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Scientific article

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Determination of import dependence indicators for biotechnological enterprises

Abstract: The article presents the results of the analysis of the main trends in the development of the biotechnological industry. The impact on the development of the biotechnological sector of the economy of the processes associated with the emergence and spread of new diseases is shown. As a result of the analysis of these trends in the development of the biotechnological industry, as well as the structure of purchases of equipment and materials of individual biotechnological enterprises, a significant dependence of this industry on imported products was revealed, which made it possible to justify the need to solve the problem of ensuring a high level of import independence of the biotechnological complex of the Russian Federation. Existing approaches to assess the import dependence of industrial enterprises are considered. An integral indicator of import dependence for biotechnological enterprises is proposed. An example of varieties of the indicator reflecting the share of imported equipment in the total volume of equipment for the implementation of production processes at the enterprise is given.

Keywords: biotechnological industry, biotechnological enterprise, import dependence, assessment of the enterprise's import dependence.

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Научная статья

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Определение показателей импортозависимости биотехнологических предприятий

Аннотация: В статье приведены результаты анализа основных тенденций развития биотехнологической промышленности. Показано влияние на развитие биотехнологического сектора экономики процессов, связанных с возникновением и распространением новых заболеваний. В результате анализа указанных тенденций развития биотехнологической промышленности, а также структуры закупок оборудования и материалов отдельных биотехнологических предприятий, выявлена существенная зависимость данной отрасли промышленности от импортной продукции, что позволило обосновать необходимость решения задачи обеспечения высокого уровня импортонезависимости биотехнологического комплекса РФ. Рассмотрены существующие подходы к оценке импортозависимости промышленных предприятий. Предложен интегральный показатель импортозависимости для биотехнологических предприятий. Приведен пример разновидностей показателя, отражающего долю импортного оборудования в общем объеме оборудования для реализации производственных процессов на предприятии.

Ключевые слова: биотехнологическая промышленность, биотехнологическое предприятие, импортозависимость, оценка импортозависимости предприятия.

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Introduction

In the global economy almost no modern large organization can function without direct or indirect links with world markets. Generally speaking, international specialization makes it possible to ensure an increase in the aggregate marginality of the industrial production chain. At the same time, as practice shows, the economic effect of export of technologies and high-tech products with high added value is significantly pronounced for producers from industrialized countries. It should also be noted that import supplies often become a tool of sanctions pressure. The above circumstances lead to the fact that the definition and provision of a rational ratio of domestic and imported products in the national markets becomes a priority task of planning the development of industry at the federal level.

First of all, this applies to strategically important industries that determine the national security of the country in various spheres. Such industries include the biotechnology industry as the most important component of the sixth technological mode of economic development. The importance of the development of the biotechnology complex is determined by the use of its products and technologies in the production of pharmaceuticals used to treat cancer, autoimmune, infectious and viral diseases, which determines, among other things, the health of the nation.

In recent years, the biotechnology sector of the economy has been characterized by certain positive trends. According to research by Global Market Insights, the global biotechnology market was worth about $497 billion in 2020 ($399.4 billion in 2017), and according to forecasts, its average annual growth rate for the period from 2021 to 2027 should be 9.4%, with its total volume potentially exceeding ($952 billion). Somewhat different data are presented in the reports of Grand View Research, which is associated with marketing research in various fields and areas of activity. For example, according to Grand View Research, the global biotechnology market, 48.64% of which is formed by health care biotechnology, was $753 billion in 2020 and was expected to exceed $1 trillion by the end of 2021. At the same time, the market for biotech tools, which include diagnostic tools, consumables for the life sciences and others, was estimated by this company to be worth $41.14 billion in 2020, and its growth is projected to be (12.66% from 2021 to 2028). The rapid pace of development in this segment is primarily due to the introduction of diagnostic devices, including Polymerase Chain Reaction (PCR) test kits, at the point of care. Generally speaking, the emergence of new diseases and the scale of their spread contribute to the development of biopharmaceuticals in general. For example, the development of the biotechnology industry has, to some extent, stimulated the COVID-19 pandemic, which in recent years has become one of the largest public health problems in many countries of the world. In particular, as evidenced by Global Market Insights research, more than $13 billion was invested in the industry by investors around the world in 2020. This has accelerated the development of innovative drugs and vaccines.

It should be noted that by the end of 2021 Russia had produced about 232.9 million doses of vaccines against COVID-19 (i.e., 2.3% of the total volume of vaccines produced in the world). The leaders in COVID-19 vaccine production are China (4.5 billion doses or 45% of worldwide production), the European Union (2.25 billion doses or 22.4%), India (1.6 billion doses or 15.6%), and the USA (847.5 million doses or 8.4%). Analysis of the production volumes of various types of vaccines in the world as of the end of November 2021, allows us to conclude that the largest share in the total volume of vaccines produced against COVID-19 is accounted for by such vaccines as Sinovac (2367.9 million doses (23.6% of total production worldwide)), AstraZeneca (2262.0 million doses (22.5%)), Sinopharm (2098.4 million doses (20.9%), Pfizer/BioNTech (1935.6 million doses (19.3%). By the end of November 2021 the production volume of the Russian vaccine against coronavirus Sputnik V or Gam-CovID-Vac created at FSBI National Research Center of Epidemiology and Microbiology named after honorary academician N.F. Gamaleya was 253.8 mln doses or 2.5% of the world production volume. Russia imported 93.4 mln doses of vaccines against COVID-19, which was 2.6% of the total world exports (China exported 1487.6 mln doses (40.6%), European Union — 1366.8 mln doses (37.3%), USA — 348.0 mln doses (9.5%), Republic of Korea — 133.6 mln doses (3.6%). On the whole according to the data of the Federal customs service of Russia in January-September 2021 the country exported 608.6 t of vaccines under the code “other vaccines for people” (including export of vaccines against COVID-19 under this code with the value of over 1.2 bln dollars. The main countries to which the vaccines were exported were Argentina (over $220 million), Mexico ($190 million), the United Arab Emirates ($126 million), and others).

At the same time, despite the implementation in recent years of various programs aimed at state support of import substitution, a significant part of biotechnological production depends on imported technologies, equipment and materials. (In particular, a study of the structure of purchases of equipment and materials by Biocad CJSC), one of the largest Russian biotechnology companies whose activities are related to the implementation of the full cycle of drug development for the treatment of autoimmune, cancer, infectious and other diseases, shows that imported products prevail in almost all categories of purchased materials and equipment. For example, the share of imports in the categories "consumables for production" is 99%, "R&D materials" is 97%, "production raw materials" is 96%, "technological and engineering equipment" is 95%, and "laboratory and auxiliary equipment" is 71% (Fig.). (Official site of company BIOCAD. Available at: https://biocad.ru/)

In this connection, the task arises of ensuring such a level of import-independence of the RF biotechnology complex that would ensure, on the one hand, the effect of international cooperation and, on the other hand, make it possible to reduce the risks of restrictions on foreign supplies of equipment and technologies.

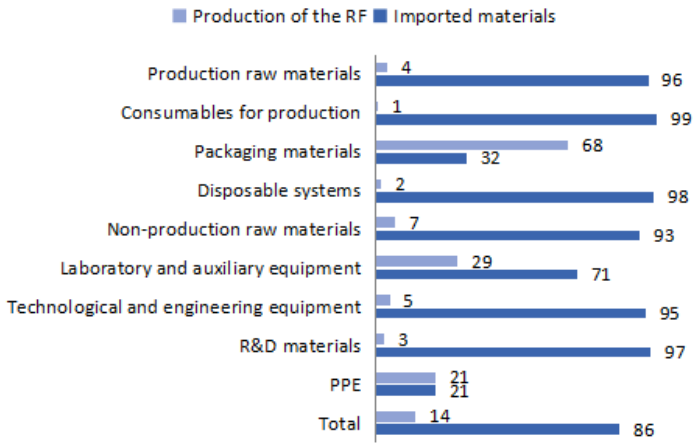

Fig. Distribution of purchases of equipment and materials in Biocad in 2021, %

Рис. Распределение закупок оборудования и материалов в «Биокад» в 2021 г., %

At the present time under the import dependence we understand the existing or potential threat to the national economic system or its components, arising in case of a significant change in the conditions of supply of imported products. These changes include both the options of complete cessation of supply of products, raw materials, materials, technologies, spare parts of foreign production, as well as an increase in the delivery time and prices for imported products due to a variety of reasons.

The scientific literature distinguishes between import dependence at the level of (countries), (regions and corporations) (Beloshitskii, Patlasov, 2021).

In the modern literature there are various approaches to the assessment of import dependence of industrial enterprises. (So, in practice, in most cases, the import dependence is determined on the basis of the analysis of costs for imported raw materials, materials and equipment purchased by industrial enterprises in order to implement production and technological processes). In this case the share of imports in the total expenditure of the enterprise on technology, raw materials, materials, components and equipment used in the implementation of production and technological processes is calculated. Also to solve the problem under consideration such indicator (as "the share of imports in the cost of production" can be used). In some cases, it is proposed to distinguish between the variants of foreign-made products, which may be subject to sanctions, as well as products characterized by different levels of innovativeness, including taking into account their compliance with different technological modes. (Some authors, when determining the values of indicators characterizing the levels of technical, technological, and raw material import dependence of production, propose to introduce rating assessments for different types of imported resources).

Certain attention should be paid to the coefficient of the level of import dependence of products, which was developed within the framework of research ordered by the Russian Ministry of Industry and Trade

as a tool for comparative evaluation to determine samples of weapons, military and special equipment, characterized by high and critical dependence on foreign-made electronic component base. (This coefficient is based on determining the level of dependence of weapons, military and special equipment samples on the electronic component base of foreign production used in their creation as a result of analysis of the share of foreign-made products in the samples of final products and their cost, elements of products, in relation to which import substitution measures are implemented, the level of use of nonreproducible / system-forming products, as well as the degree of use of products manufactured in countries with sufficiently aggressive).

Results

Summarizing the known methods for the analysis of import dependence, it should be noted that it is advisable to consider an integral indicator for an industrial enterprise, reflecting the impact of foreign supplies on individual business processes and / or technological processes, taking into account:

– the risks associated with the organization of interaction with countries of various types;

– the degree of influence of imports on the processes in question;

– plans for the replacement and/or modernization of equipment.

This approach involves the calculation of private indicators of import dependence on the processes, which it is advisable to classify according to the following features:

– taking into account the time factor – current and projected;

– by the degree of consideration of the impact on processes – gross (without taking into account "criticality") and functional (taking into account "criticality");

– taking into account the dimensionality – natural and cost.

From the point of view of risks of interaction organization it is possible at the initial stage of analysis to distinguish two groups of countries-suppliers: conditionally "friendly" – risk coefficient 0.2 (reflects the possibility of supply failure in the required time) and "unfriendly" – risk coefficient 0.8. Further on in the course of a more detailed analysis the number of groups can be increased.

It is assumed that when determining a plan for purchasing imported equipment, the heads of enterprises take into account the need for it, taking into account the depreciation of existing equipment, its load, the need to develop production, etc.

Let us consider an example of calculating the integral indicator of the import dependence of the enterprise for the simplest case of using one type of partial indicators, reflecting the share of imported equipment in the total volume of equipment for the implementation of the process. In this case, for each process a table of the type 1 is built.

Example of varieties of the indicator reflecting the share of imported equipment in the total volume of equipment for the process

Пример разновидностей показателя, отражающего долю импортного оборудования в общем объеме оборудования для технологического процесса

	Dimension	Current	Forecast
Gross	Natural	The share of imported equipment in the total volume of used equipment (pcs./pc.)	The share of imported equipment in planned purchases (pcs./pc.)
	Cost	The share of imported equipment in the total volume of equipment (rub./rub.)	The share of imported equipment in planned purchases (rub./rub.)
Functional	Natural	The share of critical imported equipment in the total volume of critical equipment (pcs./pc.)	The share of critical imported equipment in planned purchases (pcs./pc.)
	Cost	The share of critical imported equipment in the total volume of critical equipment (rub./rub.)	The share of critical imported equipment in planned procurements (rub /rub)

There are two options for calculating an integral indicator of an enterprise's import dependence:

– based on the analysis of monetary relative indicators;

– on the basis of the analysis of natural indicators.

If necessary, the options can be combined. However, the first option generally shows the scale of the problem in terms of production volumes, while the second option shows the range of equipment.

To determine the integral indicator, the application of a weighted additive convolution of the form can be proposed:

$$D = \sum_{k=1}^{4} z_k \left(\sum_{j=1}^{j} \left(\beta_j \left(\sum_{i=1}^{i} \alpha_i a_{ij}^{k} \right) \right) \right) \quad (1)$$

where *zk* – weighting coefficient of the k "quadrant" (k = 1,...,4 – see Table 1), reflecting the selected import substitution strategy; *βj* – share of the equipment used for the j process in the total equipment of the enterprise (j=1,...,*J*); *αi* – coefficient (from 0 to 1), which reflects the risk level associated with the group of supplier countries; – the value of the indicator from the k quadrant of the i group of supplying countries (I in the general case), calculated for the equipment used for the j process.

It should be noted that when determining the indicator *βj*, the equipment utilisation rate can be taken into account, as well as the value of its availability factor.

The analysis of the production processes of biotechnology enterprises, as well as many years of practical experience, allows us to identify the following D ranges in terms of the degree of import dependence of enterprises of this type of economic activity:

– 0-0.1 – low level of dependence;

– 0.1-0.3 – acceptable level;

– above 0.3 – critical level.

The boundaries of these intervals should be refined taking into account the strategic development objectives of the enterprise and the chosen risk management strategy.

It should be noted that further, using a similar additive-multiplicative convolution, it is possible to determine the indicator in question for an industry (type of economic activity), a cooperative chain (in the case of production of complex products). In this case, the contribution of each enterprise to the output of the population of enterprises under study as a whole is taken into account. It is advisable to use the results obtained to make managerial decisions to reduce the level of import dependence. Examples of such decisions may include decisions to develop the leasing system, create equipment sharing centres, encourage the production of domestic equipment and/or service centres, change technological processes and product range, etc.

Obviously, preference should be given to options involving (the widespread introduction of innovation and digital economy tools).

Conclusions

It appears that (the proposed approach can find practical application in solving the problems of import substitution not only within individual biotech enterprises but also in cluster formations). In this case, the degree of promptness and accuracy of the evaluation of indicators included in expression is determined by the availability and functionality of corporate information systems of biotechnology cluster management, (including those based on methods of data mining).

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