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ТЕХНОЛОГІЇ КЛАСТЕРНОГО АНАЛІЗУ ЯК ОСОБЛИВІСТЬ СУЧАСНОГО ЕТАПУ ІНТЕЛЕКТУАЛІЗАЦІЇ СУСПІЛЬСТВА

І.Є. Андрущак, Ю.Я. Матвіїв, В.А. Кошелюк, Н.М. Ліщина , В.П. Марценюк. Технології кластерного аналізу як особливість сучасного етапу інтелектуалізації суспільства. Стаття присвячена питанням особливостям кластеризації як чинника її інноваційного розвитку. Визначено сутність кластера та його роль у забезпеченні інноваційного розвитку. Розкрито умови та наведено приклади ефективного функціонування кластерних структур. Зроблено висновок про необхідність подальших досліджень процесів кластеризації з урахуванням світового досвіду.
Ключові слова: кластер, кластеризація, кластерний підхід, інновації, інноваціний розвиток, конкурентоспроможність.

И.Е. Андрущак, Ю.Я. Матвиив, В. А. Кошелюк, Н.М. Лищина , В.П. Марценюк. Технологии кластерного анализа как особенность современного этапа интеллектуализации общества. Статья посвящена вопросам особенностям кластеризации как факт/ора ее инновационного развития. Определена сущность кластера и его роль в обеспечении инновационного развития. Раскрыты условия и приведены примеры эффективного функционирования кластерных структур. Сделан вывод о необходимости дальнейших исследований процессов кластеризации с учетом мирового опыта.
Ключевые слова: кластер, кластеризация, кластерный подход, инновации, инновациный развитие, конкурентоспособность.

I.Ye.Andrushchak, Yu.Ya. Matthew, V.A. Koshelyuk, O.M. Sivakovskaya, N.M.Lishchyna, V.P Martsenyuk. Technologies of cluster analysis as a feature of the modern stage of intellectualization of society. The article is devoted to the problems of clusterization as a factor of its innovative development. The essence of the cluster and its role in providing innovative development are determined. Conditions are revealed and examples of effective functioning of cluster structures are given. The conclusion is made on the necessity of further researches of clusterization processes taking into account the world experience.
Key words: cluster, clustering, cluster approach, innovation, innovative development, competitiveness.

Formulation of the problem. The current stage of development of the world economy is characterized by rapid pace of scientific and technological progress and intellectualization. Intensive development and introduction of new technologies in national and international markets and international integration in the field of advanced technologies are a strategic model for the rapid economic growth of highly developed countries. The growing intellectualization of the global marketplace pushes out obsolete technologies and promotes the introduction of new products based on recent scientific advances in science and technology. Intellectualization and scientific and technological progress will lead to the globalization of the world economy and the creation of a single market for goods and services. In the context of strengthening the processes of globalization, the key to competitiveness of the country in world markets is its innovative development. According to world practice, clusterization is one of the most effective means of realizing state innovation policy and stimulating innovation processes. At the present stage of the development of the domestic economy in connection with the need for its modernization on an innovative basis, clusterization processes are of particular importance. Therefore, for Ukraine, the study of world experience in the formation and development of clusters as the basis of innovation economy is relevant.

Setting up tasks. Unfortunately, the last two decades have not contributed to the active growth of the standard of living of the population, and especially the quality of life. Unfortunately, this did not promote this institutional transformation that took place in Ukraine. The living standard of the population, high welfare certainly depends on the development of the economy as a whole on the basis of scientific and technological progress, the introduction of educational institutions, educational organizations, the significance of which, as a whole, exceeds the sum of the constituent parts. That is, the educational cluster is more than a trick in terms of the educational services market concept compared to those forms of inter-sectoral integration as vertically integrated holding structures, associations, strategic alliances, network associations, joint ventures, technology parks, business incubators, industrial parks , special economic zones, etc. Most researchers, among which are P. Aren, P. Antila, D. Acoff, I. Ansoff, T. Andersen, O. Bogma, M. Budnik, G. Kleiner, A. Kulman, V. Pulman, B. Pis'mak, G. Semenov, V. Tretiak, V. Feldman et al. Agree that the cluster is a more complex phenomenon than a mere association of institutions, organizations, enterprises for joint marketing activities, or the implementation of a coherent policy, in education - this is, say, in the field of training. The cluster provides for a deeper technological co-operation based on their participation in the system of accumulation of value. At the same

time, educational institutions are not only included in the process of co-operation, but, more importantly, continue to compete with each other selectively in selected areas. Such a competitive environment is the driving force behind economic growth, the productivity of all factors of production, and the rapid expansion of innovations as a prerequisite for improving the well-being of the population and quality of life.

Analysis of recent researches and publications. Foreign and domestic scientists made an important contribution to the study of clusterization processes and their impact on the economic development of the countries: E. Bergman, Z. Varnalius, I. Vishnyakov, M. Voinarenko, M. Keating, J. Clegg, E. Lemmer, M. Porter , S. Sokolenko, E. Fezer, V. Shovkalyuk and other scientists. Questions of clusterization are at the center of attention of Ukrainian scientists O. Husenko, V. Vergun, V. Kulishov, S. Mitsyuk, O. Stutnitsky, M. Khmara. The conceptual foundations of innovation development are highlighted in the publications of such scholars as O. Alimov, N. Goncharov, V. Grinev, M. Drazhan, L. Neykov, D. Chervanov, A. Chukhno and others. However, in contemporary economic literature, insufficient attention is paid to the problem of the relationship between clusterization processes and accelerating the innovative development of the economy, the study of world experience in cluster formation and their role in the formation of an innovative economy [1-3].

Basic material presentation. Cluster analysis appeared relatively recently - in 1939 he proposed a scientist K. Trion. Literally, the term "cluster" in the English translation "cluster" means cluster, cluster, bunch, group. Especially rapid development of cluster analysis took place in the 60's of the last century. The preconditions for this were the emergence of high-speed computers and the recognition of classifications by the fundamental method of scientific research.

The founder of the theory of clusters is the American economist Michael Porter. He gave the definition of the cluster, investigated the conditions for the emergence of cluster associations, their structural features and advantages in the development of the national economy. Examining the competitive positions of more than 100 industries from different countries, M. Porter draws attention to the fact that the most competitive on the international scale of firms in one industry are not sys-tems located in different developed countries, but concentrated in the same country, and sometimes even in one region of the country . And this is no accident. One or more firms, reaching competitiveness in the global market, send their influence to the nearest environment: suppliers, consumers and competitors. In turn, the success of the environment influences the further growth of the company's competitiveness.

According to M. Porter, clusters are geographically focused groups of interconnected companies, specialized suppliers, service providers, firms in related industries, and organizations associated with their activities (universities, standardization agencies, trade associations) in certain areas , competing with each other, but doing it together [2].

Cluster analysis is a method of multidimensional statistical research, which includes the collection of data containing information about sample objects and their ordering in relatively homogeneous, similar groups.

Consequently, the essence of the cluster analysis is to carry out the classification of research objects with the help of numerous computational procedures. As a result, clusters or groups of very similar objects are formed. Unlike other methods, this kind of analysis makes it possible to classify objects not by one sign, but by several simultaneously. For this purpose, appropriate indicators are introduced that characterize a degree of proximity to all classification parameters.

The purpose of the cluster analysis is to find the available structures, which is expressed in the formation of groups of similar objects - clusters. At the same time, its effect lies in introducing the structure into the objects under study. This means that clustering methods are needed to identify a structure in the data, which is not easy to find in a visual inspection or with the help of experts.

The main thing in the structure of clusters is the dissemination of innovations and the establishment of social ties throughout the system of value creation and socio-cultural values. This minimizes transaction and transformation costs and enhances the competitiveness of the economy. The only logistic window for interaction with the external environment allows to establish cooperative international relations. In the global market clusters are present as the only agents of the network and competition, which allows them to act as equal subjects and to withstand harmful tendencies of competition [3, p. 4].

The disclosure of the essence of the laws of intellectualization of the economy consists in understanding the role of labor, and the attitude towards it from the side of society. Labor acts as a substance of economic relations. In the context of a substantive approach to the study of the intellectualization of the economy it becomes possible to identify the essential and qualitative characteristics of the latter as patterns of development of economic relations.

To the labor substance of the economy should include both material and intellectual production,

including the generation of socially important ideas. The whole economic evolution of mankind is characterized by a contradiction between the interaction of two archetypes: labor and wealth. Individualization of these archetypes is embodied in the subjects of the employee and the owner of physical or financial capital. Man in the process of labor activity is constantly evolving: accumulated and improved knowledge, enriched competences, developing skills. In the process of learning through experience, labor productivity increases, its means, technologies and forms of organization of production are improved. Thus, the equipment is equipped with the knowledge of the industrial forces of society.

In today's economy, the role of creative industries, in which competitive advantages are provided through the creation, accumulation and use of intellectual resources, is significantly enhanced.

The development and mastering of high, intellectual technologies radically transformed the nature of human labor, turning it into an intellectual, creative one. Creative work is an advanced kind of work activity. The motivation for such work, unlike the usual one, is to meet the needs for self-realization, the development of competences and the development of their creative abilities.

The conducted researches indicate that today the application of the cluster approach in Ukraine is a prerequisite for improving the efficiency of innovation development [4, p. 48]. It is for Ukraine, especially in the context of growing globalization and competition, that the issue of creating and promoting the effective development of cluster associations becomes of particular importance and has an unconditional perspective in the context of changes taking place in the global economy, in which the possession of a qualitatively new type of resources comes to the fore , namely information, innovation and intelligence.

According to scientists [1; 2; 6], in recent decades, clustering is the most successful instrument of economic development in the global economy. For Ukraine, the processes of clusterization which are only forming, it is especially important to study the world practice of the functioning of cluster associations and their impact on the innovative development of the national economy.

According to experts, clusterization covers about 50% of the economies of the leading industrialized countries of the world. In the US, over 380 industrial-innovation clusters employ over half of the enterprises, and the share of GDP produced in them exceeds 60%; in the countries of the European Union, clusters employ 38% of the labor force. Danish, Finnish, Norwegian, Swedish industries are fully covered by clustering. In Italy, 206 industrial clusters account for 43% of the total workforce in the industry, and their share in national exports exceeds 30%. Cluster structures operate successfully in other countries: 168 clusters or 19.9% of their total - in the UK, 32 in Germany (chemistry and engineering), 96 in France (food production, cosmetics), 61 in Poland , 96 - in India; in China, where more than 30,000 companies with a population of 3.5 million work in 60 special cluster zones. and a total annual sales volume of over 200 mdd. dollars [1, p. 36; 6, p. 53].

The analysis of over 500 cluster initiatives implemented over the past 10 years in 20 countries has shown that the high competitiveness of these countries lies in the strong positions of individual clusters [6, p. 52].

In the face of increasing competition from countries on the global market, the value of clusters will increase, because customisers are territories of development and much more effective than some enterprises, even those with a significant industrial and technical potential. This is evidenced by the trends in the creation of cross-border cluster structures in European countries, namely: in Austria, Germany (Bavaria) and the Czech Republic (Bohemia) - cluster for glass production; in Germany and the Netherlands (border areas) - clusters for the production of plastics, biotechnology and metalworking; in Belgium and the Netherlands (border areas) - a cluster of high technologies, etc. In European countries there is an active process of creating high-tech clusters. Such clusters are based in Austria - a cluster in Vienna - Biotechnology and Molecular Medicine, Belgium - a cluster of "Multimedia Valley of Flanders", Great Britain - a cluster of high technologies "Cambridgeshire", Germany - a cluster of chemical industry (Northern Ruhr region), a cluster of corporate information system (Lower Saxony), Ireland - Dublin cluster of software, Spain - cluster of machine tools (Baskonija) [6, p. 53].

If until recently clusters have been the privilege of the most advanced economies, then in recent years there has been a manifestation of this phenomenon in countries with a transformational economy. In Hungary, Poland, Czech Republic, Slovenia clustering is supported by special programs. In particular, there are more than 150 clusters operating in Hungary in the following areas: construction, textile manufacturing, thermal water, optical mechanics, automotive, woodworking, electronics, and more, as well as more than 75 industrial parks, bringing together 556 companies with a working capacity of 60 thousand person [2, p. 207].

The main condition for the formation and effective development of clusters is the state policy of their support, which is determined by many national peculiarities. The conducted studies indicate that the most effective tools for state support for clusters are:

- firstly, direct financing (subsidies, loans), which reaches 50% of the cost of creating new products and technologies (France, USA), loans without interest (Sweden) and free loans reaching 50% of the cost of introducing innovations (Germany).

- secondly, preferential taxation for enterprises, including exemption from taxes on research and development costs, preferential taxation of universities and research institutes (Japan), reduction of state taxes and tax privileges for individual inventors (Austria, Germany, USA, Japan), as well as exemptions from taxes on applications by inventors of clerical processes, services of patent attorneys (the Netherlands, Germany), creation of a special infrastructure for their support in the field of insurance (Japan);

- thirdly, the creation of innovation-funded funds taking into account potential commercial risks (UK, Germany, France, Switzerland, the Netherlands), state programs on risk reduction and reimbursement of risks (Japan), legislative provision on protection of intellectual property and copyright [1 , with. 37]. The practice of implementing cluster strategies is related to the operation of grant programs of funds supporting cluster initiatives (for example, the National DATAR Planning Agency in France, the CASSIS cluster information and search system in Luxembourg, the National Competitiveness Council in the USA, the LINK Cooperation Program in the United Kingdom) ; formation of special institutes, agencies that are part of cluster initiatives and are able to effectively perform their functions in the development and construction of network structures and their internationalization (centers of expertise - Finland, centers of excellence, consulting, marketing and analytical and branding companies - USA); the creation of business incubators, technology parks, special (free) economic zones as important infrastructure components and catalysts for the creation and effective operation of innovative clusters.

As the practice of developing the most successful firms and prosperous countries of the world shows, clusters, first of all, are innovative as an important tool for the development of competitiveness and intellectualization of the economy. Similar clusters are relatively easy to identify: computer programs (Silicon Valley, Bangalore), optical equipment (Tokyo), mobile communications (Stockholm and Helsinki), biotechnology, life sciences and medical instruments (Boston`s Route 128, BioValley 21 , MedisonValley 22), cars (Detroit, Toyota City, Wolfsburg, etc.). Each such cluster is a lot of participants. For example, the Medicon Valley cluster (Copenhagen, Denmark and Malmö, Sweden) brings together seven science parks and focuses on world-class scientific studies in the field of natural science. Medicon Valley combines hospitals, universities, government research institutes, industry and investors. The network of participants in this project - the Academy of Medicon Valley - promotes collaboration between different types of companies in the field of natural science [5].

European countries in the mid-1990s began to develop cluster programs because of the obvious advantage of cluster-based intellectualization of their own economies. In the United States, more attention is being paid to the creation of a network of technology-centered centers on the basis of universities and to support interaction between large and small companies, universities, and financial institutions based on cluster strategies. In Finland, an interministerial program of cluster research is in place. National cluster programs also have other European countries.

In determining the degree of similarity of objects of cluster analysis, four types of coefficients are used: correlation coefficients, distance indicators, coefficients of associativity and probabilities, similarity coefficients. Each of these indicators has its advantages and disadvantages, which must first be taken into account. In practice, the most widespread social and economic sciences have obtained correlation coefficients and distances.

As a result of the analysis of the aggregate of input data, homogeneous groups are created in such a way that objects within these groups are similar to each other according to some criterion, and objects from different groups differ from each other.

Clustering can take place in two main ways, including hierarchical or iterative procedures.

In the context of intellectualization of the economy, innovative clusters and their activities benefit both the private sector and the state. The list of such benefits can be attributed to: increase of knowledge in the cluster and expansion of opportunities for their distribution, availability of conditions for inter-firm learning and cooperation, exchange of information and pooling of efforts for joint implementation of projects, the formation of teams of specialized highly skilled workers, strengthening of formal and other links It promotes the emergence of new ideas and new types of business.

It is possible to distinguish some of the main reasons for the significant contribution of innovative clusters to the intellectualization of the modern economy:

1. Innovation clusters embody the implementation of the concept of "open innovation" in practice [9].

The main idea of "open innovation": innovations are not created by isolated enterprises, but they arise in a dynamic environment where competent organizations and skilled workers, producers and suppliers interact. In this environment, intensive partnerships develop, and universities are actively involved in the process of exchange of scientific and technical information. This approach allows assimilate the knowledge that has already been accumulated and generate new ideas and products. For example, to accelerate the generation and diffusion of new technologies and promote the idea of "open innovation", Philips Electronic from Eindhoven, the Netherlands, transferred the research laboratories Philips, where it was the only user, to the High Tech Campus. She invited not only their partners, but also competitors (such as IBM) to create their own research facilities there. Today, more than 35 companies and research organizations are concentrated on Campus.

2. The success of innovative clusters is due to the interaction of the three forces (the concept of a triple spiral) [7]: academic centers (universities), entrepreneurship and risk capital (business), as well as the innovation policy of the state (government). The University is a source of knowledge and technology, the role of business is in production, and the government is a guarantor of stable interactions and a source of favorable conditions. In this model, innovation is not so much a separate initiative of a particular party (for example, a country), but is created from this interaction, which increases the efficiency of the results of joint work.

3. Close cooperation with the economic, social, science-intensive areas reduces ambiguity, risks and destabilization caused by innovation. Interacting clusters form an integration environment to reduce transaction costs, increase flexibility, establish communication links and increase information flows.

Conclusion

These trends reaffirm the conclusion that clusters provide an exchange of knowledge that stimulates innovation. In other words, modern clusters are not just a business agglomeration, the emergence of which is due to the desire to minimize costs and get closer to the markets, and an effective innovation environment that enables firms that are members of it and organizations to become more innovative and knowledge-intensive. Global clustering experience may be useful for Ukraine for its further innovative economic development.

Ukraine, like most other European countries, tries to reach the economic level of the countries of Western Europe and the developed countries of the world. It has a small, but proprietary clustering experience of individual regions. In the future it is expedient to consider this experience, compare it with the successful experience of other countries, and especially countries with a transitive economy, to identify the main problems and perspectives of the clustering of the domestic economy.

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