CLUSTER AS A TOOL FOR THE CHALLENGES OF DEVELOPMENT

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Abstract. *In this paper we discuss the cluster as a tool for the Challenges of Development. Our opinions are based upon the conclusions of the EU Commission Communications, scientists and research organizations. It is well known that economic prosperity among the regions of Europe is linked to the degree of cluster strength. Regions with a higher share of employment in industries that belong to strong clusters are generally more prosperous. Clusters are part of Microeconomic Competitiveness. Cluster is a system supporting the business management improvement. Clusters may embody the characteristics of the modern innovation process: they can be considered as "reduced scale innovation systems". The cluster activities and initiatives help establish interdisciplinary teams on special thematic fields, which jointly initiate novel ideas and innovative products. In cultural and creative industries, clusters are vertically disintegrated networks of production units that can function flexibly when faced by high levels of instability and the risk that prevails in the production and consumption of cultural goods and services. Cluster's ten emerging industries cover more than 45 million employees in Europe, which corresponds to 22% of all European employment and 35% of European payroll. Clusters and, more generally, regional agglomerations are often at the core of innovative development. Clusters help to develop a special form of thinking. It can direct the policy towards different directions, namely: development of science and technologies, education and vocational training, export and foreign investments. Clusters provide the welfare, that is, a result of country's competitiveness. Cluster-based approaches could become a core tool for a "new industrial policy".*

Keywords: cluster; innovation; competitiveness; emerging industries; cluster policy.

Introduction

Clusters are linked with generally recognized successful cases in the world economy. Cluster-based approach is unique and universal. It means that the competitiveness of developed country's economy is more increased by clusters while the economy is developed synergistically in the condition of developing economy.

In this paper, we discuss about the cluster as a supporting factor of microeconomics competitiveness. As a system, it encourages innovation, the emergence of new sectors, acts synergistically and provides the increase of competitiveness of the region. We will prove our position based on the works of the European Commission communication, staff working documents, reports of recognized research organizations and famous scientists.

Marshall (1890) first introduced clusters as part of an economic analysis. "He described the advantages of agglomeration of economic activities in terms of availability of a qualified workforce and specialization. Similarly, Schumpeter (1939) referred to the "swarming" or clustering of industry. Based on Alfred Marshall's concepts, Becattini raised the issue of the importance of place-based economic development with the notions of external economies that changed the approach to industrial policy. More recently, the concept of clusters has been popularized and implemented by Porter (1990)" (COM, 2008, p.7).

"More recent research on clusters indicates that even within a given field there is room for many different successful clusters, each taking a unique, individual role. Clusters are differentiated by their specialization in a particular stage of their field's value chain, by their focus on specific geographic areas, or by targeting selected customer needs or market segments" (Ketels, 2003, p.4).

While analyzing the Cluster, as a supporting factor of microeconomics competitiveness, we used the Worlds Economic Forum's Global Competitiveness Reports. For cluster, as seen through this prism, is characterized by invisible supporting effects of development, which we presented in the paper. Together with these effects, we discussed on emerging industries. These ten industries contribute efficient functioning of the cluster and they themselves develop better.

In the review of Cluster as a system, we took the system characteristics from several studies (Laszlo & Krippner, 1998; Laszlo, 2011; Morin, 2014). Then we analyzed the cluster and came to the conclusion that the cluster was a system. We think that the cluster's systematicity stipulates that the cluster is a universal tool for the challenges of development.

The Clusters success gave a big impulse for Cluster Initiatives (CIs) in many developed as well as developing countries. "CIs in developing and transition economies are considerably younger than in advanced economies. This reflects the fact that cluster based development projects became popular in advanced economies as early as the mid-1990's, while CIs were not adopted in developing and transition economies on a larger scale until after the year 2000. In developing economies 55% of CIs were started in 2003 or later. For transition economies that share is even higher, 72%, while the corresponding share for advanced economies is only 28%" (Ketels Lindqvist & Solvell, 2006, p.13). For interested readers in further study of CIs, the same group of scientists submitted "The Cluster Initiative Greenbook 2.0" (Lindqvist, Ketels & Solvel, 2013), that describes: "what they do, how they operate, how they perform; The analysis is based on data from 356 cluster organizations in 50 countries world-wide, primarily in OECD countries".

There are lots of literature on the efficiency of clusters and Cluster Initiatives in economy, the partly analysis of which is sustained in this paper format. So we would like to mentioned that we fully agree with Ketels (2015, p.28), who, based upon the many authors' work (Aiginger, 2006; Aghion et al., 2011; Rodrik, 2004; Stiglitz et al., 2013; Warwick, 2013), argues that "cluster-based approaches could become a core tool for a "new industrial policy".

Methodology

For the preparation of this publication, we reviewed the literature for the clusters, systems, innovations and competitiveness. Data, reports and surveys were analyzed in detail, in order to create a clear picture related to research topics. In this study, we focus on analyzing visible and invisible sides of clusters. To test these hypotheses we use the case study as an analytical tool, also synthesis, analogy, correlation and systemic approach.

Cluster – part of the Microeconomic Competitiveness

"An industrial cluster is an agglomeration of companies, suppliers, service providers, and associated institutions in a particular field. Often included are financial providers, educational institutions, and various levels of government" (WB, 2009, p.11). The concept of clusters is very similar to the concept of "open innovation" which is nowadays broadly accepted. Similarities also exist with the concept of "triple helix".

The World Economic Forum's researchers in their report wrote, "The New GCI framework distinguishes two broad areas of microeconomic competitiveness (Figure 1): the sophistication of company operations and the quality of the business environment. A third category - the state of cluster development (agglomeration economics) - is conceptually distinct, but data limitations preclude independent measurement. Cluster variables are included as part of the business environment" (GCR, 2008-2009, p.48).
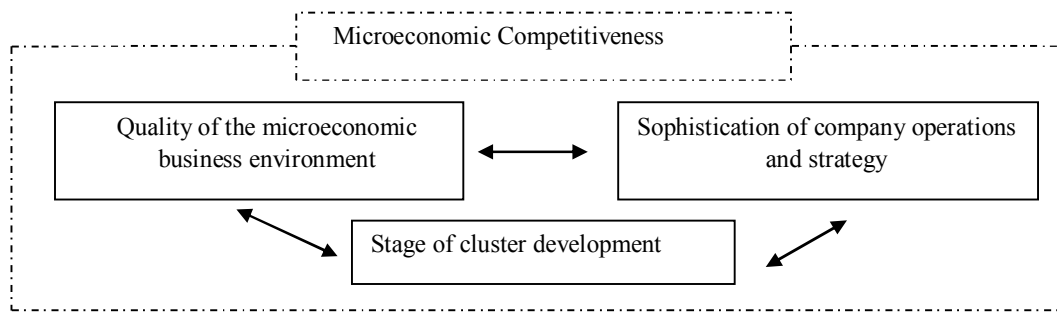
Figure 1. Microeconomic Competitiveness by the World Economic Forum

Besides the above-mentioned importance of a cluster, we would like to highlight the invisible effects of clusters that many scientists write about. They are as follows:

- "Clusters affect competition in three broad ways: *first*, by increasing the productivity of companies based in the area; *second*, by driving the direction and pace of innovation, which underpins future productivity growth; and *third*, by stimulating the formation of new businesses, which expands and strengthens the cluster itself. A cluster allows each member to benefit *as if* it had greater scale or *as if* it had joined with others formally—without requiring it to sacrifice its flexibility" (Porter M., HBR, 1998);

- "Although cluster firms and cluster organizations compete against each other - in particular those which belong to the same sector of activities - there are many reasons justifying competition and cooperation at the same time. There is scope for further strengthening cluster excellence through trans-national cluster cooperation at business level" (COM, 2008, p.7);

- As members of clusters, they have sense of "civil responsibility" which makes them to think broader than just from the point of view of private-ownership interests. The result is effective owner. Clusters also completely answer the modern opinions regarding the social responsibility;

- The speed of cluster formation depends and is determined by the processes that are taking place beyond the clustering scheme. Different processes are taking place, such as: organizing and activation of copyright protection and patent activities, transfer of technologies, development of international scientific and educational links that promote processes of integration, etc.

At evaluating the Cluster-based economic policy, the worldwide recognized researchers point out that "Cluster-based economic policy suggests a different perspective: First, all clusters are important, not only traded or high-tech sectors. The productivity across all of them determines the standard of living a country or region can sustain. Second, cluster efforts are not about targeting - they are a tool that, in principle, is open to all clusters in a region. Third, cluster efforts are directed at improving the underlying conditions for higher levels of productivity and innovation, not the outcomes in terms of market share or employment directly" (Ketels, 2003, p.16).

For the extension of the above mentioned, we think that the cluster of education and science must be granted the most important role among any valid clusters in economics. This cluster is "the heart" of system and promotes the innovation and competitiveness in the developed countries. Cluster formation in the economy of developing country is the shortest way of development. We will try to explain the reasoning and opinions and expressed schematically the invisible effects of education and science cluster on transition economies (Gagnidze, 2013, p.3) on Figure 2.

For analyzing the cluster of education and science, we applied the list of the main participants of the cluster from the work by Solvell. In his book he has "identified six main types: firms, financial actors, public actors, universities, organizations for collaboration and media"(Solvell, 2009, p.16).

We consider that frequency of branches of the "cluster tree" presented on Figure 2 is determined by "fertility" of the ground on which this tree grows. As for the fertility of the ground, it's determined by intensity of the processes going on beyond the cluster participants, namely: interest of government in cluster policy, attractiveness of investment environment, rate of technology transfer, formation and

effective functioning of corresponding institutions, development of new educational and vocational programs, creation and generation of new knowledge, enforcement of intellectual property law, promoting development of close integration processes based on long-term scientific and educational links, etc.
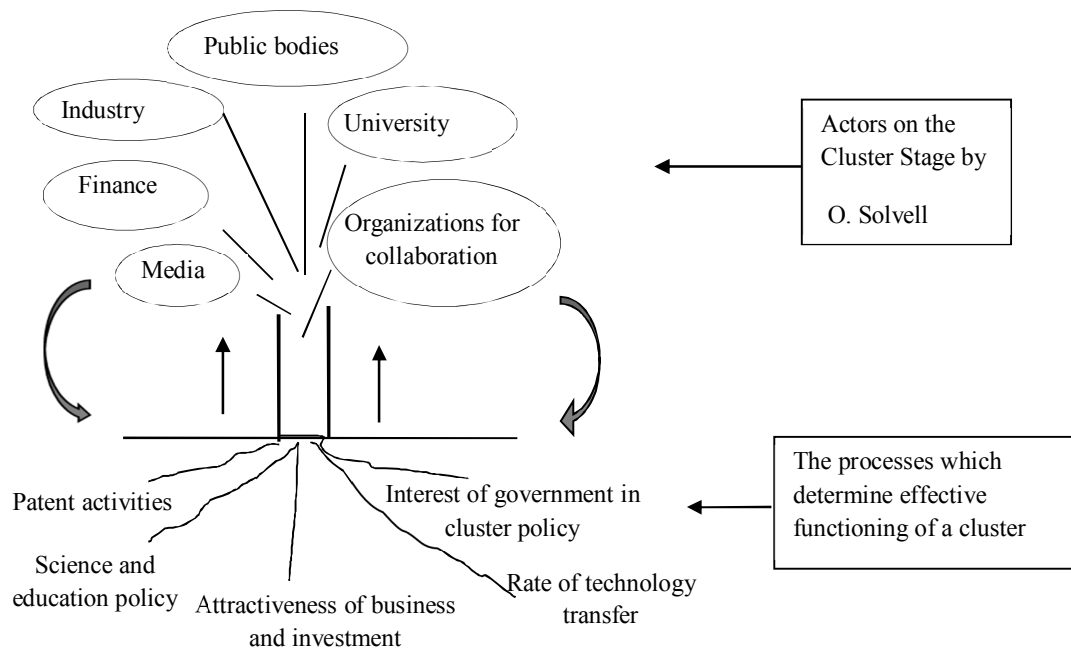

Figure 2. Visible and invisible sides of the education and science cluster

The overground and underground parts, given on Figure 2, with close relation to each other create continuously updated and effective system. The frequency of branches of the cluster tree is too high in the economy of developed countries. This is hard to say on the Developing Country where the desirable effective links are weak and their results are less impressionable. We wish to mention convincingly that the education and science cluster is really "Perpendo Mobile" for the development of any economy. The difference is only among the "Power" of this engine. We should search its reason in Gap Model. It has been "identified seven gaps of innovation in clusters. There are five internal gaps and two external gaps (Sölvell & Williams, 2013, p.23).

If we describe the characteristics of the "ground" for clusters to grow presented on Figure 2 in Georgia, it can be said that the previous government of the country didn't show much interest in developing cluster promoting policy. The surveys prove that Georgia and Belarus were the only ones among the countries of Eastern Partnership in which there were no discussions about cluster policy on the government level let alone the European countries, where there are over 2000 Cluster Initiatives nowadays.

Clusters and innovations

Economic prosperity among the regions of Europe is linked to the degree of cluster strength. Regions with a higher share of employment in industries that belong to strong clusters are generally more prosperous (COM, 2008, p. 28). 78% of the innovative companies working in a cluster introduced new or significantly improved products compared to the 74% of the 2004 Innobarometer. Similarly, 63% of the innovative cluster companies introduced innovative production technology, compared to the 56% that the Innobarometer found amongst innovative European Union enterprises two years ago. These results suggest that innovation is indeed spurred by clusters (SEC, 2008, Annex, p.20, 23, 27).

In proving the mentioned, we focus on to two facts: *First*, the World Economic Forum's researchers write in their reports on evaluating the content of "Twelfth pillar: Innovation": "it means sufficient investment in research and development (R&D), especially by the private sector; the presence of high-quality scientific research institutions that can generate the basic knowledge needed to build the new technologies; extensive collaboration in research and technological developments between universities and industry; and the protection of intellectual property" (GCR, 2014-2015, p.9). *Second,* the named Twelfth pillar with others includes the following indicators: Quality of scientific research institutions; Company spending on R&D; University-industry collaboration in R&D; Gov't procurement of advanced tech products; Availability of scientists and engineers; PCT patents. It is clear that all the above-mentioned characteristics in any country's economy are improved with the existence of cluster (the more powerful the cluster is, the more it's improved). Once more, it points out the universality of the cluster approach.

It is mentioned in the statistical analysis and overview of current policy done in many countries that "Innovation is increasingly characterized as an open process, in which many different actors - companies, customers, investors, universities, and other organizations - cooperate in a complex ways. Ideas move across institutional boundaries more frequently. The traditional linear model of innovation with clearly assigned roles for basic research at the university, and applied research in a company R&D center, is no longer relevant. Innovation can benefit from geographic proximity, which facilitates the flows of tacit knowledge and the unplanned interactions that are critical parts of the innovation process. This is one of the reasons why innovation occurs locally whereas its benefits spread more widely through productivity gains (Innovation Clusters in Europe, p.5).

The University is granted the special role for effective operation of clusters. The necessity of their modernization is mentioned in the documents of the Commissions. "The Council stresses the vital role of higher education and lifelong learning in supporting innovation. The Council supports the conclusion of the Commission's Communication "Delivering on the Modernization Agenda for Universities" that universities in Europe must be reformed and modernized. It also agrees that the priority areas for reform are improving governance, developing new partnerships with business, increasing and diversifying sources of funding and extending opportunities for higher education and lifelong learning to support the innovation capacity of the labor force" (2769th C/06/337, 2006, p.5).

The strong interdependence between the Clusters and Innovations is also confirmed by that Innovation clusters are determined in the latest documents of the Commission, namely: "Innovation clusters means structures or organized groups of independent parties (such as innovative start-ups, small, medium and large enterprises, as well as research and knowledge dissemination organizations, non-for-profit organizations and other related economic actors) designed to stimulate innovative activity by promoting sharing of facilities and exchange of knowledge and expertise and by contributing effectively to knowledge transfer, networking, information dissemination and collaboration among the undertakings and other organizations in the cluster" (SWD, 2014, p.10).

Clusters and Emerging Industries

Cluster's ten emerging industries (Advanced Packaging, Biopharmaceuticals, Blue Growth Industries, Creative Industries, Digital Industries, Environmental Industries, Experience Industries, Logistical Services, Medical Devices, and Mobility Technologies**)** cover more than 45 million employees in Europe, which corresponds to 22% of all European employment and 35% of European payroll (Ketels & Protsiv, 2014, p.4). "Emerging industries" are either new industrial sectors or existing industrial sectors that are evolving or merging into new industries. They are most often driven by, needs, key enabling technologies, new business models such as innovative service concepts, and by societal challenges that industry must address as a matter of survival (EFCEI, 2013, p.9).

There are indicated in the documents of the European Commission that "Clusters should be open, flexible and attractive to the best talent and expertise available worldwide. Efforts at regional, national

and EU level should facilitate the establishment of closer and more efficient linkages between clusters as well as with leading research institutes within Europe and abroad. At the same time, cluster organizations are invited to improve their support services and better integrate innovative SMEs into clusters (COM, 2008, p.9.). Researchers of emerging industry pointed out that, "Small firms playing a disproportionately large role in the development of emerging technologies. In fact, despite accounting for a more 8% of all patents in the database, small firms contributed 24% of the patents of U.S. firms in emerging industry clusters" (Monfardini et al., 2012, p.20).

A key role for a cluster organization is therefore to facilitate the creation of new value chains by connecting companies from different sectors and sub-sectors that have a need to move up in the new value chain. "A very good example of such a sophisticated strategy can be found at the management organization of the German cluster supported under the Leading Edge-Cluster Programme of the Federal Ministry of Education and Research (BMBF). The cluster is regarded as a pioneer for Industry 4.0 and gathers 174 companies, research institutes and organizations from various industries such as mechanical engineering, automotive components, agricultural machinery, industrial laundry technology, electronics and ICT. At its core are more than thirty cross-sectorial innovation projects that are combined with so-called "sustainability initiatives" to ensure technology transfer among cluster participants and commercialization of the new products at the global market (Lämmer-Gamp, Kergel & Nerger, 2014, p.29). The same we can say about Chemical Cluster of Bavaria.

We can discuss another good example for combining services following a strategy that aims at the promotion of cross-sectorial fertilization is provided by the Greek Corallia – Hellenic Technology Cluster Initiative. Corallia host three different clusters: gi-Cluster (Innovative Gaming Technologies and Creative Content cluster), mi-Cluster (Nano/Microelectronics-based Systems and Applications Cluster) and si-Cluster (Space Technologies and Applications Cluster). Thus, the cluster is a strong tool for the development of related and new branches for the country on any level of development.

Cluster as a system

The word "system" derives from the Greek "synhistanai" which means "to place together". The scientists write about the system that "A system is a set of interconnected elements which form a whole and show properties which are properties of the whole rather than of the individual elements (Laszlo, 2011). In its broadest conception, a "system" may be described as a complex of interacting components together with the *relationships* among them that permit the identification of a boundary-maintaining entity or process (Laszlo & Krippner, 1998, p.47). The claim that a system is more than the sum of its parts is very well known, and indeed was already made by Aristotle, and it encapsulates a very interesting point, namely that a system has certain qualities and properties that we cannot find in the parts by themselves. These qualities come from the *organization* of the system (Morin, 2014, p.15). Within clusters, these entities can operate more efficiently and *can share* common technologies, infrastructure, pools of knowledge, and demand.

Therefore, the system characteristics are: proximity of the constituent elements, interrelationships of separate and one whole, dynamics, mutual influence, synergy. These features are characteristic for clusters, for which we can conclude that cluster also is a system (Gagnidze, 2015, pp.2-3), namely:

1. As ineffective activity of one of clusters major players ("firms, financial actors, public actors, universities, organizations for collaboration and media" (Solvell, 2009, p.16) will cause damage not only him but to all of them and vice-versa, the success of one will support all of them. *Interaction* is too high;
2. The system is characterized by *synergy*, the same may be observed on Cluster and its component firms. Cluster firms are more innovative than non-cluster firms. "63% of the innovative cluster companies introduced innovative production technology, compared to the 56% that the Innobarometer found amongst innovative European Union enterprises" (COM, 2008, p.20);

3. Cluster creates *an unified system of interests*, namely: a) the interest of science is research, creation of new knowledge and offer of new products to the market; b) the interest of education is to master and transfer new knowledge; c) the interest of businesses is to offer new products to the market and make a profit; d) the interest of State is local economic development and the raise of welfare. Such convergence of interests is an indisputable guarantee of success;

4. Cluster is *not a closed system*, so it brings out the best potential of the region over time. "38% of all European employees work in enterprises that are part of a cluster. In some regions, this share goes up to over 50%while in others it is only about 25%" (COM, 2008, p.27);

5. Cluster system is characterized by *dynamics*, since it forms sub-clusters. As a result, it's renewable and meets the increased and new requirements. Over time, the clusters can change their profile and specialization, which has happened in several large clusters. "One example for such evolutionary process is the Humber seafood cluster in the UK, which transformed from a commodity producer within an increasingly competitive global frozen seafood industry to a leading value-added fresh/chilled fish hub serving Europe" (COM, 2008, p.9);

6. Cluster is an *extendable system*. On one side, it improves the separate firm's management and economic indicators and on the other, with this process it encourages to strengthen the chain of firms and business environment improvement in whole. The World Economic Forum's Global Competitiveness Report confirms this. In this report, the clusters are considered as part of Microeconomic Competitiveness and the state of cluster development is as one of the indicators of "Business Sophistication" pillar. Other indicators of this pillar also focus on cluster, these are: Local supplier quantity, Local supplier quality, Nature of competitive advantage, Value chain breadth, Control of international distribution, Production process sophistication, Extent of marketing, Willingness to delegate authority (GCR, 2014-15, p.105). Let us remember what we have already mentioned above that the cluster supports the improvement of the indicator of the same report "Twelfth pillar: Innovation".

Conclusions

Generally, high quality of life in the developed countries provides the desire to preserve its achievements even in long-term. It is possible to reach the mentioned by inherent benefits for clusters that is described in a brief summary of cluster policies in 31 European countries, namely: the benefits of a cluster come in three dimensions:

• Firstly, companies can operate with a higher level of efficiency, drawing on more specialized assets and suppliers with shorter reaction times than they would be able to in isolation;

• Secondly, companies and research institutions can achieve higher levels of innovation. Knowledge spillovers and the close interaction with customers and other companies create more new ideas and provide intense pressure to innovate while the cluster environment lowers the cost of experimenting;

• Thirdly, the level of business formations tends to be higher in clusters. Start-ups are more reliant on external suppliers and partners, all of which they find in a cluster. Clusters also *reduce the costs of failure,* as entrepreneurs can fall back on local employment opportunities in the many other companies in the same field (Cluster policy in Europe, 2008, p.5).

Therefore, we conclude that the cluster is one of the best tools for the challenges of development.

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