

**EQUIVOCALITY
IN DELINEATING
THE BORDERS
OF A CLUSTER:
THE BALTIC'S CASE**

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Increasing competition between states striving to integrate into the global economic system has created a need for a spatially targeted regional policy as a means of boosting national competitiveness. The regional polarisation approach, which seeks to create new and support the existing nodes of a regional economic system — clusters, technopoles, industrial districts, etc., — has gained wide currency in public administration. The heralds of such forms of spatial networking are various institutional, cultural, organizational, technological, social, and cognitive proximities. Combinations of these proximities create the unique mosaic of a regional milieu. Geographical proximity translates into the boundaries of spatial networks, which rarely follow the existing administrative divisions. Thus, the identification of spatial networks is becoming the focus of regional governance. This article is part of a complex study on equivocality in identifying the boundaries of spatial networking. In this work, we pay particular attention to delineating the boundaries of territorial clusters. This form of spatial networking is both a contemporary tool for targeted regional development and a result of spontaneous functional integration of economic entities. Building on an extensive factual base, we present a complex model of territorial cohesion for delineating the boundaries of a territorial cluster. The model makes it possible to integrate data on geographical, institutional, cultural, organisational, technological, social, and cognitive proximities. The properties of a cluster as a form of networking warrants distinguishing between internal, external, thematic, and absorptive types of boundaries. The feasibility of this approach is tested in the Baltics' national and regional

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Submitted on December 15, 2017

doi: 10.5922/2079-8555-2018-2-4

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2018



clusters, with special attention being paid to the Latvian IT-cluster. Committed to economic clustering and glocal cluster interactions beyond national borders, the Baltics are an ideal case study for testing our model. Latvia's mature IT-cluster is an important national growth point. Regional and industry-specific policies should consider the differences between the cluster's geographical and non-geographical boundaries.

Keywords: cluster policy, territorial cluster, cluster initiative, cross-border cooperation, territorial cohesion, Baltic States, cluster boundary

Introduction

The large-scale changes in the world economic system over the last decades accompanied by the expansion of the ideas of network economy, open innovations, co-production of value and a combination of creativity and entrepreneurship have created the need for new development paths and economic restructuring in many countries. The desire to remain competitive in the international arena has intensified competition among different economic systems. It created demand for the reinvention of approaches, forms, methods and mechanisms for implementation and management of traditional economic processes. Artificial geospatial polarization is one of the trends in economic development. It involves establishing various spatial networks such as international and regional clusters, regional innovation systems, knowledge regions, international innovation networks, etc. This controlled deformation is usually accompanied by a spatial concentration of personnel, financial, knowledge, entrepreneurial, investment, management and other resources, which increases territorial heterogeneity.

Development of economic relations facilitates the formation of a territorial community as a basis for various types of spatial units. Sometimes several territorial communities coexist within one region. This exacerbates the problem of equivocality of their spatial boundaries. There is no integrated methodological approach to the development of tools for boundary identification and border mapping. This complicates the identification and evaluation of properties, structure and functional features of territorial communities as well as related forms of spatial-networking interactions and their management. In this respect, this work is a continuation of a holistic study of economic geography focused on the problem of equivocality in identifying the boundaries of a territorial community in the modern geo-economic context. Based on the results of the previous researches, the article demonstrates the applicability of the developed approach to the identification of boundaries of a territorial community to a cluster as one of the most widespread spatial-networking interaction forms.

The paper presents the current stage of cluster formation processes drawing on the example of the Baltic States with their active cluster policy. Over the past decade, they were involved in a number of cluster initiatives launched and actual clusters created. Moreover, their small area and the fact that they are neighbours provide a solid basis for the formation of regional, national, and international clusters. In this respect, Lithuania, Latvia and Estonia are of great interest for this research as they are viewed as a platform for testing the theoretical models that were previously proposed.

Model of the boundaries of a territorial community

Social geography views a territorial community as a complex territorially rooted system of spatial networks of heterogeneous entities (enterprises, government authorities, research and educational institutions, public organizations, etc.) located within a geographically defined area and connected by technological, social, organizational, institutional, cultural and/or cognitive similarities [1—3]. A territorial community is characterized by emergent properties arising from a fusion of the properties of interacting subjects and a contextual environment. The decomposition of its structural elements made it possible to identify seven basic interconnected types of proximity (geographical, technological, social, organizational, institutional, cultural and cognitive). The formation of territorial communities is not always based on all of these types of proximity, and their composition is not constant either. Geographical proximity provides a basis for interaction processes. It reflects territorial cohesion of the entities involved. Geographical proximity is supplemented by other "non-territorial" (otherwise "virtual") types of proximity. The spatial model of a territorial community demonstrates their cohesion — Fig. 1.

The largest virtual proximity is the institutional one. It characterizes the embeddedness of territorial community elements in a single institutional field being a combination of formal and informal institutions. Institutional proximity serves a basis for the cultural one, which is its continuation. It reveals similarities in beliefs, organizational and business culture, norms of behaviour and management traditions, which are often accompanied by common historical traditions of the interacting subjects. The organizational and technological types of proximity directly relate to the nature and type of activities conducted by business entities. Organizational proximity is the similarity in size and structure of companies, specialization areas, target resource and sales markets, and development strategies. Technological proximity involves unified standards, technological compatibility strategy and common specialization. The social and

cognitive types of proximity are the most local types. They require stable social relationships and close personal contacts. Social proximity refers to kinship, friendship, familiarity and other close informal ties, while the cognitive one implies mutual understanding due to the similarity of processes of thinking, perception and interpretation of information, events and phenomena.

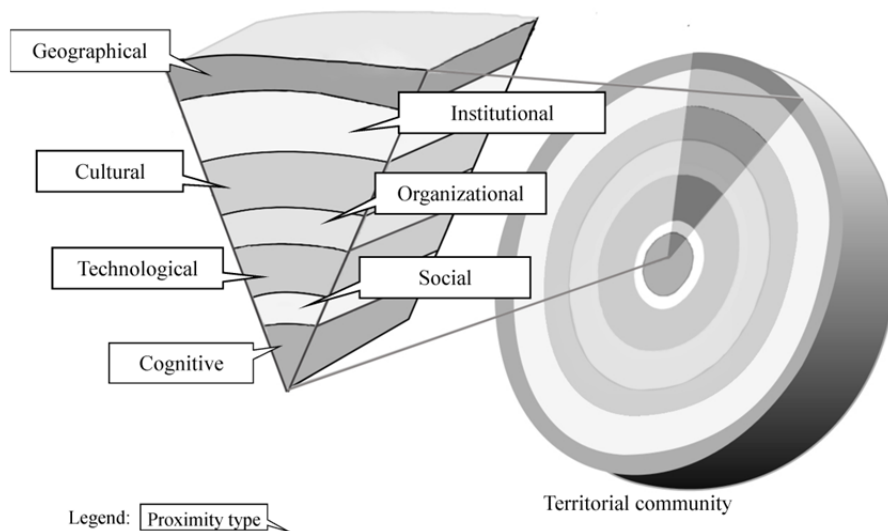


Fig. 1. Schematic model of a territorial community

This systematic approach to territorial proximity was further used for developing a theoretical approach to the definition of its boundary as a complex multi-component object of study (Table).

The multidimensional boundary of a territorial community

Boundary Type	Characteristics
Geographic	Determined by the physical location of interaction participants — elements of a territorial community; tied to infrastructure objects; can be intermittent due to the dispersity of global-local interactions
Institutional	Outlines an institutional space of interactions within a territorial community; has two contours: external — formally fixed by laws, regulations, standards, etc., and internal — informal, determined by shared values, procedures and other informal institutions

End of table

Boundary Type	Characteristics
Cultural	Outlines a single cultural space, including the industry sector, based on previous interactions of territorial community elements
Organizational	Determined by the organizational and functional features of territorial community elements; can be cross-sectoral, interdisciplinary or inter-organizational in nature
Technological	Determined by technological compatibility and similarity of technological standards; outlines a single technological space; falls within the accepted scientific and technological paradigm
Social	Outlines a space of sustainable social interactions among territorial community elements; highly dynamic; its identification is subjective
Cognitive	Determined by a similar level of competencies, knowledge bases, socio-economic (including scientific and technological) development of territorial community elements; implicit; its identification is highly subjective and labour-intensive

Principal model of the boundaries of a territorial cluster

A territorial cluster is currently one of the most popular forms of spatial-network interactions. The main reason for the upsurge in its popularity was set out in the works of M. Porter [4]; although D. F. Darwent [5], N. M. Hansen [6], H. R. Laswell [7] and others [8] had studied the phenomenon of clustering in the economy before those publications. Despite the fact that there are many types of clusters (industrial, innovative, entrepreneurial, scientific-technological, professional, high-tech, etc.), in general, this form of interaction is a localized open system of competing and cooperating actors bound by common aspirations and interests. Territorial clusters are formed on the basis of a territorial community serving as a space for the establishment of a rooted network of stable cluster interactions. Thus, a cluster can have two types of boundaries: objective, that are inherent in all territorial communities (geographical, institutional, cultural, etc.), and individual, that is associated with specific forms of interaction (internal, external, thematic, absorptive capacity). The extensive geographic coverage of a territorial community makes it possible to form clusters at various hierarchical levels: regional, national, and international (including cross-border and transnational). Figure 2 presents a principal territorial-functional model of regional, cross-border and transnational clusters.

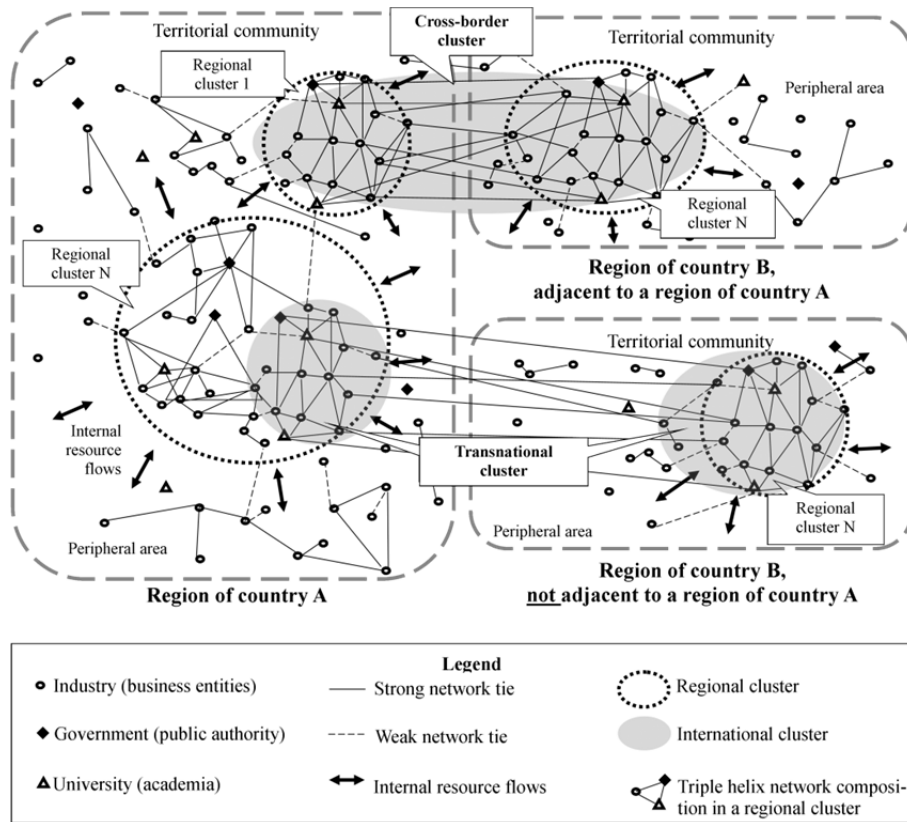


Fig. 2. Territorial cluster model at different hierarchical levels

The proposed territorial cluster model is a combination of several knowledge generation models including "local buzz — global pipelines" [9], Etzkowitz-Leydesdorff's triple helix [10], the double triple helix [11] and the regional innovation system [12—13]. The nucleus of a regional cluster is a sustainable partner network of three institutional helices: university — industry — government. The organizational diversity of participants creates a favourable environment for entrepreneurial and, especially, innovative activities in the region. Localized participants of cluster interactions being institutionally recognized members of the cluster serve as reference points for the multidimensional internal cluster boundary in geographical, organizational, institutional, cultural, technological, social and cognitive spaces.

The non-territorial boundaries of a cluster can be both clear and fuzzy depending on the degree and nature of virtual similarity of its actors, or cluster members. Criteria for the identification of boundaries of a territorial cluster vary depending on the type of proximity. For institutional proximity, they include the unity of formalized quality standards and condi-

tions for economic activities. For cultural proximity, they are shaped by the unification of business standards and consolidation of functional roles of participants of cluster interactions. For organizational proximity, it is the operation of a membership system. Technological proximity is defined by unified technological standards. Social proximity is characterized by regular industry-specific events aimed at strengthening the external and internal links of a cluster, exchanging knowledge among its members, collective learning, etc. A criterion for determining cognitive proximity boundary is a common long-term vision expressed in the cluster's mission and shared by all its members. If the degree of proximity is small according to any of the criteria, it becomes difficult to distinguish a complete set of interacting actors, and it is necessary to consider the exclusion of the category from further study.

In the course of interaction, the actors of a cluster exchange information and knowledge that is both explicit and implicit. Codified (otherwise explicit) knowledge can be alienated from its source, systematized, transmitted, deliberately reproduced and materialized as a product (for example, technology). Implicit knowledge, on the contrary, is inalienable from its creator, so it cannot be codified or systematized. It is embedded in skills and experience of qualified personnel, technical practices, informal norms of behaviour, culture, etc. The strategic strengths of a region are associated with this type of knowledge. The nature of implicit knowledge is determined by ambiguity (the more tacit the transferred knowledge, the greater the ambiguity of its perception); complexity (high dependence on the recipient's absorptive capacity); stability (insensitivity to environmental changes explained by a long knowledge-formation time connected with deepening the understanding of the processes and maintaining the ability to adapt to current needs); integrity (coherence of transfer) [14]. Difficulties in the diffusion of tacit knowledge result in "stickiness".

The actors exchange accumulated implicit knowledge through collective learning. The cluster members' ability to value, assimilate and apply new implicit knowledge successfully is called absorptive capacity [15]. It can be potential, i. e. associated with the assimilation of knowledge, and realized, i. e. related to its transformation and use [16]. High absorptive capacity provides an opportunity for participants to increase their competitiveness through access to knowledge flows. It requires mature territorial proximity with the cluster's local environment. The term for the diffusion of additive and commutative information within the local environment is "local buzz" [9]. Only actors within one particular region (including a cross-border one) can access it. Absorptive capacities of clusters vary. They can be influenced by such factors as specific features of relations of their actors, the development of transport and information and communication infrastructure of the clusters' regions, etc.



Spatial clusters also have a thematic boundary. It is an outline of a geographic area of concentration of individual actors that are not cluster members but have similar specialization or competencies. For example, within the thematic boundary, there can be scientific and educational institutions conducting educational and/or research activities in compliance with the development priorities of a cluster. The external boundaries of a cluster as a spatial-network structure are determined by the location of "global pipelines". These are the key actors located outside the region of a cluster. Not being the cluster members, they affect the pathways of regional development, specialization and research topics of local economic entities as well as other major issues. They exercise this influence by transferring new knowledge through sustainable channels of interaction. In the course of the implementation of state policy on internationalization of the regional economy and development policies of individual companies, the number of such pipelines grows. This increases the number of external information flows, as well as their frequency and duration. Such a convergence of the external and internal environment of a regional cluster on the basis of information flows promotes cross-border and transnational regionalization.

Cross-border regionalization is based on stable cross-border, and then transboundary cooperation stemming from the integration of regional clusters of bordering regions. Cross-border clusters emerge when there is cross-border proximity, the mature form of which is a cross-border region [17—18]. Since each of the border regions has its own set of "triple helix" actors, the interactions within a single transboundary cluster space are characterized by the phenomenon of the "double triple helix", i.e. cross-interaction of business, government and academic actors. Transnational clusters emerge in the process of transnational regionalization when close political and economic ties are established between two or more countries, and there is also cultural, historical, social or other proximity. Interactions in a transnational cluster are also realized within the framework of the "double triple helix" model. They involve permanent collaboration, business partnership, inter-organizational cooperation and information exchange.

Under the proposed model of territorial cluster boundaries, the delimitation process takes place at three hierarchical levels: national, regional, and local. The first stage is the study of statistical data and factual information. This allows for primary assessment of the territorial cluster boundary, i.e. determining its geographical location, features (development level, the nature of education, specialization of the community, sectoral coverage, etc.) and institutional context. Intra-network analysis at the micro level is performed to distinguish between the attributive and transactional characteristics of an aggregate of cluster members. The second stage involves describing the properties and similarities of the cluster's core elements to explain how and why they interact. Then, the

focus of the research shifts to the identification of the emergent properties of the spatial cluster by comparing the properties of individual subjects to the cluster core and analyzing them in the contextual environment [19].

Institutional context of cluster formation and cluster policy in the Baltic States

The reason for the deliberate creation of clusters observed in the Baltic States in the 2000s is the desire of these small-sized countries having limited resource potential and undergoing major socio-economic transformations to boost domestic competitiveness by focusing resources on priority areas. Having withdrawn from the USSR in the early 1990s, Lithuania, Latvia and Estonia faced the need to build new political and socio-economic systems relevant to the models of developed Western countries. The implementation of the reforms was challenging since the countries were facing a severe economic recession accompanied by cuts in industrial production, inflation, a drop in the quality of life, unemployment and a sharp increase in public debt. During that period, traditional production chains and the management system were breaking, and the geography of partners, interaction patterns and technical standards were changing. A major factor affecting the economic development of the Baltic States in the 2000s was foreign direct investment and financing from the EU structural funds. The state economic policy focused on the provision of a favourable business environment and the creation of economic clusters in traditional and cutting-edge industries.

For Lithuania, cluster policy is a relatively new area. In 2007—2013, the country introduced some measures intended to facilitate the development of general infrastructure for clusters and the creation of perspective growth points of the national economy — integrated science, education and business centres (valleys). Each valley has its own specialization. They are located in 3 major cities of Lithuania: "Santara" and "Sunrise" are in Vilnius, "Santaka" and "Nemunas" are in Kaunas, and "Baltic Valley" is in Klaipeda. The first concept of development of the Lithuanian clusters was adopted in 2014 in accordance with the National Progress Strategy "Lithuania 2030" (2012) and the National Innovation Development Programme for 2014—2020 (2013). The same year, the Association of Lithuanian Clusters was established. It undertook to participate in formation and implementation of clustering policy in Lithuania; to represent interests of clusters and their members in Lithuania and abroad; to strengthen cluster management competences and disseminate good practices; to provide training.

In 2017, the concept of development of Lithuanian clusters was updated to meet the needs of cluster members in new economic conditions. The new document emphasizes the need to create a favourable environ-



ment for the development of innovative clusters; to promote cross-sectoral cooperation; to build human capacity; to internationalise Lithuanian clusters and to develop international world-class innovation clusters. The main directions of this new cluster policy are development of the innovative potential of clusters; promotion of export activities and internationalization of cluster members; increasing business interest in clustering by means of disseminating the benefits and potentials; creation of a favourable environment for the development of clusters; promotion of intersectoral, interregional and international cooperation. The updated concept retains a requirement for a minimum of 5 members in a cluster, although it introduces 4 levels of cluster development (emerging, formed, developing and mature). These levels will be one of the bases for funding allocation and cluster assessment. Under the concept, the funding sources include proprietary funds, the state and municipal budget funds, the EU and other financial support funds. According to an analysis of development of Lithuania's clusters in 2017¹, the most considerable support was that provided by the EU investment funds. Over half the clusters that stopped receiving that support have to face an issue of financing of cluster management teams.

The implementation of the cluster policy in Estonia is connected with the adoption of the National R&D and Innovation Strategy for the period of 2007—2013, that provided for the development of innovative export industries with high added value, including by means of clustering. In 2008, the country launched a state programme for supporting clusters. The programme was aimed at increasing the international competitiveness of clusters through joint initiatives of Estonian enterprises. At present, Estonia supports cluster formation on its territory at three levels: supranational (within the framework of the European cluster development programmes), national and local. Enterprise Estonia (EAS) is a major tool of the national cluster policy. The goals include the creation of technological development centres, competence centres and promotion of clustering. Local support is offered as municipal co-financing of cluster projects. Financing is provided on a competitive basis. To be eligible, an applicant shall meet several criteria: a certain part of its business shall be located in a given cluster; a cluster must operate in one of the priority fields of activity (service economy, future technologies, and information and communication technologies). There is also information support provided in the form of consultations and training, incubation services and promotion of internationalization. Another form of support is organization of joint events, training and informal meetings under the auspices of the Cluster Club to initiate joint projects of different types of actors

¹ *Lithuanian Clusterization*. 2017. Research Institute for Changes. URL: <http://www.lca.lt/summary-of-the-report-lithuanian-clusterization-2017> (accessed Feb 15, 2013).

(enterprises, science parks, incubators, industrial parks, business associations, universities, etc.). There are also marketing activities (campaigns, study visits, etc.) aimed at promoting entrepreneurship and business environment.

The EU-wide cluster development trend and the EU support programmes have produced a strong effect on clustering in the Baltic countries, including Latvia. In the early 2000s, within the framework of the EU PHARE project, four sectors of Latvian economy (IT, timber and forest products, engineering and new materials) were identified as having high clustering potential. They served as platforms for the development of cluster initiatives, the first 2 of which proved to be viable. At the national level, the importance of forming clusters was first stated in a series of documents dated 2003 to 2006, including the National Innovation Programme for 2003—2006 (2003), Industrial Development Guidelines of Latvia (2004) and the National Development Plan 2007—2013 (2006). In 2005, the country developed the National Lisbon Programme of Latvia for 2005—2008. It emphasised the importance of cluster cooperation among business, research and educational institutions. It also set out criteria for assessing the potential of Latvian clusters to provide adequate further support. However, until 2008, the instruments of state financial support for clusters had remained undeveloped. This was severely hampering the cluster formation and development processes. The fact was reflected in the Operational Programme "Entrepreneurship and Innovation" for the period 2007—2013 adopted by the Cabinet of Ministers of Latvia in 2007. The document declared the need to ensure greater coordination of business and government efforts aimed at developing clusters seen as growth points that can create a favourable environment for the transfer of knowledge and innovation in the real sector of the economy. The importance of intersectoral cooperation and diffusion of knowledge and innovation was emphasized as priorities in sector-specific development strategies.

In 2008, Latvia's Ministry of Economy developed a special programme to support cluster projects set up by unrelated companies, research, educational and other institutions that was co-financed by the EU structural funds and the cohesion fund. This tool provides support to the priority sectors of the economy, ensures the formation of new value chains, promotes international cooperation, enhances export capacity and facilitates the formation of cluster management competencies. During the first stage (2009—2011), 9 cluster initiatives in traditional and innovative sectors received grant-based funding. The programme produced a beneficial effect on the economy and was extended until 2020. The total budget for 2016—2020 amounted to 19 million euros. In accordance with the Strategic Development Plan of Latvia for 2010—2013, during the same period there was a number of other initiatives launched to form a cluster support infrastructure (the programme aimed at creation of competence



centres and technology transfer contact points in 2011—2017), to facilitate cooperation among Latvian research, educational and production sectors in applied research, new product and technology development ("Science and Technology Development Framework 2007—2013", "Policy Framework for the Development of Education 2007—2013").

At the moment, cluster development in Latvia is determined by the long-term national development priorities of economic system transformation (increasing added value, labour productivity and efficiency of resource use, creating new forms of cooperation between producers and suppliers of goods and services), as enshrined in the Development Strategy of Latvia until 2030, the National Development Plan of Latvia for 2014—2020 as well as the Guidelines for both National Industrial Policy and for Science, Technology Development, and Innovation 2014—2020. According to the Smart Specialization Strategy for 2014—2020, the most important transformational trends are the development of sectors with significant horizontal impact and contribution in the transformation of national economy, along with the change in the production and export structure in traditional sectors of the economy and the development of innovative sectors with high added value. The political tools for the strategy implementation include direct financial support by the state, the EU funds and tax incentives. At the regional level, cluster formation is promoted within the framework of the regional policy for sustainable and balanced development of the territory of Latvia. The adopted long-term strategies and development programmes for specific Latvian planning regions (Riga, Zemgale, Vidzeme, Latgale, Kurzeme) declare the priority of supporting the creation of regional clusters as integral parts of a knowledge-based economy uniting local universities, large foreign and national companies, and small and medium-sized local enterprises in order to create new value chains.

Baltic clusters and cluster initiatives: features and localization

The active clustering process in Lithuania, Latvia and Estonia over the last decade is associated with the expansion of financial support instruments for national and regional clusters, including access to the Pan-European investment funds and programmes. To date, most of the Baltic clusters initiatives are undertaken, i. e. clusters have been formed by deliberate efforts (for example, in Lithuania their share is about 75%). The public administration sector as a subject of cluster policy performs a significant role in this process. Common features of most Baltic clusters include their immaturity; small size and a small number of members; weak inter-organizational links between the real sector and research organizations; prevalence of small and medium-sized enterprises; predominant location in the largest cities of the countries; funding dependence

on various support programmes, especially the EU ones; weak cluster management; aim of enhancing international integration; dependence on foreign technological, investment, material and technical, personnel and other resources.

According to the European Cluster Excellence Initiative², only two Baltic clusters have the Silver Labels confirming the successful implementation of cluster management improvement processes. These are Estonian and Latvian information and communication technologies clusters (ICT). Other 17 clusters (11 Estonian, 4 Latvian, 2 Lithuanian) are awarded the Bronze Labels, which demonstrates their interest in the development and improvement of cluster processes organization. As of the beginning of 2018, none of the clusters in Lithuania, Latvia or Estonia was awarded the Golden Label. This indicates a low maturity level of cluster development in these countries. In the Baltic countries, the service industry is the most active sector of cluster development. Major areas of specialization of the Baltic countries include tourism, information and communication technologies, medicine and healthcare, construction, production and design. A poll of Lithuanian cluster managers³ shows that the following industries are actively involved in cluster cooperation in that country: creative industries, ICT, manufacturing and engineering, energy, and construction. A similar trend is seen in Estonia. Latvia develops transport and logistics and food products along with the above-stated industries.

In Lithuania, there are over 50 clusters and cluster initiatives. That is the biggest number in the Baltics. The majority of clusters develop in the largest and economically strongest Lithuanian cities — Vilnius, Klaipėda, and Kaunas, where the concentration of personnel, financial and infrastructure resources is the highest in the country. However, cluster initiatives can also be found in Lithuanian towns (Biržai, Ignalina, Šiauliai, Kedainiai, etc.) with unique natural resources and developed specialization, mostly tourism. In total, cluster links connect 34 cities and municipal districts in Lithuania. The lowest cluster network density is observed in the counties of Taurage, Marijampolė and Telsiai. Organizationally, most members of Lithuanian clusters are micro, small and medium-sized enterprises. The public administration sector also occupies a crucial role. Research and educational organizations, associations and other non-profit organizations are poorly involved in cluster cooperation. Their participation mostly enhances the image of a cluster. Lithuanian companies rarely

² *European Cluster Excellence Initiative*. 2017. URL: <https://www.cluster-analysis.org/benchmarked-clusters> (accessed Feb 15, 2018).

³ *Lithuanian Clusterization*. 2017. Research Institute for Changes. URL: <http://www.lca.lt/summary-of-the-report-lithuanian-clusterization-2017> (accessed Feb 15, 2013).



outsource R&D as well as staff training and retraining. Lithuanian enterprises join clusters mainly to overcome their financial limitations by combining their efforts to conduct research, develop and launch new products and services, enter international markets, participate in an international project and apply for a grant. The technological, as well as the internal institutional and cultural, boundaries of most Lithuanian clusters are at the initial stage of their formation. The report on Lithuanian clusterization in 2017 points out that Lithuanian companies show little interest in creating a legal ecosystem, certification and training of their employees⁴.

Estonia ranks second among the Baltic countries in terms of the number of clusters. At the moment, there are around 20 cluster formations. The cores of most clusters gravitate towards Tallinn, the capital and the economic centre of the country, that provides more than half of its GDP. Organizationally, clusters are formed mainly by micro and small businesses and start-ups. There is a considerable proportion of companies with foreign participation, mainly Finnish and Swedish. Estonian companies form clusters to develop joint products and services and promote them internationally, and to form localized value chains. More than half of all identified Estonian clusters are interested in improving the quality of cluster management and strengthening cluster links. This is proved by their active participation in the European Cluster Excellence Initiative benchmarking. Specializations of the clusters are consistent with the development priorities of the country and its key region (Tallinn). They include ICT, health and medical science, mechatronics, environmental technologies, creative industries, tourism, transport and logistics, and finance. Estonia has established an infrastructure to support its clusters. There is a number of partner organizations directly involved in cluster interactions, including their initiators: centres for development of technology, educational and research institutions, competence centres, and scientific and industrial parks. Public authorities take an active part in the clustering process by creating a favourable business environment and an institutional interaction space as well as applying various financing instruments and a number of other mechanisms.

Latvia is the third among the Baltic States in terms of the number of clusters and cluster initiatives. In total, there are about 15 of them identified. The most mature are an IT cluster and a cluster of forestry and wood processing industry. The majority of cluster members are located in the metropolitan area of Riga and its vicinity. The basis for the Latvian economy is formed by micro and small companies. They account for approximately 95 % of it. For them, clustering is an effective tool for inc-

⁴ *Lithuanian Clusterization*. 2017. Research Institute for Changes. URL: <http://www.lca.lt/summary-of-the-report-lithuanian-clusterization-2017> (accessed Feb 15, 2013).

reasing competitiveness. Medium-sized and large enterprises also participate in clusters. However, their share is not high. The leading role in coordinating cluster development efforts in Latvia belongs to industry associations. The state does not take such an active part in clustering, which is negatively assessed by their direct participants [20]. There is no overall coordination of clusters and cluster initiatives at the national level. Latvia's degree of industrial cluster formation is insufficient [21]. This limits the ability of local businesses to profit from economies of scale and effectively use various locally-generated resources that are inherently inalienable and are an important factor in long-term competitiveness. Therefore, they are forced to rely on comparative advantages in labour costs. According to the survey of Latvian cluster representatives [20], the major factor for cluster emergence is the desire to increase export volume (89%), to increase competitiveness (78%), to increase productivity (44%) and to access additional sources of financing (67%). Only a fifth of all respondents consider the formation of a cluster as a mechanism for strengthening existing cooperation and an opportunity to execute their common strategic idea. The cluster growth in Latvia is hampered not only by a lack of financial resources and bureaucratized state support but also by a number of factors impeding the formation of cognitive, social and organizational proximity. For example, lack of understanding in society of the very idea of a cluster and its importance for regional development; difficulties in reaching a consensus on common mechanisms and tools for improving competitiveness, and at the initial stage of clustering — difficulties in finding partners sharing a cluster approach and in identifying complementary activities [20].

Problems of identifying the multidimensional boundary of the Baltic cluster: a case study of the IT cluster of Latvia

The Latvian IT cluster was established in 2000 and is one of the most mature territorial clusters in the Baltic States. This makes it attractive for testing a comprehensive methodology for delimiting the multidimensional boundary of a territorial community. A well-developed IT sphere is one of the national priorities in the Republic of Latvia, and a strong IT cluster is an important structural element of its economic system. Identification of the spatial boundaries of an IT cluster as a planning and management object is of significant practical importance. At the national and regional levels, Latvian authorities can use it when implementing their territorial and sectoral development policies; at the intercompany level, cluster managers can use it for devising a cluster growth strategy. Since the boundaries of all cluster formations are subject to strong fluctuations, their delimitation at a certain point in time is similar, in a way, to a pic-



ture of a cluster taken at a given point in space and time. Assessment of the dynamics of cluster boundaries requires continuous monitoring of its components: geographical, institutional, cultural, organizational, technological, social and cognitive. The results of this study represent a spatial section at the beginning of 2018.

The characteristics of cluster members determine its internal boundaries. The internal geographic boundary of the Latvian IT cluster outlines the location of its existing members. It lies within the administrative boundaries of Riga. Despite the changes in its organizational structure over the past five years, the cluster retained a high degree of concentration — within a single urban metropolitan area. The internal contour of the institutional boundary of the Latvian IT cluster is determined by the membership mechanism. In 2018, there are 38 members in the cluster. These are mostly small IT companies registered as limited liability companies. More than 20% of the members began their operation before the 2000s and have gained considerable work experience. There are also several large companies: "TIETO Latvia" and "VISMA Enterprise" employing around 700 and 200 people respectively. A lot of the cluster members are also members of specialized national associations (for example, the Latvian Information Technology and Telecommunications Association, the Latvian Open Technologies Association, the Federation of Security and Defence Industries of Latvia, the Latvian Internet Association). This creates favourable conditions for the formation of a single institutional and cultural space covering most IT companies in the country. The IT cluster itself has a membership in the Latvian Information and Communication Technologies Association and the Latvian Chamber of Commerce and Industry. This allows for the development, support and dissemination of uniform business standards in the IT sphere.

The internal organizational boundary of the Latvian IT cluster is inter-organizational in nature, as the members of the cluster are not only business but also research and educational institutions (Riga Business School, Baltic Computer Academy (BDA), "Learn IT" — a coding club for children). The industry affiliation of the IT cluster members is not homogeneous. There are IT firms specializing in software development, IT consultations, hardware architecture, networking and data transmission solutions, financial and business management solutions, business analysis solutions, Enterprise Resource Planning solutions, finance management and accountancy solutions. Also, there are companies that provide complementary services including publishing, marketing, hosting, etc. Nevertheless, the intersectoral linkages within the cluster's internal organizational boundary are rather limited due to a small number of its members. It is difficult to assess its social boundary remotely. We can only make an assumption that the cluster members are socially connected since the number of their employees is rather small and they are concent-

rated in one city with a population of slightly over 640 thousand people. We assume that social links among the employees of the cluster members are formed not only through professional contacts but also through informal interactions (for example, the use of common urban infrastructure, studying in the same educational institution (school, university, etc.), living in the neighbourhood as well as through common friends, acquaintances, relatives, etc.).

Delimitation of the internal cognitive boundary of the Latvian IT cluster as well as the social one is a laborious process and is associated with a high degree of subjectivity. The cognitive boundary directly outlines the contours of cognitive proximity. It is a mutual understanding arising from the actors' similarity in thinking and perception, including the perception of their mission, goals and paths of development, and existing problems. In general, the very fact of membership shows a certain level of mutual understanding between the companies reached at the stage of development of their common vision: "to create a value network of Latvian companies providing reliable IT development and application services for export". For the majority of the cluster members, the preferred areas of cooperation include development of export activities and joint promotion. An analysis of specialization of the cluster members has shown that there is a small group of enterprises that focus on the development of IT technologies for the health sector (ABC Software, Datakom, Meditec, Datamed, etc.). This may be complementary to the Baltic medical and healthcare clusters.

The external boundary of a cluster is determined by the location of its members' partnership network. The external geographical boundary of the Latvian IT cluster extends beyond the national border, passing through the territory of 33 states⁵. This creates favourable conditions for the circulation of new knowledge. In Europe, the cluster's strongest links are those with the economic entities located in the countries of the Baltic Sea region. The external institutional and cultural boundary of the Latvian IT cluster is quite broad. This is proved by successful cooperation with both companies from the USA and Western Europe, as well as from Eastern Europe, Asia and Africa. Business languages spoken in most member companies include Latvian, English, and Russian. German is widely spoken, too. Some companies use Lithuanian, Estonian, and Norwegian. The external organizational boundary, as well as the internal one, is of an inter-organizational nature. National non-member partners of the IT cluster include educational and research organizations, professional associa-

⁵ Australia, Azerbaijan, Belarus, Brazil, Canada, Denmark, Estonia, Finland, Georgia, Germany, Great Britain, Hungary, Iceland, Kazakhstan, Kenya, Latvia, Lithuania, Moldova, Namibia, Nigeria, Norway, Panama, Philippines, Poland, Russia, Singapore, Slovenia, Sweden, Turkmenistan, Turkey, Finland, South Africa, Ukraine, the USA.

tions, and state institutions; one of the international ones is Belarus High Technology Park. The economic entities of the cluster cooperate with large multinational corporations (Oracle, Novell, Microsoft, Cisco, IBM, etc.). They are their certified gold and silver partners. This ensures high technological compatibility with international companies from the international partnership network of IT giants and significantly expands the technological boundary of the cluster.

The thematic boundary of the cluster is determined by the peculiarities and geographic location of regional actors with similar specialization, competencies, level of development that are not formally cluster members but have the potential for cooperation. The geographical area of the actors complementary to the Latvian IT cluster includes Riga, Marupe and two major transport hubs: Valmiera bordering Estonia and Rezekne bordering Russia. The defining points of the absorption boundary of the Latvian IT cluster are IT centres including clusters, located near the cluster core: Vilnius and Kaunas in Lithuania, Tallinn in Estonia. The proximity measure was their location within a 4-hour drive from each other. This is based on the assumption that the best absorption efficiency is reached when a distance between potential interaction points is such that a person can reach them, transfer information and return within one day. The absorption zone covers the entire territory of the country.

Conclusions

Addressing the problem of equivocality of the boundaries of various spatial-network entities is an important practical task of state territorial development policy. It involves monitoring and assessing transformations of the nodes of territorial economic systems in the geospace, which are the result of a deliberate concentration of resources in strategically important sectors and regions. To ensure national competitiveness, state authorities tend to focus their regional policies on supporting existing or creating new growth points that can give an impetus to the development of the region as a whole. Herein, the growth points are various forms of spatial-network interactions such as a cluster, network, industrial area, etc. formed from a combination of certain types of proximity and rooted in a regional context. The territorial proximity of a particular region is a unique mosaic of the institutional, cultural, organizational, technological, social and cognitive types of proximity of its elements united by geographical proximity being the basis for a variety of interactions, the most stable of which are registered by science and practice. The elements of a territorial social system can simultaneously participate in several various forms of spatial-network interactions, depending on the purpose of contact. These forms feature boundaries that are highly dynamic and flexible

and may not coincide with the administrative borders of regions and go far beyond them. The identification and delimitation of different types of boundaries of spatial-network entities in a changing geospatial environment are vital for accurate assessment and forecasting of their development being influenced by a whole range of external and internal factors affecting the participants of interactions, their external partners and the environment in which they operate.

The reported study was funded by the Russian Foundation for Basic Research according to the research project No. 16-36-00258 "Equivocality in Identifying the Boundaries of Spatial Networking".

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To cite this article:

Mikhaylov, A. S., Mikhaylova, A. A. 2018, Equivocality in Delineating the Borders of a Cluster: The Baltic's Case, *Balt. Reg.*, Vol. 10, no. 2, p. 56—75. doi: 10.5922/2079-8555-2018-2-4.