Assessment of the effectiveness of the import substitution program (a case study in the mushroom and truffle cultivation industry)

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ORIGINAL ARTICLE

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Abstract. The article assesses the outcomes of the import substitution program in agriculture over the past decade, based on the analysis of functioning results of mushroom and truffle cultivation industry. It reviews the main measures of state support for agricultural producers, such as financial subsidies, preferential loans and tax incentives. Special attention is paid to the assessment of competition in the industry through the calculation of market power indices, including the concentration index, the Herfindahl-Hirschman index and the Hall-Tideman index. It has been found that the implementation of this program from 2014 until now has led to several significant outcomes. Firstly, it stimulated active growth in domestic mushroom industry by providing financial subsidies, preferential loans, tax incentives, and infrastructure support, which allowed Russian producers to expand their capacities and improve product quality. Secondly, the implementation of this program has made it possible to almost completely eliminate foreign suppliers from the market, shifting market dominance to domestic companies. At the same time it was determined the implementation of this program didn't let to avoid the dependence on foreign technologies which is currently a new challenge for the industry requiring further adjustments to state support measures for national production. The findings reveal that while the program succeeded in replacing imported products, long-term sustainability requires investments in domestic technological capabilities. The continued technological dependence creates barriers to technological independence and highlights the need for a new phase of the program focused on developing domestic technological capabilities and maintenance infrastructure to ensure long-term sustainability and competitiveness in the sector. The article concludes with recommendations for improving future policy directions, including greater support for domestic innovation, machinery manufacturing, and staff training.

Keywords: import substitution; government support; agriculture; mushroom and truffle production; market power concentration indices

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Introduction

The relevance of this study is due to the significant changes that have taken place in the Russian mushroom cultivation industry over the past decade, including under the influence of the import substitution program that was launched in 2014. Understanding the role and the impact of government support on the industry is crucial for optimizing support measures and identifying opportunities and challenges for the further development of the mushroom industry in particular, and the agricultural sector in general. As global geopolitical instability and sanctions have increased, the need for self-sufficiency in agricultural production has become a strategic priority for Russia. According to Rosstat, by 2023, the share of agricultural products of domestic production has increased by more than 30% compared to 2013, largely due to the policy of import substitution[1]. These shifts underscore the urgency of assessing the program's long-term impact and the sustainability of current growth, especially in the context of ongoing technological dependence.

The aim of the study is to assess the impact of the import substitution program on the mushroom cultivation market in Russia, analyze changes in the structure of the industry, and identify potential challenges that may hinder the further growth of domestic production in this industry. To achieve this aim, general scientific methods such as comparative analysis, statistical analysis, synthesis and generalization were

[1] *Agriculture in Russia. 2023: Stat.sat./Rosstat – From 29 M., 2023. – 104 p.*

employed, as well as economic and mathematical methods such as the calculation of concentration indices, the Herfindahl-Hirschman Index and the Hall-Taidman Index). These methods allowed for a detailed assessment of the degree of monopolization and competition in the industry, identification of key players and structural changes in the market over the past 10 years.

The question of market concentration assessment is addressed in the article by O.Y. Chelnokova, which presents a methodology for applying the Herfindahl-Hirschman Index to analyze industry markets. This method is used in the present study to assess the level of competition in the mushroom sector, as it provides an objective measure of market dominance by individual firms [1].

Gavrilenkov and Struchenevsky examine the shift from an innovation-based model to an import substitution policy. They argue that without a strong foundation in domestic technologies and R&D, the model may prove unsustainable in the long term [2].

The work by E.Z. Golosman and S.A. Volchenkova addresses the chemical industry and emphasizes that catalysts for import substitution are not only business support measures but also include systemic development of science and technology [3].

The article "Import Substitution in Action" presents sectoral examples illustrating both the successes and challenges of implementation. While effective localization efforts are noted, problems with quality and price competitiveness are also identified [4].

The article "Import Substitution is Working" provides a review of the initial outcomes of import substitution programs across various sectors, including agriculture. It highlights that results were largely achieved through import restrictions and subsidies for domestic enterprises [5].

The prospects of import substitution in the modern economy are analyzed by V.V. Klyushin and I.I. Romanets, who stress the need for strategic planning and achieving technological independence as long-term objectives [6].

The work by V.A. Kulagin discusses the criteria for effective import substitution. The author emphasizes that the success of the policy depends on a combination of government support and market-based incentives. Special attention is given to performance indicators such as technology localization, employment growth, and the increase in domestic production [7].

N.V. Obolensky shares practical experience in implementing import substitution in the field of higher education, highlighting the importance of workforce training and academic support for industrial projects [8].

In their 2024 study, L.V. Rakhlina and T.V. Volkova examine the key problems that hinder full-scale import substitution: technological backwardness, lack of infrastructure, and workforce shortages. Nevertheless, the authors argue that with sufficient political will and coordinated efforts, a sustainable transition to independent domestic production is achievable [9].

I. Shirokova focuses on the investment aspect of import substitution programs. The article stresses that without modernization of equipment and the development of domestic production of components, dependence on foreign technologies will persist [10].

The issue of import substitution in the agro-industrial complex, as well as the assessment of market concentration and industry competitiveness, is widely covered in contemporary academic literature. The study by M.I. Svishcheva analyzes the dynamics of mushroom production, export, and import in Russia. The author emphasizes that before the implementation of the import substitution program, the market was heavily dependent on foreign supplies, particularly from Poland. The work includes relevant statistical data and demonstrates the positive impact of state support on the growth of domestic production, making it important for analyzing structural shifts in the industry [11].

The study by L. Yu. Urazaeva and I.A. Galimov proposes a mathematical model of import substitution that considers production capacity, investment, and localization indicators. This research allows for the formalization and forecasting of state policy effectiveness [12].

Consequently, the reviewed literature demonstrates that import substitution is considered both from an economic and institutional perspective. Special attention is paid to assessing competitive market structures,

the effectiveness of government support, and the need for technological modernization-making these sources essential for studying the transformation of the mushroom industry.

Main part

Until 2014, the Russian mushroom industry was underdeveloped and could not compete with foreign suppliers. The market was dominated by imported products, which accounted for 85% of the total volume of mushrooms and truffles sold in the Russian market. Most of the mushrooms came from Poland, Belarus and Lithuania. For many years, Poland remained the main supplier of fresh champignons to Russia, with a share of 98% in total imports in 2013 [11]. Both a lack of domestic production and a low level of technology in domestic enterprises caused this.

Due to the sanctions imposed by Western countries in 2014, Russia adopted an import substitution policy in various sectors of the economy, including agriculture. The agricultural development program aimed to reduce dependence on foreign products by developing the Russian agro-industrial complex. The total amount of funding for the 2014-2020 program was 18, 5059.3 million rubles, including 75, 297 million rubles from the federal budget, 46,001.9 million rubles from the consolidated budgets of the constituent entities of the Russian Federation and 63,760.4 million rubles from extra-budgetary sources[2].

The state program for the development of agriculture and the regulation of agricultural products, raw materials, and food markets included a set of measures aimed at ensuring the sustainable development of the Russian agro-industrial complex, covering a wide range of support measures shown in Figure 1.

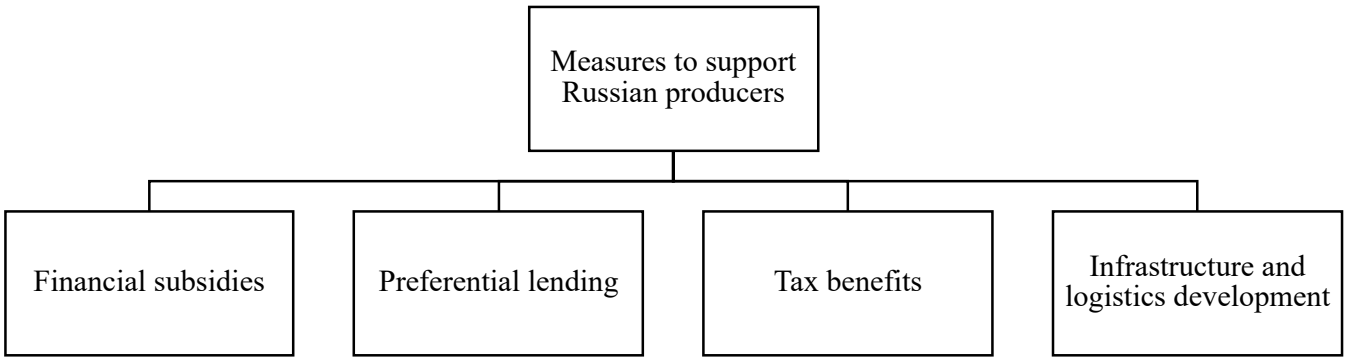

Figure 1. Measures to support Russian agricultural producers

Source: Author

One of the key forms of support was the provision of financial subsidies to agricultural producers. These subsidies were aimed at compensating for part of the costs that farmers and agricultural enterprises incur in the production process. In particular, it concerned the costs of purchasing agricultural machinery, seeds, fertilizers, and the modernization of production facilities. The main purpose of the subsidies was to reduce the financial burden on agricultural producers. This allowed them to not only offset some of the costs, but also stimulate production growth. In the mushroom industry, subsidies were used to modernize equipment and introduce new technologies, which made it possible to improve and increase the volume of domestic products on the market.

Another important mechanism was the provision of preferential loans to agricultural producers. These loans allowed farmers and agricultural enterprises to obtain the necessary financial resources on favorable terms. The preferential loan rates significantly reduced the financial burden on agricultural producers, enabling them to invest in the development, modernization and expansion of their operations. For example, loans were used to purchase machinery, build and renovate warehouses and other production facilities, which was important for mushroom production enterprises seeking to improve product storage and processing capabilities. In addition, government guarantees on these loans decreased the risks for banks, increased the availability of financing for farmers.

The program also provided tax benefits for farmers. Agricultural enterprises could take advantage of

[2] *Decree of the Government of the Russian Federation of April 15, 2014 No. 315 "On Amendments to the State Program for the Development of Agriculture and Regulation of Agricultural Products, Raw Materials and Food Markets for 2013-2020"*

these tax breaks, which helped them reduce their tax burden and contributed to the financial stability of agricultural producers. In the mushroom cultivation industry, tax incentives helped to reduce the cost of doing business, giving companies more opportunities to reinvest in the development of their production and the purchase of necessary equipment.

One of the most important aspects of the state program was the support and enhancement of agricultural infrastructure, which included the construction and modernization of roads, establishment of warehouses, and development of a system for storing and processing agricultural products. Improving the infrastructure was crucial for the efficient operation of agricultural enterprises, as it helped lower transportation and storage costs. In the field of mushroom cultivation, these measures have contributed to creating more efficient supply chains, which has significantly accelerated the delivery of goods from producer to consumer and increased competitiveness in the market. Infrastructure development also included the establishment of regional sales markets, which was especially important for small and medium-sized farms, including mushroom producers, as it allowed them to not only increase their profitability, but also reduce their dependence on large retail chains.

The program provided for the creation of a system of state regulation of foreign trade and the domestic agricultural market to reduce the impact of external factors on domestic producers. It also included measures to improve conditions for Russian exports of agricultural products, including subsidies for transportation, stimulating the supply of agricultural products abroad and the development of export infrastructure, which helped strengthen the position of Russian producers in international markets, reducing their dependence on imported products.

To give a more accurate assessment of the impact of the import substitution program on the mushroom production market, we will assess the level of competition within the industry in 2013 and 2023. We will calculate the following indicators to measure the concentration of market power and monopolization of the industry):

– The concentration index (the sum of the market shares of the largest firms), is calculated according to the formula[3]:

$$CR_k = \sum_{i=1}^{k} Y_i \quad (1)$$

where Y_i is the market share of company i;
k is the number of companies for which this indicator is calculated.

– The Herfindahl-Hirschman index is calculated using the formula [1]:

$$HHI = \sum_{i=1}^{k} Y_i^2 \quad (2)$$

– The Hall-Tideman index is calculated using the formula:

$$HT = \frac{1}{2(\sum_{J-1}^{n} rx_i)-1} \quad (3)$$

where n is the number of firms in the industry;
r is the industry rank of each firm (in descending order, the largest firm has rank 1);
xj is the share of the output owned by each company, in %.

As mentioned above, in 2013, the share of Russian enterprises in the mushroom production market was only 15%, the rest was occupied by foreign suppliers, in particularly Polish companies, which effectively monopolized the industry with 83.3% of the market. To calculate the concentration of domestic producers, we identified the 10 largest players in the industry based on revenue for 2013 (Table 1).

According to the table, in 2013, several major players dominated the mushroom production market in Russia. However, domestic products accounted for only 15% of the market, with the rest being represented

[3] *The Central Bank of the Russian Federation. Information and analytical material "On the coefficients of market concentration" by G. Gambarov. - Text: electronic // URL: https://www.cbr.ru/Content/Document/File/158262/02_DS.pdf (date of request: 03/15/2025).*

by foreign supplies. The industry leader among Russian producers, Agrotechmarket LLC, controlled 9% of the domestic mushroom supply market with revenues of 987,261,000 rubles. The shares of other Russian companies were insignificant, ranging from 1.8% to 0.2%.

Table 1 – Leaders of the Russian mushroom growing industry for 2013

Company	Revenue for 2013, Rub.	Market share, %
Agrotechmarket LLC	987 261 000	60
Project Griby LLC	201 692 000	12
NGC Kashira LLC	158 719 000	10
Orix LLC	135 473 000	8
Agroprom LLC	44 946 000	3
TPK "Discoros-Tyumen LLC	24 320 000	1
Agrocombinate"Ecofud" LLC	21 954 000	1
Agrotechnologia LLC	21 787 000	1
KFC Tuymazyagrogrib LLC	20 118 000	1
Penta LLC	20 028 000	1

Source: Author

Next, we will analyze the level of competition in the mushroom industry among Russian producers[4], for which we will calculate the corresponding concentration coefficients (Table 2).

Table 2 – Assessment of the competition level in mushroom and truffle cultivation in 2013

Indicator	Value	Interpretation of the result
The Concentration index	82%	High concentration
The Herfindahl-Hirschman Index	39%	High concentration
The Hall-Tideman Index	20%	High concentration

Source: Author

The assessment of the competition level in 2013 showed that the Mushroom and Truffle Cultivation industry in 2013 was characterized by a high degree of concentration. Domestic companies controlled only about 15% of the market, with the rest of the market being occupied by imported products. The 82% concentration index indicates that most of the market share (82%) is concentrated among the largest companies, which, in turn, limits competition among small and medium-sized domestic producers. The Herfindahl-Hirschman index of 39% confirms this high concentration, as an index value above 0.25 indicates the predominance of several major players in the market, which narrows the competitive opportunities. The Hall-Tideman index of 20% additionally confirms the high degree of concentration and demonstrates the strong influence of the largest players on market processes.

To calculate the concentration indicators, we will identify the 10 largest players in the industry by revenue for 2023 (table 3).

Table 3 – Leaders of the Russian mushroom cultivation industry for 2023

Company	Revenue for 2023, Rub.	Market share, %
Mushroom Rainbow LLC	5 220 135 000	32
Voronezh Champignon LLC	4 798 342 000	29
Master Mushroom LLC	1 603 964 000	10
Mushroom Company LLC	1 060 008 000	6

[4] *While it would have been more accurate to make this calculation considering foreign producers as well, the difficulty in obtaining data on their revenue during this period prevented us from doing so..*

Company	Revenue for 2023, Rub.	Market share, %
Russian Mushroom LLC	1 038 868 000	6
Sibagroholding LLC	734 455 000	4
NGK Kashira LLC	697 451 000	4
Aigies Agro LLC	627 474 000	4
RM Group LLC	323 328 000	2
Penta LLC	20 028 000	1

Source: Author

Table 3 shows the market share distribution among the top ten players in the industry. The clear leader is the Mushroom Rainbow Company with 32% of the market and revenue of 5,220,135,000 rubles. Voronezh Champignon is in the second place, which, despite significant production volumes, controls 29% of the market with revenue of 4,798,342,000 rubles, which is 3% less than the leader. Master Mushroom takes the third place and demonstrates good results, with revenue of 1,603,964,000 rubles and 10% market share. Other companies like Mushroom Company and Russian Mushroom have significantly smaller market shares, which indicates a higher level of competition among small and medium-sized businesses in this industry.

It is important to note that Mushroom Rainbow maintains a high degree of market control, which gives it competitive advantages in pricing, distribution and innovative technologies. Nevertheless, the presence of such players as Voronezh Champignon, with a similar level of market share, creates conditions for intense competition, which requires the company to constantly modernize production facilities and develop marketing strategies.

Next, we will calculate the concentration of market power as of 2023 (Table 4).

Table 4 – Assessment of the competition level in mushroom and truffle cultivation in 2023

Indicator	Value	Interpretation of the result
The concentration index	71%	High concentration
The Herfindahl-Hirschman Index	20%	High concentration
The Hall-Tideman Index	20%	High concentration

Source: Author

The assessment of the competition level in the Mushroom and Truffle Cultivation industry, as presented in Table 4, shows that the market has a high degree of concentration. The concentration index of 71% indicates that the top ten firms control most of the market, which is confirmed by the dominant position of several major players. In turn, the Herfindahl-Hirschman index of 20% also indicates a high concentration, which is typical for industries where several large companies have significant market influence. The Hall-Tideman index, also equal to 20%, confirms the data on high concentration and competition, where top companies have a significant impact on market processes. The top ten companies control 71% of the market, which creates certain barriers to entry for new players, as well as increases the level of competition among existing businesses.

Thus, the study showed that the mushroom growing market in Russia has experienced significant changes over the past ten years, and one of the most important factors that led to them was the import substitution program launched in 2014.

One of the most notable aspects of the transformation is the increase in market volumes. In 2013, the total revenue of the top ten companies was only 1.6 billion rubles, while in 2023 this figure had increased to 16.4 billion rubles. This significant rise indicates a multiple expansion of the market and the development of production. The import substitution program, aimed at stimulating domestic production and reducing dependence on foreign supplies, has played an important role in this process. With the increase in market value, production has also grown in volume significantly. This fact can be confirmed by a decrease in the level of monopolization of the industry and higher competition, enabling better product quality and price

optimization in the market.

In parallel with the elimination of foreign producers, the import substitution program created an opportunity for several new major domestic players to enter the market. One of these companies is the Mushroom Rainbow company, a leading producer and supplier of fresh champignons on the Russian market with a production volume of more than 32,000 tons of fresh champignons per year[5]. Thanks to government support, Mushroom Rainbow has built a full-cycle production facility: from the production of compost and soil cover for champignon cultivation to the supply of products to retail outlets. The company gained a strategic advantage, allowing it to control a significant part of the production and distribution process.

In addition, Voronezh Champignon LLC took the second place in terms of revenue in 2023, increasing its revenues to 4.8 billion rubles. The emergence of new market leaders, along with the growth of existing players, was the result of the successful implementation of the import substitution program. It created favorable conditions for new companies offering innovative solutions and enhanced the investment attractiveness of the industry.

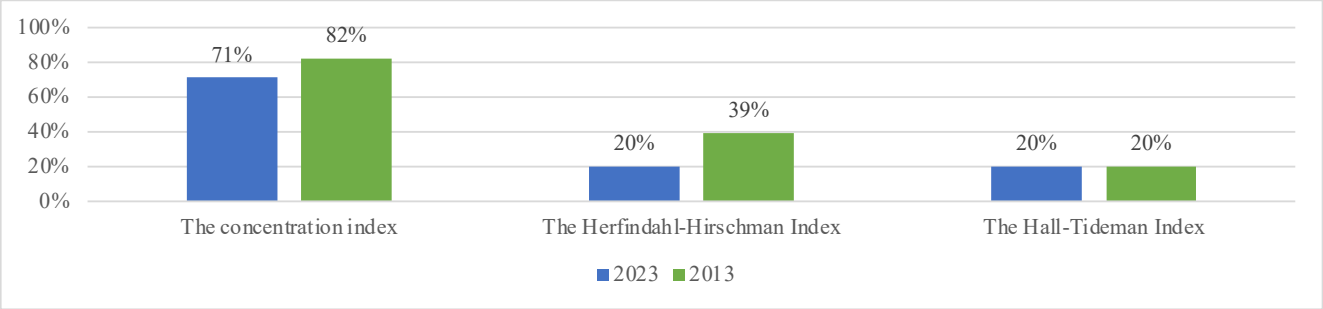

Figure 2. Dynamics of competition indicators over 10 years

Source: Author

The comparison of data on the concentration and market concentration indices in 2013 and 2023 reveals significant changes in the mushroom cultivation market in Russia. In 2023, the concentration index decreased from 82% to 71%, indicating a slight weakening of the dominance of the largest players and an improvement in market competition. The Herfindahl-Hirschman index also decreased from 39% to 20%, which confirms a decrease in concentration and greater market diversification. Nevertheless, the Hall-Tideman index remained at 20%, which indicates that the market continues to be concentrated among several major players, while competition remains at a high level.

Thus, over the past decade, the industry has grown and become more competitive, but there is still a high concentration of market shares in the hands of several companies, which poses a challenge. This high market concentration creates barriers to entry for new market participants, making it difficult to enter the market and reducing overall competition. As a result, this can lead to price monopolies, as the largest players control prices increase the cost of products for end users.

Having described the positive changes, it should also be noted that one of the main challenges facing the Russian mushroom industry now is the obsolescence of equipment and related difficulties in maintaining, repairing, and replacing it. For example, despite the active development of production, Russian companies, including industry leader Mushroom Rainbow LLC, continue to use European technologies and equipment, in particular, Dutch full-cycle technology, which increases production efficiency, but creates dependence on foreign supplies and technologies.

Consequently, the import substitution program has reduced dependence on imported products, but it has not solved the problem of dependence on foreign technologies and equipment. Existing equipment requires regular updates and highly qualified maintenance, which is a significant barrier to further growth. Under the conditions of sanctions and restrictions, access to Western technologies is becoming more and more problematic, and high maintenance and modernization costs are becoming an obstacle for many

[5] *The official website of Mushroom Rainbow - Text: electronic // Mushroom Rainbow: [website]. - URL: https://gribnaya-raduga.ru / (date of request: 03/15/2025)*

manufacturers.

Thus, in order to ensure the long-term sustainability of the mushroom industry, it is essential to not only support the development of domestic producers, but also solve the problem of creating and implementing domestic technology, as well as building our own production facilities and maintenance infrastructure. Measures that consider these factors should be incorporated into the list of amendments made to the state program for the development of agriculture and regulation of agricultural products, raw materials and food markets for 2013-2020 on April 15, 2024.

Conclusion

As a result of our research, we can conclude that the Russian mushroom market has seen significant changes in the last ten years. Until 2014, the market was dominated by imported products, and production was not well developed. However, government support measures have enabled domestic companies to replace imported goods. Now, domestic companies occupy 90% of the market, while foreign companies mainly provide equipment, technology, and consulting services.

At the same time, another challenge in the industry has emerged – the obsolescence of equipment and the difficulty of maintaining and replacing it, due to Russian manufacturers' continued use of European equipment and technology for mushroom production. For instance, the Mushroom Rainbow company implements full-cycle production using Dutch technology, which creates significant obstacles to further industry development in terms of maintenance, repair, and spare parts procurement.

Thus, the import substitution program has successfully solved the problem of replacing imported products, but it has not eliminated dependence on foreign technologies. This has become a new challenge for the industry, requiring adjustments to the measures of state support for domestic production.

Based on the study findings, we recommend a shift in the focus of state support toward technological sovereignty in the agricultural sector. In particular, subsidies and grants should prioritize domestic equipment manufacturing, research and development, and the creation of a national competence center for mushroom cultivation technologies. Moreover, future policy measures should incorporate mechanisms for workforce development and vocational training to reduce operational dependency on foreign service providers. Forecasts suggest that by 2030, the domestic mushroom industry could fully cover internal demand and enter international markets, provided that challenges related to technology and infrastructure are addressed. The results of this study can be used to adjust government agricultural policy, inform strategic planning in the agro-industrial complex, and serve as a reference for private investment decisions in the sector.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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