

Analysis of the Process of Formation of Territorial Innovation Clusters in the Russian Industry

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Abstract—In modern conditions, territorial innovation clusters can be considered one of the important directions for implementing a circular economy. In this regard, the main directions and factors under the influence of which the effect of recycling resources in clusters is formed. On the example of metal-producing and consuming industries, recommendations were developed to improve the indicators characterizing the circular economy. Analyze the directions of development of the circular economy in modern industry, determine the role of territorial innovative clusters in this process, establish the main directions for implementing the circular economy in clusters. To expand methodological and methodological approaches to the economic evaluation of recycling resources in clusters.

Keywords—Natural resources, Territorial innovation cluster.

I. INTRODUCTION

The powerful basis of the Russian industry, formed in the USSR, allows the regions to successfully carry out structural adjustment, actively using modern market mechanisms of development, which in the first place should include innovation and cluster approach. The implementation of such a strategy is most fully possible on the basis of territorial innovation clusters, which in the future should ensure the self-development of territorial economic systems. M. Porter defined the cluster as "a group of geographically neighboring interconnected companies and related organizations operating in a certain area and characterized by common activities and complementary to each other" [1]. The experts note that traditional possibilities of industrial policy are restricted under modern conditions. The new economic policy has to rest on scientifically based mechanism of the sustainable industry development reflecting specific features of the modern development stage. It refers in the first rate to territorial, innovative and integration aspects. The contemporary organization format securing the implementation of these trends is presented by territorial innovation clusters (TIC). Presently, the TICs are widely used all over the world including Russia (25 TICs are being created).

II. DISCUSSION

Since the 90-ies of the last century, clusters in its development have gone through several stages. Usually, when studying

clusters, the following principles of cooperation of cluster members are singled out:

- related activities;
- territorial proximity;
- voluntary participation in the cluster, unlike the strictly structured holdings, enterprises that are part of the clusters, do not lose their independence;
- self-organization, cluster members determine the form, structure of the cluster, areas of cooperation;
- combination of cooperation and competition

The relations of the cluster members are based on cooperation and openness. This approach allows the cluster to be more competitive in the market. Like any organizational structure, clusters have a number of advantages and disadvantages, but the advantages of modern clusters can not be associated only with the circumstances arising from the close territorial location of cluster members and the possibility of combining resources and efforts, which leads to joint actions in the market, joint training, exchange of scientific, commercial information, business experience, collective promotion of the interests of cluster members in cooperation with state bodies, the media, local authorities, etc.

The main advantage of modern clusters is their innovation. Territorial innovation cluster is a fundamentally new phenomenon in the economy, which is the most advanced form of cluster development (regional innovation clusters), combining two main modern aspects of industry development (territorial and innovative), resulting in synergetic effects of innovation [2].

Innovative development is constantly becoming more complicated: the methods of development and commercialization of innovations are being improved, the number of participants in innovation activities is increasing. Today, representatives of various fields of activity are involved in this process: scientists, researchers, production workers, marketers, partners and consumers, government officials, etc. thus, modern innovative development is the result of the interaction of science, government and business, which is called the "triple helix".

An important theoretical and practical issue is the study of the possibility of complex interaction of elements of the triple helix in territorial innovation clusters.

The emergence and realization of the advantages of territorial innovation clusters are associated with the implementation of the triple helix principle. The generation of innovations in such a cluster takes place at the level of technology, product, marketing and organization of work [3].

The theory of the "triple helix" was created by G. Itzkowitz (Stanford University) and L. Leidesdorf (Amsterdam University). It is used in the implementation of development programmes in many EU countries, Asia, Latin America, etc. This concept is based on the leading role of academia (universities). Universities, producing new knowledge, should stimulate their implementation, on this basis, there is an improvement of technologies and forms of entrepreneurship. Thus, the expansion of the functions of universities leads to the fact that the participants of the "triple helix" in addition to the usual functions in the process of cooperation acquire additional [4]. Industrial production begins to be carried out in the territories of universities in scientific parks, new structures are being created and successfully functioning (business incubators, innovation and investment centers, research centers, collective use centers: engineering, technology transfer, prototyping and industrial design, etc.). The role of the state, which in the new conditions is designed to create conditions for the implementation of such activities, is changing. Industrial enterprises are beginning to actively develop new areas of activity, for example, to participate in the educational process, providing training for workers, etc.

Currently, the following features of the formation of the "triple helix" in Russia are highlighted [5]:

- the need to integrate University and academic science, as the main volume of fundamental research is carried out in the institutes of RAS, and the main volume of training is conducted by Universities;
- insufficient budget funding for science;
- the need to overcome the isolation of scientific organizations, Universities, business sector;
- lack of innovative activity of industrial enterprises;
- the interaction of business with other participants of the "triple helix" qualitatively different from the interaction in developed countries.

Experts note that the relations between the main subjects of the innovation system in Russia often reflect the process of creating "double" instead of "triple helices", which significantly complicates the development of the innovation process in the

Russian industry. The formation of the triple helix should be carried out on the basis of free joint efforts of all participants of the innovation process. A significant role in this should be played by territorial innovation clusters, which allow the transition from the mechanism of competition to cooperation, and in its interactive, network forms and are characterized by the ability of dynamic self-development. The mechanism of

self-sustaining innovation growth in clusters is provided as a result [6, 7]:

- joint functioning of all elements of the "triple helix»;
- implementation of the principle of collaboration (cooperation, joint activities of cluster members to achieve common goals, while the exchange of knowledge, training and agreement)
- the network structure of the cluster, which allows for high-speed transfer of information and simplify the use of financial resources, new knowledge, marketing strategies, etc.;
- flexible cluster structure open to new members, which is able to change the configuration;
- integration of cluster members around the overall production idea;
- coordination of work and interaction of cluster members as a single team.

For Russia, the creation and operation of cluster structures is one of the important tools to support sustainable, innovative development of industry. The process of creating clusters in the country started in 2005 and Since 2012 is implementing a program of creating and maintaining territorial innovation clusters, and achieved certain results. Table 1 shows the main results of their development. Table 1 shows the main results of their development.

TABLE I. RESULTS OF REGIONAL INNOVATION CLUSTERS DEVELOPMENT

Indicator	Indicator by years			
	2012	2013	2014	Growth 2012/2014,%.,
Number of new High-performance jobs, thousand units.	29	35,2	39,7	137
Volume of investment costs	292,5	380,5	463,3	158
Participants of the cluster, billion rubles.				
R & D expenses participants of the cluster, billion rubles	72,9	84,6	85,4	117

Source: [8].

The structure of distribution of pilot territorial innovation clusters by regions indicates a high level of their innovation [9]:

- the studied clusters 21 (100 %)
- of them in the regions:
- "strong innovators" 13 (62,0 %)
- "medium-sized innovators" 5 (24,0 %)
- the "mid innovator" 1 (9.3 %)
- "srednebelaya innovators".2 (4.7 %)
- located in the leading regions of the index quality of innovation policy 15 % (71.4 %)

This approach allowed clusters to provide a high-quality innovation base (in terms of knowledge and training). Describing the state policy in the field of implementation of the pilot program, it should be noted the innovative direction of financing. In the period from 2013 to 2014 to support the pilot regional innovation clusters was

the total amount of subsidies under the pilot program in 2014 amounted to 2.5 billion rubles, including [9]:

- development of innovation and education infrastructures 1.9 billion rubles;
- professional development, retraining of personnel, methodical, organizational, expert-analytical and information support 0.5 billion rubles;
- The Ministry of economic development of Russia provided support for the creation of innovation and research infrastructure of pilot clusters in the period from 2014 to 2015, which significantly increased the level of their commercialization. As follows from the above data, the main amount of funding in 2014 (1.9 billion rubles) 76% of the total expenditure is directed to these purposes.

Generalization of the results of the creation of 25 pilot territorial innovation clusters allowed to evaluate the standard Russian cluster, which has [9]:

- average number of participants 70 participants, including those included in the cluster;
- in the last 2 years 50 (71 %) participants the distance between the participants;
- less than 150 km (1.5 hours drive) 80 % of participants members who are members of the cluster in the last 2 years 50 (71 %) participants cluster members involved;
- in joint projects 18 (26 %) participants in trainings 40 % participants;
- financial support of the management company 14% of participants contact management with participants 220 (3 cases per academic year) mention of the cluster in the media in 2014 26 times.

These data indicate that the standard Russian innovation territorial cluster mainly meets the requirements for a Mature cluster. However, these are only the first results.

The European standard provides for the presence of a Mature cluster program and development strategy, which are regularly reviewed in the cluster structure necessarily the presence of universities and research centers.

In order to ensure a significant competitive advantage in the cluster, there should be [10]:

- officially registered 90% of participants
- including commercial organizations,
- in the area of specialization of the cluster 45% of participants

- term of operation of the management company at least 2 years
- contacts of the management company at least 20 % of participants
- share of interacting participants in the cluster at least 15 %

Eleven Russian pilot clusters include specializing in new industries (information technology, Biopharmaceuticals, new technologies), the rest was created on the basis of large enterprises of the Soviet period and small firms based in these enterprises, their specialization presented in the following areas: nuclear radiation technology, aerospace, shipbuilding, chemical and petrochemical industries, etc. Experts say that based on international experience, in the cluster must have at least 30-50 relevant companies to realize the potential of diffusion of innovations [11]. At the same time, there are less than 50 specialized firms in 13 clusters out of 21 examined by researchers, and even less than 30 in 6 clusters

Therefore, the main problems of functioning of Russian pilot clusters are currently [9]:

- a small number of small companies participating in the cluster;
- insufficient levels of interaction and trust between their participants

The EU has adopted a procedure under which the European cluster improvement initiative has been implemented since 2009, which involves a comparative analysis and development of recommendations to improve the quality of management in clusters. The experience gained by the EU can be useful in the implementation of the clustering of Russian industry [12].

It should be noted that the European Secretariat for cluster analysis (European Secretariat for Cluster Analysis) is assessing clusters to establish their compliance with management standards (gold, silver or bronze) in 2015, four Russian territorial innovation clusters were awarded the bronze standard (Nuclear innovation cluster (Dimitrovgrad Ulyanovsk region); Kamsky innovative territorial production cluster (Republic of Tatarstan); the Zelenograd cluster (Moscow); territorial innovation aerospace cluster (Samara region)).

III. CONCLUSION

The above results of the analysis of the process of formation of territorial innovation clusters in the Russian industry allow us to draw the following conclusions:

- the creation of a group of pilot territorial innovation clusters allowed to intensify the clustering process;
- territorial innovation clusters are one of the promising directions of the triple helix principle implementation;
- the successful formation and development of a network of territorial innovation clusters will ensure the competitiveness of the Russian industry.

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