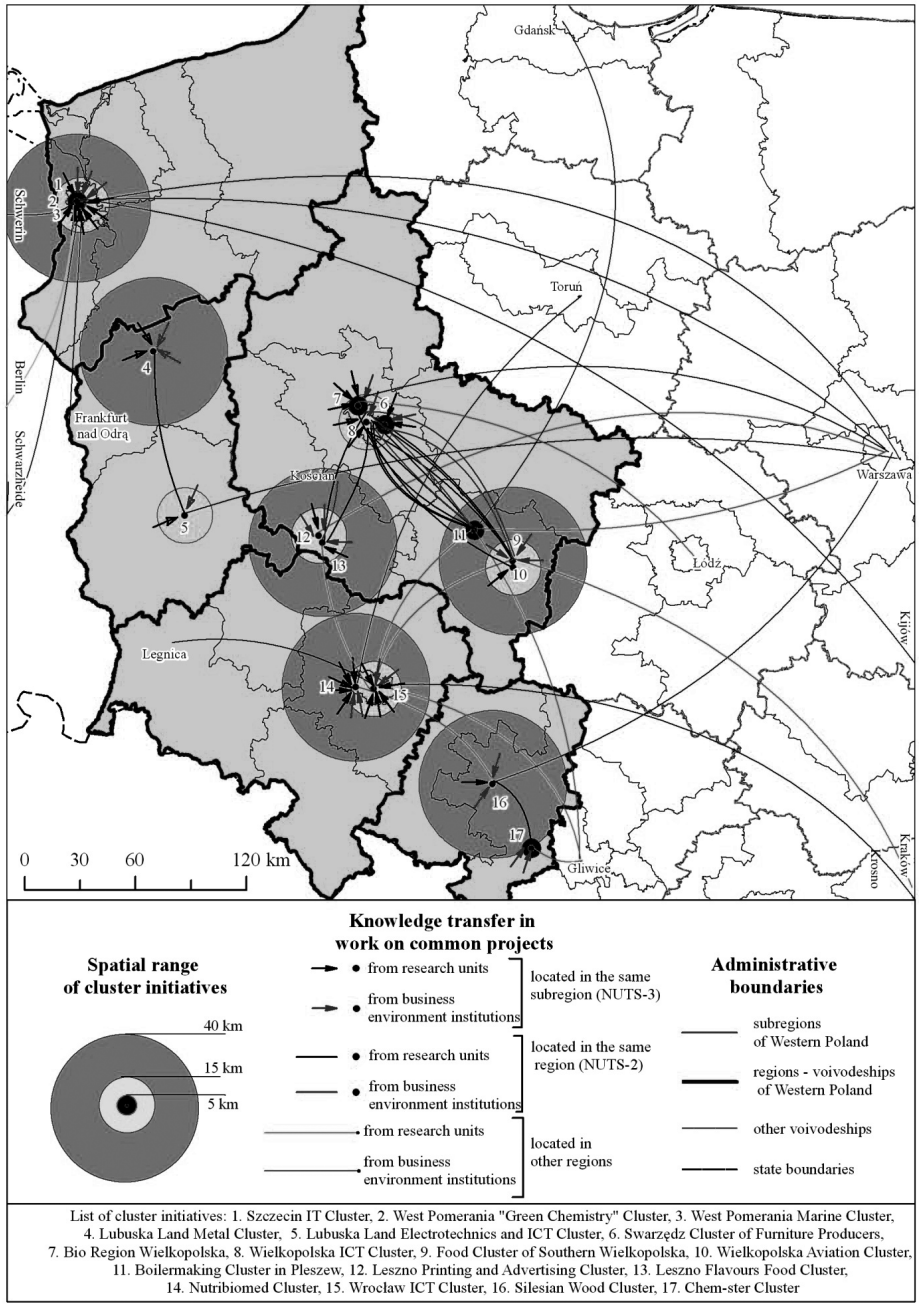


Fig. 2. Regional closure of knowledge transfer from research units and business environment institutions to firms in cluster organisations

Source: own compilation

Table 1. Regional closure of knowledge transfer in cluster organisations in the voivodeships of Western Poland

| Voivodeship | C1 | | C2 | |
|---|---|---|---|---|
| | NUTS2 | NUTS3 | NUTS2 | NUTS3 |
| Lower Silesia | 83,33 | 59,52 | 79,17 | 45,83 |
| Lubuska Land | 83,33 | 73,33 | 100,00 | 83,33 |
| Opole Region | 75,00 | 75,00 | 75,00 | 75,00 |
| Wielkopolska | 74,99 | 62,47 | 84,07 | 61,11 |
| West Pomerania | 68,72 | 68,72 | 94,44 | 94,44 |
| **Mean** | **77,07** | **67,81** | **86,54** | **71,94** |

Source: own compilation

Table 2. Regional closure of knowledge flows in cluster organisations in the voivodeships of Western Poland by ISIC

| ISIC section | C1 | | C2 | |
|---|---|---|---|---|
| | NUTS2 | NUTS3 | NUTS2 | NUTS3 |
| J | 81,67 | 81,67 | 93,75 | 93,75 |
| M | 65,65 | 65,65 | 63,96 | 63,96 |
| C, incl.: | 73,16 | 58,43 | 82,96 | 56,30 |
| C:L | 75,27 | 64,12 | 79,33 | 58,00 |
| C:ML | 90,00 | 80,00 | 100,00 | 83,33 |
| C:MH | 51,05 | 22,63 | 75,00 | 25,00 |

Explanations: J – information and communication, M – professional, scientific and technical activities, C – industrial manufacturing, including C:L – low-tech manufacturing, C:ML – medium-low tech manufacturing and C:MH – medium-high tech manufacturing.

Source: own compilation

# 6. Conclusions

From the fig. 2 several observations can be made. In the case of cooperation with business environment institutions, readily notable is a low level of cooperation of cluster organisations from Western Poland with entities from the neighbouring regions. It is only in the southern part of Wielkopolska that one can find agreements with entities from Lower Silesia. But in all the studied voivodeships, organisations have links with universities and business environment units (agencies, associations, economic chambers) from Poland's capital, Warsaw.

Some cluster agreements carried out projects with units from more distant places: Gdańsk, Cracow, or Krosno. In the most internationalised organisa-

tion – the 'Green Chemistry' West Pomeranian Cluster from Szczecin – links extended even further, to entities from Germany (Berlin, Schwarzheide, Schwerin) and Ukraine (Kiev, Dniepropietrovsk).

Results presented in tab. 1 and 2 lead to several observations and conclusions. First, the regional closure of knowledge transfer from research units and institutions in the given line of business to firms cooperating in cluster organisations is similar in the voivodeships of Western Poland, the means for all the regions under study (formula [1]) being 77.07% and 67.81%, respectively. This means that, on average, 2–3 in 10 entities transferring knowledge to firms in cluster organisation come from the outside of the region/subregion in which those firms operate. Taking into consideration only public universities and academies cooperating on a project (formula [2]), the mean regional closure of knowledge transfer was higher (86.54% and 71.94%, respectively). This shows that an average of 13% of public didactic units (in the case of a region) and 28% (in the case of a subregion) transferring knowledge to firms, come from further away than their nearest vicinity. When comparing the voivodeships (NTS-2), Lubuska Land and West Pomerania have shown an especially high degree of closure (cooperation on projects with research units from the home region). This can be the evidence of the didactic units being of high standard in those regions (the West Pomeranian Technical University, the State Higher Vocational School in Gorzów Wielkopolski), but also of a smaller demand for specialised knowledge from the outside of the region than in the other voivodeships.

When comparing individual subregions (NTS-3 units), the degree of closure of knowledge transfer is especially low in the case of cluster organisations situated outside voivodeship capitals (e.g. in the Kalisz, Leszno, Pleszew or Kędzierzyn-Koźle subregions), where the institutional background in the form of scientific and research units is poor, so coordinators and participants of those agreements have to reach for more distant knowledge sources.

When analysing the matter by line of business, one can observe a regularity that the degree of closure of knowledge transfer is especially low (meaning seeking more distant cooperators and more distant knowledge) in the high-tech industry and services from section M of the ISIC. Cluster initiatives in low-tech sectors usually avail themselves of sources situated in close regional proximity. This shows that the more advanced and innovative the projects carried out in clusters, and the more specialised technical knowledge and equipment they need, the more necessary, more diversified and often more distant sources of knowledge are, because those located nearby turn out to be insufficient. When analysing the situation of cluster organisations in section J, i.e. ICT, the degree of regional closure of knowledge transfer calculated for them is relatively high, which could be indicative of a fairly frequent use of the knowledge of people working in nearby research units and institutions. From the talks with ICT cluster coordinators, one can deduce

that entrepreneurs from this sector generally rarely use knowledge from institutions in this line of business and scientific units; rather, they tend to trace current technological advances and new developments in economic activity themselves (using generally available Internet resources), on the assumption that researchers – e.g. from universities – may have a less up-to-date knowledge about those new developments than they do. Hence the total number of institutions cooperating with ICT cluster organisations is low.

It can also be assumed that in the course of maturation of a cluster and cluster organisation – going through successive stages of its development, which takes place when it operates for a longer time and implements new, common projects and actions – the regional closure of knowledge flows tends to decrease; there is a search for scientific and research partners as well as those involved in a similar line of business from ever more distant regions and subregions.

The presented study shows preliminary results and formulated conclusions can be a starting point for empirical works in other regions and cluster organisations. One serious limitation to this research is that calculations show only relations between firms in cluster organisation and cooperating institutions, without characterizing the quality and the effectiveness of these relations. Sometimes one cooperation link that involves knowledge transfer may bring more positive results to a cluster organisation than several others. It would also be more challenging to find and investigate a closure of any purposeful knowledge transfer or spontaneous knowledge spillovers in clusters understood as spatial concentrations of firms and institutions around one economic activity and not only in the formalised cluster agreements – in this paper referred to as cluster organisations.

Acknowledgments:

I would like to thank Prof. Tadeusz Stryjakiewicz and Dr. Krzysztof Stachowiak from the Adam Mickiewicz University in Poznan for their help in preparing this research and interpreting its results. The research was supported financially from the means of the Polish National Science Centre granted by the decision no.: 2015/17/N/HS4/00205.

## References


Bathelt H., Cohendet P. (2014), *The Creation of Knowledge: Local Building, Global Accessing and Economic Development – Toward an Agenda*, "Journal of Economic Geography", 14, pp. 869–882.

Benneworth P., Dassen A. (2011), *Strengthening Global-Local Connectivity in Regional Innovation Strategies: Implications for Regional Innovation Policy*, "OECD Regional Development Working Papers", 2011/01, OECD Publishing, Paris.

Benneworth P., Henry N. (2004), *Where is the value added in the cluster approach? Hermeneutic theorising economic geography and clusters as a multiperspectival approach*. "Urban Studies" 41 (5/6), pp. 1011–1023.

Bergman E.M. (2008), *Cluster life-cycles: an emerging synthesis*, [in:] C. Karlsson (ed.) *Handbook of research on cluster theory*, Edward Elgar, Cheltenham, pp. 114–132.

Boschma R.A. (2005), *Proximity and Innovation: a Critical Assessment*, "Regional Studies", 39, 1, pp. 61–64.

Churski P., Stryjakiewicz T. (2006), *New experiences of Polish regional policy in the first years of membership in the European Union*, "Quaestiones Geographicae", Series B, 25, pp. 17–28.

Cooke P. (2005), *Regionally Asymmetric Knowledge Capabilities and Open Innovation: Exploring Globalisation 2 – A New Model of Industry Organisation*, "Research Policy", 34, pp. 1128–1149.

Cruz S.C.S., Teixeira A.A.C. (2010), *The Evolution of the Cluster Literature: Shedding Light on the Regional Studies – Regional Science Debate*, "Regional Studies", 44, 9, pp. 1263–1288.

Dahl M.S., Petersen C.R. (2004), *Knowledge Flows through Informal Contacts in Industrial Clusters: Myths or Realities?*, DRUID Working Paper No. 03–01.

Domański R. (1972), *Kształtowanie otwartych regionów ekonomicznych [eng: Shaping open economic regions]*, PWE, Warszawa.

Dyba W. (2016), *Mechanisms of knowledge flows in bottom-up and top-down cluster initiatives*, "Regional Studies, Regional Science", 3:1, pp. 287–295.

Internet materials of the Polish Agency of Enterprise Development (PARP): http://www.parp.gov.pl/, http://www.pi.gov.pl/klastry/, https://mapaklastrow.pi.gov.pl/.

Isard W. (1960), *Methods of Regional Analysis; an Introduction to Regional Science*, Cambridge: Published jointly by the Technology Press of the Massachusetts Institute of Technology and Wiley, New York.

Jankowska B. (2012), *Koopetycja w klastrach kreatywnych. Przyczynek do teorii regulacji w gospodarce rynkowej [Coopetition in creative clusters. A contribution to regulation theory in market economy]*, Wyd. UE w Poznaniu, Poznań.

Karlsson C., Gråsjö U. (2014), *Knowledge Flows, Knowledge Externalities, and Regional Economic Development*, [in:] M.M. Fischer, P. Nijkamp (eds.), *Handbook of Regional Science*, Springer Verlag, Berlin–Heidelberg, pp. 413–437.

Kowalski A.M. (2013), *The Impact of Industrial Clusters on the Innovativeness of Business Firms in Poland*, "World Journal of Social Sciences", Vol. 3, No. 1, pp. 73–84.

Kowalski A.M. (2013), *Znaczenie klastrów dla innowacyjności gospodarki w Polsce [eng: Significance of clusters for the innovativeness of the Polish economy]*, Oficyna Wydawnicza Szkoła Główna Handlowa, Warszawa.

Lindqvist G., Ketels C., Sölvell Ö. (2013), *The Cluster Initiative Greenbook 2.0*, Ivory Tower Publishers, Stockholm.

Lissoni F. (2001), *Knowledge Codification and the Geography of Innovation: The Case of Brescia Mechanical Cluster*, "Research Policy", 30, pp. 1479–1500.

Maskell P. (2001), *Towards a Knowledge-Based Theory of the Geographical Cluster*, "Industrial and Corporate Change", 10, pp. 921–943.

Micek G. (2008), *Grona przedsiębiorczości jako przedmiot analizy oraz instrument rozwoju lokalnego i regionalnego w warunkach polskich [eng: Clusters of entrepreneurship as a study object and an instrument of local and regional development in the Polish conditions]*, „Przegląd Geograficzny", 80, 4, pp. 541–560.

Porter M.E. (1990), *The Competitive Advantage of Nations*, Macmillan, New York.

Sokołowicz M.E. (2013). *Zagadnienie bliskości w badaniach nad rozwojem terytorialnym. Podejście instytucjonalne* [eng: *The proximity issue in research on territorial development. An institutional approach*], [in:] A. Nowakowska (ed.). *Zrozumieć terytorium. Idea i praktyka* [eng: *Understanding terrority. Idea and practice*], Wyd. UŁ, Łódź.

Storper M., Venables A.J. (2004), *Buzz: Face-to-face Contact and the Urban Economy*, "Journal of Economic Geography", 4, pp. 351–370.

Stough R.R. (2015), *Cluster Life-Cycles, Entrepreneurship and Regional Economic Development with a Case Study of the Korean Shipbuilding Cluster*, [in:] P. Nijkamp et al. (eds.), *Regional Science Matters*, Springer International Publishings, Switzerland, pp. 223–254.

Stryjakiewicz T. (2005), *Contrasting Experiences with Business networking in a Transition Economy: The Case of Poland*, [in:] C.G. Alvstam, E.W. Schamp (eds.), *Linking Industries Across The World: Processes of Global Networking*, Ashgate, Aldershot, Burlington, pp. 197–222.

Stryjakiewicz T., Dyba W. (2014), *Organizacja przestrzenna i funkcjonowanie klastrów w województwie wielkopolskim* [eng. *Spatial organisation and functioning of clusters in the Wielkopolska Voivodeship*], Wyd. WROT, Poznań.

Swann G.M.P., (2009), *Clusters and networks*, [in:] G.M.P. Swann, (ed.), *The Economics of Innovation*, Edward Elgar Publishing, Cheltenham, Northampton, pp. 147–172.

Vorley T. (2008), *Geographic Cluster – a Historical Review*, "Geography Compass", 2/3, pp. 790–813.

## Appendix: List of analysed cluster organisations from Western Poland

| No. | Name | Line of business | ISIC/ PCEA Section | Voivodeship, seat | Spatial range |
|---|---|---|---|---|---|
| 1 | Nutribiomed Cluster | biotechnology | M | Lower Silesia, Wrocław | Highly compact |
| 2 | ICT Cluster: Knowledge and Innovation Community | ICT | J | Lower Silesia, Wrocław | Local |
| 3 | Lubuska Land Metal Cluster | Metalurgy | C:ML | Lubuska Land, Gorzów Wlkp | Subregional |
| 4 | Lubuska Land Electrotechnics and ICT Cluster | Electrotech-nics, ICS | J | Lubuska Land, Zielona Góra | Local |
| 5 | Chem-ster Cluster | Chemistry | M | Opolskie, Kędzierzyn-Koźle | Subregional |
| 6 | Silesian Wood Cluster | Furniture | C:L | Opolskie: Opole | Subregional |
| 7 | Leszno Printing & Advertising Cluster | Poligraphy, advertisment | C:L | Wielkopolska, Leszno | Subregional |
| 8 | Food Clus-ter of Southern Wielkopolska | Food | C:L | Wielkopolska, Kalisz | Local |
| 9 | Leszno Flavours Food Cluster | Food | C:L | Wielkopolska, Leszno | Subregional |
| 10 | Boilermaking Cluster | Machines industry | C:MH | Wielkopolska, Pleszew | Highly compact |
| 11 | Wielkopolska Aviation Cluster | Aviation industry | C:MH | Wielkopolska, Kalisz | Local |
| 12 | Wielkopolska ICT Cluster | ICT | J | Wielkopolska, Poznań | Local |
| 13 | Bio Region Wielkopolska | Biotechnology | M | Wielkopolska, Poznań | Highly compact |
| 14 | Swarzędz Cluster of Furniture Producers | Furniture | C:L | Wielkopolska, Swarzędz | Highly compact |
| 15 | Green Chemistry | Chemistry | M | West Pomerania, Szczecin | Local |
| 16 | West Pomerania Marine Cluster | Shipbuilding | C:ML | West Pomerania, Szczecin | Subregional |
| 17 | Szczecin IT Cluster | ICT | J | West Pomerania, Szczecin | Highly compact |

Source: own compilation

**Regionalne domknięcie transferu wiedzy w organizacjach klastrowych w Polsce zachodniej**

**Streszczenie:** W wielu pracach dotyczących klastrów – aktualnego tematu badawczego wielu analiz regionalnych – autorzy wskazują, że przestrzenna bliskość podmiotów ekonomicznych pozytywnie wpływa na możliwości współpracy i przepływu wiedzy (zarówno spontanicznego, jak i celowego). Bliskość geograficzna może być jednak rozumiana różnie: zależy od uwarunkowań regionalnych i krajowych. W niniejszym artykule badam w jakim stopniu powiązania w zakresie transferu wiedzy podmiotów organizacji klastrowych mają miejsce wewnątrz, a w jakim stopniu wykraczają poza, regiony administracyjne Polski zachodniej. W tym celu formułuję operacyjną definicję „regionalnego domknięcia" powiązań, jak również wzór pozwalający na pomiar tego domknięcia. Rezultaty badania dowodzą, że jakkolwiek większość powiązań rzeczywiście zachodzi wewnątrz regionów (rozumianych jako jednostki NUTS-2 i NUTS-3), ich zasięg przestrzenny zależy od rodzaju działalności podmiotów współpracujących w klastrach i typów realizowanych przez nie projektów (m.in. im bardziej zaawansowane technologicznie projekty, tym mniejsze regionalne domknięcie przepływu wiedzy).

**Słowa kluczowe:** klastry, organizacje klastrowe, transfer wiedzy, regionalne domknięcie

**JEL:** C20, D83, D85, R12



Received: 2016-08-14; verified: 2016-12-03. Accepted: 2016-12-15