Theoretical Aspects of Regional Clusters

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Abstract: Regional cluster initiatives plays important role in economy nowadays, but scientists and researchers did not come to single definition of this phenomenon. Regional clusters can be defined as agglomeration of economic activities, horizontal and vertical cooperation of enterprises or Triple Helix network, where university-industry-government interacts or others. This paper explores, from a literature review standpoint, possible dimensions and theoretical aspects of regional clusters. Research findings suggests that regional cluster can be defined as combination of 5 dimensions-single sector enterprises, that cooperate and compete; supportive enterprises from wide range of sectors; public and government institutions, interested in economic development of sector and region; other institutions, like research, education, finance and others and fifth is regional dimension, which combines all four previously mentioned dimensions into one region.

INTRODUCTION

Michael E. Porter [1-5] in his early research defined cluster as a set of related industries, but after developed well known definition for clusters: a cluster is a geographically proximate group of interconnected companies and associated institutions in a specific field based on commonalities and complementarities. Other economists offer cluster definitions based on different measurements. In this cases cluster is:

- type of cooperation [6],
- vertical and horizontal form of network [7, 8],
- geographical proximity of companies [9],
- companies that produce the same product [10, 11],
- companies that share common vision and support infrastructure [12],
- system that connects private and public sector [13].

Renewed interest in cluster phenomena from scientists like Porter and Harvard Business School in early 1990s made clusters a new trend in research and business world. International organizations like Organization for Economic Co-operation and Development (OECD) [14-20]

is researching regional clusters and its impact on global and regional economy. World Bank is looking for opportunities to implement cluster strategies [21-23] and European Commission is collecting data on cluster tendencies, statistics, development [24, 25, 26]. European Commission is also supporting different initiatives like Cluster Innovation Platform, Cluster Observatory and others. The cluster concept is associated with world known cluster-Silicon Valley, that is high-tech cluster in California, USA, where most of high-tech companies like Apple, Adobe, eBay, Google, Yahoo and Twitter are located. Many researchers [9, 5] are trying to explain why business that is located in cluster is more successful. Success of Silicon Valley is explained with presence of two universities (Stanford and California), that ensure qualified workforce and latest research [27]; formal and mutual agreements between companies in location [9] that reduces uncertainty and helps companies to obtain additional resources, expertise and complementary services [28]; and other factors, including platform for latest innovation and research and supporting industries and institutions. Although Silicon Valley is one of the most successful cluster examples, scientists [29] agree and tendencies in latest researches by international

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organizations [21, 30, 31] shows that nowadays more attention is paid to regional clusters that emphasis regional uniqueness, and ensures regional growth and development by setting up university, industry and government network in regions.

MATERIALS AND METHODS

Although researchers and scientists tend to use Porter's definition of clusters [29, 32, 33], there is not a consensus. For this reason aim of this paper is to explore, from a literature review standpoint, theoretical aspects of regional clusters. To achieve the aim of the paper, author set up the following tasks: 1) to describe historical development of regional cluster term, 2) to introduce regional cluster definition based on five dimensions, and 3) to analyze presence of all five cluster dimensions depending on cluster typology and life cycle. Paper is literature review based on the monographic descriptive method, as well as analysis and synthesis. Material used for this research is scientific research articles, published in well know journals and conference proceedings and books. Based on available information author develops definition of regional clusters and analyse its characteristics and historical development.

RESULTS AND DISCUSSION

Cluster theory as we know it nowadays has arisen in 20th century, and is characterized by theoretical and empirical studies related to the enterprise, its location, collaborative ties with other companies and institutions, and the degree of agglomeration. But cluster concept has developed earlier.

Starting with the beginning of regional economic theory in 18th century in Adam Smith's and David Ricardo's works, geographic and regional aspects of enterprise, resources and location of economic activities are receiving increasing attention. Absolute advantage theory of Adam Smith is considered as the basis for the theory of economic specialization between firms, regions and countries [34, 35]. David Ricardo [36] defined a comparative advantage of international trade and specialization and moved the theory of regional competitiveness, based on one of the country's capacity to produce goods cheaper than any other country. Ricardo and Smith ideas are reflected in the general principles of the cluster concept.

Research on concentration of business and economic activities in the given geographical area, as is the case of regional clusters, can be found in a number of economic researches from 19th and 20st century. In this historical period cluster concept has not yet been introduced, but, for example, in study published by Alfred Marshall in 1890 [37] industrial districts in England are analysed. Marshall comes to the conclusion that many small factories operating in the same sector benefit from the concentration in a particular place. The cluster concept was introduced by Porter in the end of 20th century, however, Porter and other economic theorists [1, 4, 38] points out that Porter is not the implementer of cluster ideas as they began as an industrial district in Marshalls' theory. Cluster concept has evolved over time, and author divide concept development in several stages, as is shown in Table 1.

In Table 1 author compiled the main theories that have contributed to the cluster concept development since 1890. In 1890 Marshall introduced the term "industrial district" and carried out the study that contribute to cluster theory nowadays. After Marshall's death an interest in industrial districts subsided, due to emphasis on mass production and large corporations [57]. Interest in industrial districts rebirth in Italy, where Beccatini conducted studies and enriched industrial district theory with social, historical and cultural aspects of the business that are kept together in a particular place [39, 40]. Ideas of Beccatini are criticized by a number of economic theorists [58, 59], indicating that the research is based on deep historical factors in Italy and the historical position of SMEs, so that the study results cannot be generalized beyond.

A.J. Scott [45], after studying the high-tech, primarily medical, clusters, enterprise choice to operate close to other similar companies based on cost-saving opportunities, but later he [46] complemented theory by two factors that ensure the long-term existence of agglomeration namely access to skilled labour and structured cooperation ties between the companies, which also contributes to the process of innovation in enterprises.

Modern cluster theory was founded by Porter who defined clusters as interactions of companies from interrelated industries in defined geographical area. The new economic geography is having wider view on clustering theory [60] and makes the assumption that the spatial structure of the business leads to interaction between transaction costs and all kinds of profit

Table 1: Development of cluster concept since year 1890 until nowadays

| Theory	Theoretician of economics	Cluster profile	Cluster concept according to theory
Industrial district theory	Marshall [37]	Industrial: emphasis on manufacturing industry knowledge transfer.	Agglomeration of economic activities into industrial districts provides access to skilled labour, raw materials with lower price and ensures
Italian School creative milieu theory	Becattini [39-42], Bellandi [43], Lazzaretti [44]	Socio-economic: emphasis on social, historical, cultural aspects	Industrial district is a socio-territorial entity which is characterized by an open community and corporate co-existence and interaction of a given geographical area. Firms are kept together by complex internal and external factors, common and related costs, historical and cultural complex.
Californian School transaction cost theory	Scott [45, 46], Scott and Angel [47]	Spatial: emphasis on location centre of economic activities	The manufacturers tend to coalesce and form a certain economic activity centres. It is formed as a result of high transaction costs in case of spatial distribution of companies, which transaction costs interact.
Cluster theory	Porter [1-4]	Industrial: emphasis on competitiveness	Geographically proximate group of interconnected companies and associated institutions in a specific field based on commonalities and complementarities.
New Economic Geography theory	Krugman [48, 49], Schmutzler [50]	Spatial: emphasis on location of related and unrelated enterprises	Interaction between companies, suppliers, employees, customers. In addition, the company has positive benefits from the proximity of firms in other sectors, not just related industries.
Regional Innovative System theory	Cooke [51],Hae Soe [52], OECD [14-20]	Innovative: emphasis on innovative high-tech clusters	In the knowledge based economy, an innovative business group (cluster) is based on a complicated infrastructure, which is sharing knowledge and is using cooperation between entrepreneurs, investors and researchers.
Regional Cluster theory	Porter [5, 53], Rocha, Sternberg [54], Porter, Delgado, Stern [55, 56], European Commission [24]	Regional: emphasis on cluster and regional development interaction	Concentration of interdependent companies and other institutions in specific geographic area. Companies interact with each other, collaborate, and compete. The central thesis: regional clusters have a positive and statistically significant impact on regional development indicators, such as employment, wages, and innovation capability.

Source: Authors' construction
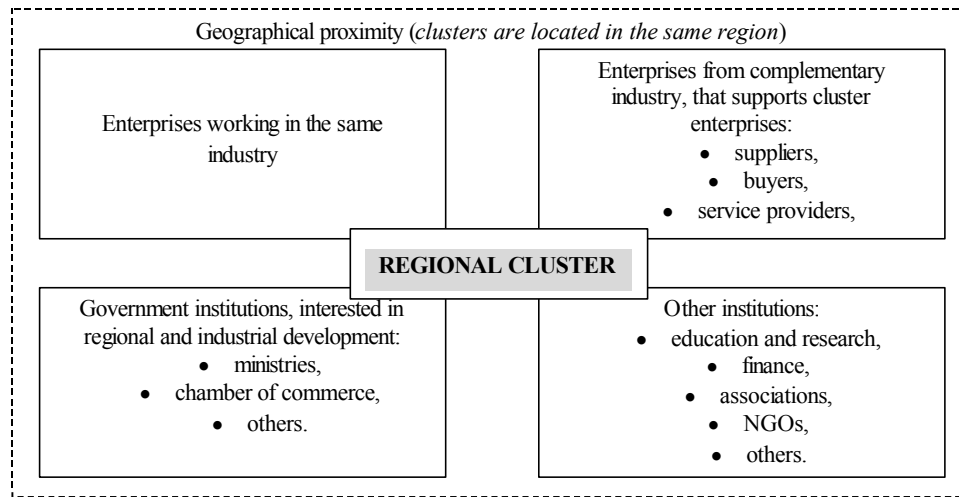
Fig. 1: Dimensions of regional cluster concept
    Source: Authors' construction

improvement opportunities [61]. Companies are gaining positive agglomeration effects even if the agglomeration is made by different companies in different industries. Also, non-industry stakeholders interact with one another, creating a positive environment for knowledge-sharing, technology transfer and marketing [48-50, 62].

Porter's cluster theory laid the foundation for competitiveness dimension of clusters, but soon after the field study conducted by the OECD, and studies of economic theorists [51, 52] showed that clusters stimulates innovation. Thus the next stage in the development of clustering theory was developed-

innovation system theory. Company as a whole, individually and collectively ensure the creation and diffusion of innovation, provides a system in which the government can implement policies conducive to innovation [63] to ensure the development of innovation in all forms of regions [64]. Innovation system depends on infrastructure, institutional development, business and political environment [51, 65].

Latest of cluster theories is regional cluster theory with emphasis on interaction between regional clusters and regional development. Porter, who invented cluster theory, in his further researches with colleagues Delgado and Stern [5, 53, 55, 56] came to conclusion that clusters play important role in regional economy. Literature review points out important dimensions of regional cluster. Author combine five most important regional cluster dimensions in Figure 1.

First, regional cluster is made of companies working in the same industry. Marshall in early 1890s [37] built his industrial district theory based on companies from one industry, and it stays as main factor for cluster establishment and development nowadays. Geographic proximity of companies in some location is made of small and medium size enterprises [37, 40, 41, 66], which cooperate and compete, and complement each other [2-5]. Companies can be related with buying and selling relations, or cooperate in innovation and development process of new product or service, or jointly work to attract skilled workforce [67, 68]. Author summarise that agreements between companies can be formal (signed agreements, legislation) or informal (mutual agreements on innovation and development process).

Secondly, regional cluster is made of companies from complementary industries and supportive institutions that result in formal and informal relations between enterprises, government institutions, non-governmental organizations, finance, educations, research and other institutions [2-5, 9, 13, 29, 54]. In the cluster establishment phase enterprises and institutions are general, but together with cluster development, specialised institutions and enterprises appear [69]. Cooperation with complementary companies and institutions result in government support for cluster development, access to finance, knowledge and technology transfer and others.

All the previously mentioned factors and dimensions are located in geographical proximity, forming the most important dimension of regional cluster [5, 55, 56]. It is not important where the company is located, it is important to be located near other companies, to form previously mentioned cooperation networks. Marshall in early 1890s [37] indentified benefits of this type of location-it is lower costs and access to qualified workforce and resources. Marshall and other scientists focus on benefits from location, but latest tendencies in economic literature [55, 56] focus on positive effect on regional growth and development.

Based on previously described regional cluster dimensions (Figure 1) author has developed definition for regional cluster: regional cluster is informal form of cooperation and interaction between companies in the same industry, involving related and complementary businesses, scientific, educational and government and other related institutions in the same region.

Author also suggests that cluster dimensions will be present fully or partly depending on stage of development and type of cluster, discussed in following chapters.

Researchers [70-73] and institutions [74, 71] have found that cluster has a life cycle similar to product and industry life cycle. Cluster life cycle can be divided in stages according to cluster development. It can be hero phase, maturely and renaissance, followed by decline and museum phase [75], or potential, latent and working clusters [76] or others. Despite different definitions, author is summarizing cluster stages and its characters:

- Embryo or agglomeration stage-the companies indentify common aims, benefits from location without certain forms of cooperation,
- Cluster development stage-formal ties between companies are established around central activity. All involved parts indentify benefits from agglomeration and cooperation,
- Established cluster stage-all five cluster dimensions are partly or fully present. Cluster is formed as active network between companies and institutions,
- Mature cluster stage-in this stage cluster also forms cooperation and ties with other clusters, its members. Cluster has reached highest point of its development. To ensure future existence of cluster, it needs transformations,
- Transformation stage-cluster has to introduce new growth strategies in form of new technology, products or markets or separate one or more other clusters around core cluster.

Other factor influencing presence of cluster dimensions is type of cluster. Economic practitioners have

developed cluster typology based on cluster structure and type of networks and cooperation between participants. Edena and Molot [77] found that clusters can be made with horizontal links (if enterprises are engaged in the same industry) or vertical links (if enterprises are engaged in complimentary industries). Detailed and the most commonly used [78, 79] typology was developed by Markusen in 1996 [80]. According to Markusen, there are four types of clusters:

- Marshallian type-members are small and medium sized locally-owned firms. Employment growth prospects dependent on synergies and economies provided by cluster,
- Hub-and-spoke type-members are one or several large firms with numerous smaller suppliers and service firms. Employment growth prospects dependent on growth prospects of large (hub) firms,
- Satellite platforms-members are medium and large branch plants. Employment growth prospects dependent on region's ability to recruit and retain branch plants,
- State-anchored type-members are large public or non-profit entity and related, supplying service firms. Employment growth prospects dependent on region's ability to expand political support for public facility.

Authors, that developed cluster typology [77, 79, 80] commonly agree, that one cluster can consist of characters from different cluster types depending on cluster life cycle stage, character and other factors.

CONCLUSIONS

Although term "cluster" is widely used in economics, there is no consensus on term and characters of cluster. Historical background of cluster concept shows different cluster profiles and emphasis on industrial, socio-economic, spatial, innovative or regional cluster aspects thorough cluster theories. For this reason author develops five dimensions of regional cluster, defining it as informal form of cooperation and interaction between companies in the same industry, involving related and complementary businesses, scientific, educational and government and other related institutions in the same region. All five dimensions of regional cluster will be present depending on stage of cluster life cycle and type of cluster.

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