

Formation and development of pharmaceutical clusters as an innovative activity of territories

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Abstract—As a result of the formation and development of the pharmaceutical market, there appear processes that are a catalyst for structural transformations of the market. According to the authors of the present article, such structural changes in the pharmaceutical market include the processes of formation and development of pharmaceutical clusters as innovative activity of territories, which lead to an increase in market concentration and increase the level of competition for all market participants. Therefore, the study of the processes of formation and development of pharmaceutical clusters as an innovative activity of the territories is of undoubted interest for research. The study of assessment methods for the processes of formation and development of pharmaceutical clusters as an innovation activity of territories is still relevant, and the implementation of existing approaches in the companies' practice requires theoretical substantiation. This article discusses the main trends in the formation and development of pharmaceutical clusters as an innovative activity of the territories.

Keywords—*pharmaceutical market, innovation activity, pharmaceutical cluster, market structure, market conditions.*

I. INTRODUCTION

The pharmaceutical market is one of the most high-tech markets in the world economy. For it, the product line, which is represented by original drugs, is updated very quickly. The pharmaceutical industry can become one of the efficient engines of the Russian economy, but sustaining the industry competitiveness requires constant financial investments and the development of innovative processes. Investments in the pharmaceutical industry can provide a high rate of return. The processes of formation of pharmaceutical clusters were studied by the foreign experts, namely J. Lang LaSalle on the example of pharmaceutical clusters in the USA, Europe and the Asia-Pacific region, H. Herve on the example of pharmaceutical cluster in the state of Andhra Pradesh, as well as by the Russian researchers: V.L. Adzhienko on the example of the trans-regional pharmaceutical cluster of the Southern Federal District, N.A. Vorontsova on the example of the prospects for the formation of a

pharmaceutical cluster in the Irkutsk region, A.M. Izmailov on the example of cluster policy and solving the problems of competitiveness of the domestic pharmaceutical industry, I.A. Karachev on the example of functioning of megaclusters in the pharmaceutical industry [8], E.V. Sapir on the example of the export potential of Russian pharmaceutical enterprises in the emerging regional clusters [15], S.Yu. Soboleva on the example of regional peculiarities of the formation of pharmaceutical clusters on the territory of the Russian Federation, P.V. Terelyansky on the example of assessment of factors of the formation of a pharmaceutical cluster using non-parametric expertise, L.S. Shakhovskaya on the example of formation of regional pharmaceutical clusters in Russia.

After approval of the development strategy of the pharmaceutical industry of the Russian Federation for the period up to 2020, pharmaceutical clusters began to actively form in various constituent entities of the Russian Federation. It is the creation of new jobs in the cluster region contributes to improving the competitiveness of the territory [16] and gives impetus to the development of the country's economy as a whole [9], which is especially relevant in an unstable macroeconomic environment [1]. Pharmaceutical clusters are a group of developers, manufacturers, equipment suppliers, research and development centers, universities, technology parks, business incubators and other companies that work in related fields of activity and are able to enhance the competitive advantages of the cluster as a whole.

The relevance of the cluster policy in the pharmaceutical market is driven by the fact that over the past decade, the population of the Russian Federation has been consuming more and more drugs. Nevertheless, the consumption of drugs from Russia is reduced by 1-2% annually, while the shares of imported drugs and imported medical equipment in the market increase. Thus, the Russian medical institutions significantly depend on foreign medical equipment, which results in an increase in government spending and a decrease in the competitiveness of the pharmaceutical industry in the Russian Federation. A way out of this situation is the development of cluster

policy in the pharmaceutical market, which involves setting goals and objectives for participants in pharmaceutical clusters to create a cumulative effect in the production and sales of medicines in the pharmaceutical market of the Russian Federation and abroad.

II. MATERIALS AND METHODS

The method of scientific abstraction made it possible to identify a number of key trends in the formation and development of pharmaceutical clusters as an innovative activity of the territories. As a result of the system analysis, the structure of the pharmaceutical market of the Russian Federation was revealed working out in detail the medicines of domestic and foreign production. Comparative analysis was used in the study of pharmaceutical clusters of Russia as of 2018. Statistical analysis is brought up to date for the description of the share of innovative medicines in the pharmaceutical market of the Russian Federation.

III. RESULTS AND DISCUSSION

As a result of the analysis of the processes of formation and development of pharmaceutical clusters as an innovation in the activity of the territories, the authors found that the share of original drugs in the pharmaceutical market of the Russian Federation is 20% compared to generics (Fig. 1).

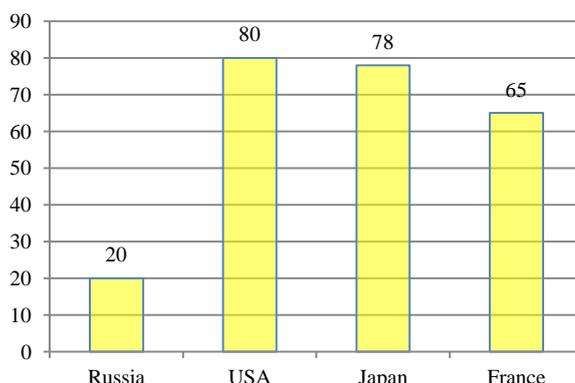


Fig. 1. The share of innovative medicines in the national pharmaceutical markets, % [6]

The graph shows that the United States and Japan create an innovative product, their indicators are close to 80%, while the Russian Federation provides only 20% of innovative products. In order to raise the level of innovations, it is necessary to create effective demand from the state. This is possible only with a quick assessment of the effectiveness of innovative drugs and, as a result, their inclusion in the standards of treatment. Further we highlight the main measures that, in our opinion, can be used for the development of innovative medicines and their implementation in practice:

- Participation of federal and regional research and medical centers in the development of medicinal products and preclinical studies;

- The necessity to create special groups of experts who would be engaged in attracting Russian and foreign experts to use in practice treatment standards based on innovative products;
- Improvement of the system for monitoring the use of appropriate standards of treatment in practice;
- Creation of a directly governmental body whose task would be the production and circulation of medicines.
- According to the authors of the article, the cluster development in the pharmaceutical market of the Russian Federation has the following advantages:
 - Organizational control is carried out at each stage of development of the pharmaceutical cluster;
 - Investment projects are implemented in shorter time intervals, and there is a saving of the initial expenses of the participants of pharmaceutical clusters;
 - The issues related to the recruitment, training and retraining of personnel are solved systematically;
 - Participants of the pharmaceutical cluster have reduced investment risks;
 - There is an increase in production and improvement of the organization of scientific support for the work of pharmaceutical companies;
 - Growth of investment attractiveness of the region where the pharmaceutical cluster is located and growth of tax revenues to the budget.

The positive impact of pharmaceutical clusters is proved by the experience of many countries [10]. Due to certain features of the industry (such as the importance of medicines for society and the state; innovation, a long cycle of development and launch of a new product on the market) in many countries, for example in the USA, Great Britain, Singapore, Germany, the innovative strategy of the pharmaceutical industry is kept and therefore the pharmaceutical clusters are created. Basically, the cluster development strategy is most characteristic for transnational corporations [2]. At the same time, the role of state policy is very important [13], the effectiveness of which should contribute to the emergence of a synergistic effect from the interaction of cluster members [3]. One can give an example of the Boston-Cambridge cluster, which is located in the United States and combines higher educational institutions, medical centers and about 500 companies that specialize in the field of pharmaceuticals and biomedical technologies. It should be noted that the efficiency of communications of cluster members can affect its performance [11], especially with the use of new technologies in promoting the market [4]. On the territory of the cluster, about 50 thousand specialists

of various profiles conduct their research. The volume of innovative products only from this cluster exceeds 5% of the total global development of the pharmaceutical industry.

Consider some of the structural parameters of the development of the pharmaceutical market of the Russian Federation. The maximum share of domestic drugs presented in the retail commercial segment of the pharmaceutical market is 24.9%, while the minimum is 10.6% in the sector of preferential drug supply, as shown in Fig. 2.

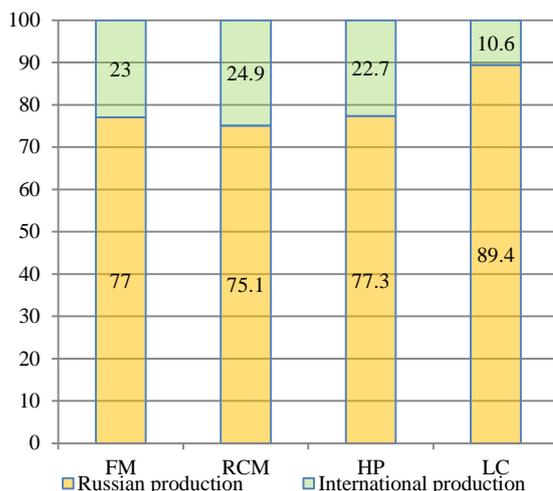


Fig. 2. Structure of the pharmaceutical market of the Russian Federation in detailing on drugs of domestic and international production in 2018, % [7] (FM is pharmaceutical market as a whole, RCM is retail commercial market, HP is hospital purchases, LC is low-cost vacation).

According to the strategy for the development of the pharmaceutical market of the Russian Federation, 50% of medicines in the pharmaceutical market should be produced by Russian companies by 2020. To date, this indicator has not yet been achieved, although the situation may change due to the creation of large domestic and foreign enterprises.

It should be noted that an important feature of pharmaceutical clusters is that organizations that are included in it increase both their competitive advantage, by complementing each other, and the competitive advantage of the cluster itself [5]. In the United States of America, for example, clusters are most common [14], and this fact can be explained by the high competition between large transnational corporations. Usually, clusters are based on universities and research centers. Primary capital is allocated from regional budgets, and further financing comes from attracting investments. As for the cluster policy within the European Union, the work of the European Institute of Technology and Innovation contributes to its development. The main direction of cluster policy in European countries over the past 5 years is the unification of innovations and support for government procurement for product development. Clusters tend to appear in regions which are in need of development.

As a result of the analysis of the formation and development of pharmaceutical clusters as an innovation activity of the territories, it was found that today more than 10 pharmaceutical clusters are of interest to well-known representatives of the global pharmaceutical market. The Kaluga Pharmaceutical Cluster is an example, which also studies biomedicine and biotechnology. The residents of this cluster are: Hemofarm LLC, a member of the STADA AG Group of Companies (which is one of the first companies to establish an enterprise in the Kaluga region), Astra-Zeneca LLC, Novo Nordisk LLC, Berlin-Chemie AG and others [12]. A GMP enterprise has also appeared in Kaluga, which produces special medicines thanks to the participation of the regional administration and regional institutes. Today, this pharmaceutical cluster has an open line for the production of drugs. The development of this pharmaceutical cluster is promoted not only by cooperation with large foreign investors, but also with domestic innovators. 5 enterprises are being built on the territory of the cluster, by 2020 the volume of output will increase 30 times and amount to 150 billion rubles. One of the important features of the Kaluga pharmaceutical cluster should be mentioned, namely, the involved enterprises are located in various industrial parks, thus they contribute to the economic and social development of the cluster.

Yaroslavl Pharmaceutical Cluster is one of the examples of interaction of educational, scientific and industrial organizations in the field of pharmaceuticals. It houses the production sites of the company R-Pharm and the Center of High Technologies ChemRar (co-production is the project of ZAO Pharmoslav), the specialization of which is the production of drugs, as well as medicinal substances. Another major resident of the Yaroslavl pharmaceutical cluster is Novartis LLC. Now in Yaroslavl, Rostov and Pereslavl-Zalessky there are 8 major projects for the development of the pharmaceutical industry (Table 1).

TABLE I. PHARMACEUTICAL CLUSTERS OF RUSSIA AS OF 2018 [7].

Cluster	Residents	Industrial parks	Innovation centers	Product types
The Kaluga Cluster "Pharmaceutics, Biomedicine and Biotechnology"	Astra-Zeneca LLC, Novo Nordisk LLC, Berlin-Chemie	Obninsk, Detchino, Grabcevo, A-park, Kaluga-YUG, B-park, Rosva	Center for preclinical studies based on Almazov National Medical Research Center, Federal Center for Nuclear Medicine, Biomedical nanocenter	Ready dosage forms, active pharmaceutical substances
Yaroslavl Pharmaceutical Cluster	R-Pharm, Nikomed, NTPharma, Teva	Novoselki	Institute of Epidemiology and Microbiology n.a. Gamalei of the RAMS, Institute of Influenza of the RAMS, Scientific Center of Neurology of	Ready dosage forms, active pharmaceutical substances

Cluster	Residents	Industrial parks	Innovation centers	Product types
			the RAMS	
The cluster of the medical and pharmaceutical industry of St.	Biocad, Farm-Holding, Novartis	Neudorf, Novo-Orlovskoye, Industrial Zone Pushkinskaya	Radium Institute n.a. V.G. Khlopin	Ready dosage forms, diagnostics and laboratory equipment, software for medical institutions, medical equipment, radio technology, nuclear medicine
Biopharmaceutical cluster Severnyi (BPHC) Center for Innovative Development of Severnyi BPHC	ChemRar, Protek, Akrikhin, Geropharm	Dolgoprudnyj, Himki	Center for Innovative Development of Severnyi BPHC	Ready dosage forms, UV-equipment, radiation protection equipment
Ural pharmaceutical cluster	Medsintez Plant, Plant Dizet LLC	Novoural'sk	Innovative companies (Skolkovo Innovation Fund, LLC Ural Center for Biopharmaceutical Technologies, LLC Ural Medical Nuclear Center)	Ready dosage forms, production of insulin substance, production of dry and liquid dialysis concentrates,
Innovative cluster of biopharmaceutical technologies, Novosibirsk region	SSC VB Vector Vector-Medica, Vector-BiAlgam	Naukograd Kolcovo	UK Biotechnopark, Innovation Center Kolcovo	Means of diagnostics and control of high diseases, dietary supplements, generics
Pharmaceuticals, medical equipment, Tomsk region	NPO Virion, Pharmstandard, Tomskhimpharm	Tomsk	Tomsk Polytechnic University, Tomsk State University	Drugs, high-tech raw materials for the pharmaceutical industry

Among the major projects, the Urals Pharmaceutical Cluster should be mentioned, which consists of drug manufacturers, pharmaceutical developers, higher educational institutions that prepare specialists for work in the pharmaceutical cluster. One of the largest foreign companies that are interested in the project was Bayer AG, which is interested in creating a unified research base. One of the key projects of the Ural Pharmaceutical Cluster is the production of insulin.

IV. CONCLUSIONS

Summing up, we can conclude that pharmaceutical clusters are formed in various Russian regions, such as the Nizhny Novgorod, Kaliningrad, Kirov, Volgograd regions and the Republic of Tatarstan and other constituent entities of the Russian Federation. Thus, the cluster approach in the regions is established. When developing a strategy for developing pharmaceutical clusters in Russia, it is necessary to take into account the experience of leaders, namely the clusters of Boston-Cambridge, New Jersey, New York, Westchester, Berlin-Brandenburg, Munich-Bavaria, Zurich, Amsterdam, Basel, Dasin, Andhra Pradesh, Shanghai, Jakarta, Melbourne. Now regional clusters become the powerful centers of economic development, on which the future and prosperity of its regions depend. The obvious fact is that attention to pharmaceutical clusters is increasing every year. The formation and development of pharmaceutical clusters is a complex of government measures whose goal is the creation and development of clusters, increasing the competitiveness of the regions in which clusters operate, the development of institutions which contribute to the clusters creation, as well as development of innovative medicines. As a result of the analysis of the processes of formation and development of pharmaceutical clusters as an innovative activity of the territories, the authors of the article highlighted the main directions of the cluster policy of the Russian pharmaceutical market: 1. Localization of production and drug development in the Russian Federation. 2. Development of the pharmaceutical industry in the economy of the Russian Federation. 3. Development of the pharmaceutical industry in the international markets.

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