The impact of cluster development on the countries' national competitiveness

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Annotation. The purpose of this paper is to identify the presence or absence of a correlation between the cluster development and the countries' national competitiveness. The authors' hypothesis is that strong correlation exists between cluster development and country's competiveness, which means that the countries with higher level of clusterization - the countries with stronger economies or higher level of national competitiveness. The source of the data analysed in this paper is the Competitiveness report of the World Economic Forum 2014-2015 and 2016–2017. The hypothesis is accepted by the data. Thus, as a conclusion, any country's national competitiveness can be improved through the cluster development, which stimulates the creation of innovations, innovative products and innovative activities in general within the framework of innovative-oriented economy.

Keywords: competitiveness, cluster development, state of cluster development, innovation, business sophistication, higher education and training, institutions.

In the context of the intensification of globalization and in view of the deepening of innovative processes, competition between the countries' economies is increasing each year, therefore issue of improving the countries' national competitiveness is being actualized. In such conditions, traditional instruments of improuving the competitiveness do not fully meet the new business conditions, the challenges of the external environment and, as results, do not allow to solve this problem. So there is one the most effective instrument for increasing the competitiveness of the national economy, relatively new and progressive, - clustering.

Cluster is an instrument for increasing competitiveness, moreover, the foreign experience provides examples of increasing the territories' and production complexes' competitiveness through the implementation of innovative-integrated structures - clusters. The largest contribution to the promotion of clusters was given by Michael Porter, who defined the essence of cluster as „geographic concentration of interconnected companies, specialized suppliers, service providers, firms in related industries and associated institutions (for example universities, standards agencies and trade associations) in a particular field that compete but also cooperate" [2]. To addition, Preissl and Solimene supported Porter's idea and defined clusters as a group of interdependent organizations which contribute to innovation in a particular sector or in a particular industry [3].

Tan and his colleagues argue that relations between companies in the cluster is based not only on cooperation but also on competition, so there are developed coopetition relations, the competition between companies generating a further innovation within the cluster [7].

Camison indicates that cluster brings many advantages to its members, advantages unavailable to those who are not part of the cluster [1].

Analyzing scientific works of foreign researchers about clusters we can notice the following [5; 8]:

• Clusters have a key role and they are very important in the development of microeconomic competitiveness. Clusters affect the competition of companies in three ways: by increasing the productivity of companies, by driving the direction and pace of innovation (which underpins future productivity growth) and by stimulating the formation of new businesses. For example, countries with well-developed clusters in many industrial segments have internationally successful and globally competitive companies,

and the nature of the company competitive advantage is based on sophisticated and differentiated/unique processes and products (compared with the competition based on low costs and natural resources in companies that do not operate in a cluster environment). Through microeconomic competitiveness, clusters contribute to building the sustainable competitive advantage of a region and nation in the global economy in a particular industry sector. It is important to point out the huge impact of clusters on creating a stimulating and desirable business environment, through which an indirect impact of clusters on national competitiveness is achieved. The impact of clusters on the quality of the business environment is reflected in: (1) encouraging the local competition (many studies show that local rivalry is the key driver of international competitiveness, and clusters encourage exactly the competition among the local companies); (2) the development of entrepreneurship; (3) the presence of numerous and specialised suppliers in the local market; and (4) the established public–private partnership and the like.

• Many countries, such as Israel, the Netherlands, Finland, Germany, thanks to their high level of productivity and high investments in research and innovations, have built high national competitiveness, which further promotes the development of innovative world-class clusters.

• On the other hand, the quality of the business environment, as well as the stage of development of a country (seen through a national competitiveness) significantly affect the opportunities for cluster development in a country, their depth, externalities, etc. In general, in all transition and developing countries clusters are still not fully developed (they do not have critical mass) and 'suffer' from the lack of many supporting industries and institutions, specialised local infrastructure, undeveloped forms of association and the like.

• It is important to note that clusters affect national competitiveness in conjunction with other components of the business environment, as well as with components that are in the area of macroeconomic sources of competitiveness (fiscal and monetary policy, rule of law, political institutions, etc). At the same time, cluster development in a country depends on the development of all components of the business environment and stimulating measures in the field of macroeconomic competitiveness.

So, we can suppose, that clucter development of regions impact on the country's competitiveness. And for testing

this research hypothesis, we decide use the following
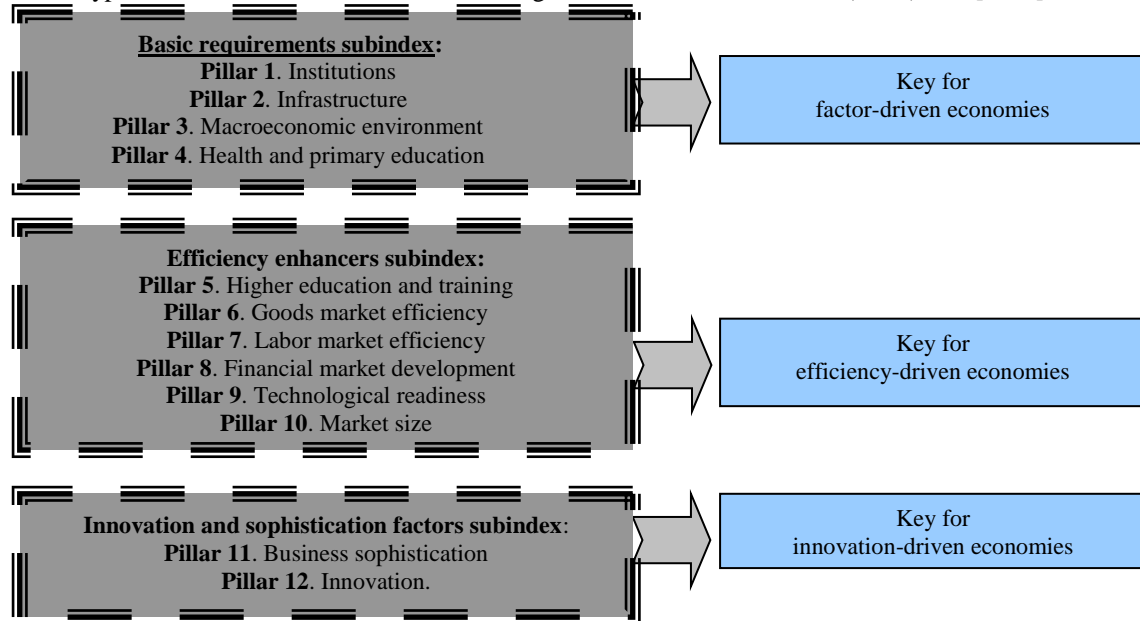
World Economic Forum (WEF) data [9; 10]:

Basic requirements subindex:
Pillar 1. Institutions
Pillar 2. Infrastructure
Pillar 3. Macroeconomic environment
Pillar 4. Health and primary education

Key for
factor-driven economies

Efficiency enhancers subindex:
Pillar 5. Higher education and training
Pillar 6. Goods market efficiency
Pillar 7. Labor market efficiency
Pillar 8. Financial market development
Pillar 9. Technological readiness
Pillar 10. Market size

Key for
efficiency-driven economies

Innovation and sophistication factors subindex:
Pillar 11. Business sophistication
Pillar 12. Innovation.

Key for
innovation-driven economies

Figure 1. The components of the Global Competitiveness Index

(1) 'Global Competitiveness Index. WEF assesses GCI by using over 100 variables, which are organised into 12 pillars of competitiveness (Figure 1). For assessing a large number of variables, use is made of the Executive Opinion Survey of randomly selected companies in each country (sampling of companies that are the subject of survey is followed by dual stratification, based on company size and sector of activity). The survey is carried out through partner institutions in each country, which guide the survey. Questions in the survey instruct respondents (company managers) to assess competitiveness variables on a scale from 1 to 7. One end of the scale (score 1) represents the worst possible situation, while the other end of the scale (score 7) represents the best possible situation.

(2) Variable 'State of cluster development' at the level of national economy enters into the calculation of GCI, is contained in the 11th pillar of competitiveness ('Business sophistication') and belongs to the third sub-index of competitiveness ('Innovation and sophistication factors'). The data are provided on the basis of personal assessment of managers in surveyed companies about cluster development in their country. The question that surveyed entrepreneurs are being asked is: 'In your country, how prevalent are well-developed and deep clusters?' The entrepreneurs answer to this question by giving scores on the scale from 1 to 7, where score 1 means an absence of clusters in the country, while score 7 indicates well-developed and deep clusters in many fields.

A statistical method of simple linear correlation is used to explore the nature and strength of correlation between the state of cluster development and national competiveness, where both observed phenomena are treated as random variables [11].

The authors' hypothesis is that strong correlation exists between cluster development and country's competiveness.

We will consider that values of Pearson's correlation coefficient ρ above 0.7 represent a strong positive correlation [6]. Then, formally written, the null versus alternative hypothesis is:

H0: $\rho = 0.7$ versus
H1: $\rho > 0.7$.

Besides, the authors decided to analyze the existence of relationship between cluster development and another sub-indexes, such as innovation, business sophistication, higher education and training and institutions. We chose these sub-indexes taking account the idea of Triple Helix system [4].

As we can observe the stated below scatter plots from the Figure 2, the relationship between all variables is linear, there is normal distribution.

As we may note, looking at Figure 2, there are strong correlations, which indicates a close relationship between the above Sub-Indexes and Index of state of cluster development and country's national competitiveness.

This fact makes it possible to explain why countries with developed cluster structures more prone to the rapid economic development and high economic results.

Therefore, such an instrument as clusterization, under current conditions of development of an innovative model of economy, is particularly effective for the countries that are increasing their economic potential.

From the Table 1, where are indicated the coefficients of correlation between all variables.

So, looking at Table 1, there the following strong correlations, in particularly: state of cluster development and national competitiveness (GCI in general) (r = 0.92); state of cluster development and sub-index of GCI 'Innovation' (r= 0.91); state of cluster development and sub-index of GCI 'Business sophistication' (r= 0.93); state of cluster development and sub-index of GCI 'Higher education and training' (r= 0.76); state of cluster development and sub-index of GCI 'Institutions' (r= 0.92).

Taking account the strength of correlation between the analysed variables, the following conclusions can be made. First of all, the autours' hypothesis that strong positive correlation exists between cluster development and country's national competitiveness (which expressed through the global competitiveness index) can be accepted.
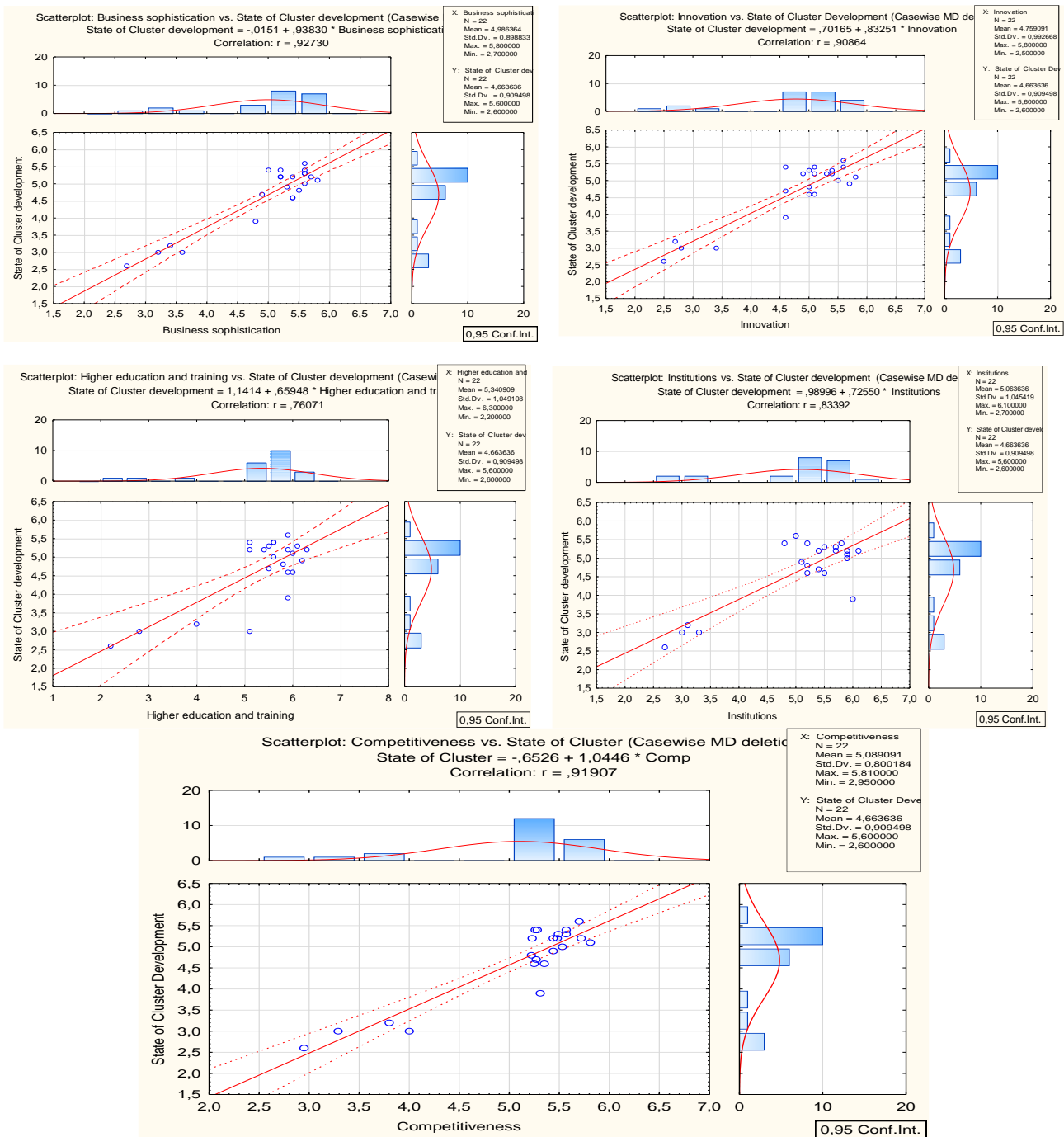
Figure 2. Sub-Index Business sophistication and state of cluster development (upper left); Sub-Index Innovation and state of cluster development (upper right); Sub-Index Higher education and training and state of cluster development (lower left); Sub-Index Institutions and state of cluster development (lower right); Index state of cluster development and GCI (lower). Source: calculations by the authors on basis [9;10].

Table 1. Matrix of correlation coefficients

	The Global Competitiveness Report	State of Cluster Development	Innovation	Business sophistication	Higher education and training	Institutions
The Global Competitiveness Report	1	0,92	0,96	0,97	0,93	0,92
State of Cluster Development	0,92	1	0,91	0,93	0,76	0,83
Innovation	0,96	0,91	1	0,97	0,88	0,86
Business sophistication	0,97	0,93	0,97	1	0,87	0,89
Higher education and training	0,93	0,76	0,88	0,87	1	0,80
Institutions	0,92	0,83	0,86	0,89	0,80	1

Source: calculations by the authors on basis [9;10].

Furthermore, coefficients of clusterizations of such sub-indexes as innovation, business sophistication, higher education and training and institutions indicate, that the process of clusterization is based on the idea of Triple Helix.

Thus, such instrument as clusterization is one of the more effective ways of increasing of countrys' competitiveness, first of all, for the developing countries. Because the spreading of cluster development can be significantly encourage innovative activities and productivity of enterprises, as a result the increasing of added value. In this way, state of cluster development can be one of the effective sources of competiveness for the transition and developing economies to increase an economic wealth in general, specially in the era of the 4th Industrial Revolution, where innovations become the unique instrument for their realization.

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Влияние кластеризации на национальную конкурентоспособность стран
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Аннотация. Целью статьи является выявить наличие или отсутствие корреляционной связи между кластеризацией и национальной конкурентоспособностью стран. Гипотеза авторов заключается в том, что между развитием кластеров и конкурентоспособностью страны существует сильная корреляция, а это означает, что страны с более высоким уровнем кластеризации - страны с более сильной экономикой или более высоким уровнем национальной конкурентоспособности. Источником данных, проанализированных в данной статье, является доклад о конкурентоспособности Всемирного экономического форума 2014-2015 и 2016-2017 гг. Гипотеза подтверждается данными. Таким образом, как результат, национальная конкурентоспособность любой страны может быть улучшена с помощью инструмента кластеризации, который стимулирует создание инноваций, инновационных продуктов и инновационной деятельности в целом в контексте инновационно ориентированной экономики.

Ключевые слова: *конкурентоспособность, развитие кластеров, состояние развития кластеров, инновации, сложность бизнеса, высшее образование и обучение, институции.*