Research Article

Food security and import substitution policy in the agro-industrial complex

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ABSTRACT

Achieving an acceptable level of economic security and its food component in meso-level systems requires an assessment of the existing sectoral potential and the structuring of the mechanism of its use that affects the achievement of the sustainable development trajectories for the agro-industrial complex and the feasibility of implementing the import substitution program. In the work, a cluster analysis was carried out based on the criterion for assessing the effectiveness of the use of accumulated potential in the regional context according to the sources of its formation, taking into account the negative impact and the influence of endogenous and exogenous factors: the effectiveness of the state policy of supporting the agro-industrial complex, counteraction to the sanctions, technical and technological potential, socioeconomic development of rural areas. The results of clustering conducted on the example of the regions of the Russian South made it possible to determine the strategic priorities for improving food security, the state support mechanisms that have been formed, and to transform external and internal conditions for the functioning of the territorial agro-industrial complex from the limiting nature of the impact to the stimulating one. The following should be distinguished as the main directions for improving food security: stimulating technical and technological modernization of the agroindustrial complex sectors within the existing logistics chains; growth of the personnel potential of the industry and introduction of advanced innovative technologies; development of modern social infrastructure in rural areas; increase in the level of investment activity of agricultural producers, especially concerning storage and processing of products.

Key words: agro-industrial complex, food security, import substitution, state support

INTRODUCTION

The main goal of the territorial agro-industrial complex development in modern conditions is to increase the economic potential of agricultural producers, as well as to stimulate import substitution processes in the part of producing competitive domestic products. In this regard, the domestic agro-industrial complex should be considered by the government as a system of interaction between economic agents, the effective functioning of which creates prerequisites for improving the level of food security.

The implementation of the task on increasing import-substituting potential in the agro-industrial complex is connected with the need to analyze existing risks that detain and adversely affect the sustainable development of a territorial agro-industrial complex and the level of food security [14]. This problem is especially acute at the level of individual territorial entities of the Russian Federation, which social and economic potential is highly differentiated, and which react differently to external threats.

The executive authorities of the regions have at their disposal a fairly wide range of levers and instruments aimed at shaping the trajectories of sustainable economic development of the agro-industrial complex. However, the amount of

budget resources that are redistributed among the constituent entities of the Russian Federation within the framework of federal targeted programs to support the agro-industrial complex is insufficient, so solution to the problem on ensuring food security continues to be one of the most urgent.

Legislative environment for agro-industrial complex support in many countries is aimed at stimulating economic activity of agricultural producers [4], however, the quality of legislative acts does not allow to create in the regions an institutional environment that would facilitate the growth of import substituting capacity without taking into account subsidies and grants from the state [12]. In this regard, the financial and economic mechanism to improve food security through the growth of import substituting capacity continues to play a leading role, which requires an increase in the efficiency of spending budget resources.

Achieving an acceptable level of economic security and its food component in meso-level systems requires assessment of the existing sectoral potential [7] and the structuring of the mechanism of its use that affects the achievement of sustainable development trajectories for the agro-industrial complex and the feasibility of implementing an import substitution program for basic food products.

In this regard, we conducted a comprehensive analysis for assessment of the effectiveness of the accumulated potential use in the regional context according to the sources of its formation, taking into account the negative impact and influence of endogenous and exogenous factors associated with the imposition of sanctions and food embargoes. The selected criteria have a quantitative assessment, which allows to determine the main problems of ensuring food security: effectiveness of the government policies to support the agro-industrial complex, counteracting the pressure of sanctions, technical and technological potential, as well as socio-economic development of rural areas.

Methodology for assessing the import-substituting potential of the agro-industrial complex

Getting an integrated assessment of the effectiveness of using the existing agro-industrial complex potential requires creation of an indicative system based on comparable indicators. For this, it is possible to use economic and statistical approaches, in particular, the method of two-stage standardization of coefficients [8]:

– Bringing the criteria to a single focus based on the nature of their impact on the use of the accumulated potential of the agro-industrial complex;

– Standardization of the values of all indicators in the regional context according to the following formula:

$$X_i^{st} = \frac{x_i - x_{min}}{x_{max} - x_{min}}. \qquad (1)$$

Further, it is necessary to perform clusterization of the territorial entities of the Russian Federation in the two-dimensional coordinate system "accumulated potential - realization of the potential". The ultimate goal of this procedure is to build a matrix of regions that will determine the key priorities of the strategy for improving food security based on a static assessment of the existing potential of the agro-industrial complex and the dynamic characteristics of effectiveness of its use.

The procedure for clustering of the territorial entities of the Russian Federation in terms of efficiency evaluation for using the accumulated potential is based on the analysis of endogenous and exogenous factors and assumes their model grouping. This allows a theoretical basis to form for creating long-term strategies and their implementation to improve sustainability of development of the agro-industrial complex in the context of ensuring food security. The agro-industrial cluster, like any other, has an "idealized structure" [5] which makes it possible to classify territorial and sectoral complexes on the basis of selected indicators in order to determine the specificity of their influence on the level of food security, the strengths and weaknesses of the agro-industrial complex.

Statistical data were used from the subjects of the North Caucasus Federal District and the Southern Federal District, with the exception of

Sevastopol and the Republic of Crimea, in the capacity of initial indicators based on which clusterization of regions is conducted. Construction of clusters, in accordance with the goal, is based on the use of criteria that have a quantitative assessment and reflect the main characteristics of the general population. The following indicators were used to measure the effectiveness of the use of accumulated potential: the ratio of the average wage in the industry to the average wage for the region, the share of imported food products, the share of innovatively active organizations, the level of profitability of products sold and the share of investment in the volume of shipped products. These indicators meet all the requirements of cluster analysis, since they allow for a comprehensive assessment of the characteristics of the territorial agro-industrial complex as clustering objects.

Assessment of the accumulated potential presupposes selection of indicators characterizing the scale of agricultural production, export-import flows of the territorial entities of the Russian Federation, and the material and technical equipment of agricultural producers. The use of these indicators corresponds to the clustering principle formulated in the work of I. Mandel: "The clustering object can be described according to the distinguished feature by a certain number of indicators, where certain specificity for chosen groups is formed with regard to the content attrbute and is variable with respect to other groups of characteristics" [2].

The quality of the cluster analysis performed requires the following requirements (Table 1).

Table 1 - Requirements for conducting cluster analysis

Requirement	Attainment
The maximum degree of homogeneity of the selected clusters	The choice of unified indicators characterizing the development of the territorial agro-industrial complex and their standardization
The maximum degree of differentiation of the criteria for clusters	The selected indicators characterize various components of the import
	substitution potential in the territorial agro-industrial complex
High density of results within clusters according to selected indicators	Using a combined cluster analysis technique in "Statistica 10" software
Stability of clusters to external influences	Using graphical analysis and dendrograms
The minimum number of research objects that are dropped out or excluded from consideration to improve the accuracy of cluster analysis procedures	The condition for successful clustering is that each region is included in one of the clusters

In the literature, the following basic algorithms and techniques are widely used: "neural networks, hierarchical trees or dendrograms, nearest neighbor methods, methods for maximizing intercluster and minimizing intracluster distance, probabilistic methods, and others" [1]. Recently, more and more attention has been attracted to the use of the analysis methods based on artificial intelligence and Data Mining [11], however, their use in our case is inexpedient, since the use of Data Mining implies the presence of unstructured large arrays of initial statistical information.

The analysis of existing clustering methods showed that to use the accumulated potential in the context of ensuring food security in the context of the subjects of the Southern Federal District and the North Caucasus Federal District, it is advisable to use the software "Statistica 10" according to the following algorithm:

1. Standardization of the initial data with a view to bringing them to a comparable level;

2. Determination of the initial number of clusters;

3. Implementation of the clustering procedure;

4. Determination of the central characteristics of the selected indicators in the clusters obtained;

5. Obtaining and analysis of dendrograms;

6. Assessment of the adequacy of the clustering procedure conducted;

7. Possibility of a meaningful interpretation of the results for clustering and their interpretation;

8. If the results obtained are incorrect, then the model needs to be corrected: changing the

number of indicators, the number of clusters, the clustering algorithm itself;

9. Obtaining final results and their interpretation.

Results of modeling the potential of import substitution in the agro-industrial complex

The results of standardization of the initial data with a view to bringing them to a comparable type are presented in Table 2.

Table 2 - Standardized indicators characterizing the import substitution potential of the subjects of the Southern Federal District and the North Caucasus Federal District

Region	Accumulated potential	Implementation potential
Republic of Adygea	0. 22	1. 25
Republic of Kalmykia	0. 28	0. 26
Krasnodar region	2. 41	1. 55
Astrakhan Region	0. 19	0. 62
Volgograd region	0. 79	0. 90
Rostov region	1. 55	1. 60
Republic of Dagestan	0. 81	0. 22
Republic of Ingushetia	0. 12	0. 64
Kabardino-Balkaria Republic	0. 49	1. 34
Karachay-Cherkess Republic	0. 22	0. 13
Republic of North Ossetia-Alania	0. 11	0. 51
Chechen Republic	0. 10	0. 12
Stavropol region	1. 90	1. 51

The clustering procedure was carried out using the Statistica software which algorithm determines the number of clusters as the difference between the number of objects (in our case, the subjects of the Southern Federal District and the North Caucasus Federal District) and the number of steps that must be taken to determine the maximum possible intercluster distance. The simulation results confirm that the choice of three clusters is optimal. The first cluster includes the Krasnodar and Stavropol Territories, as well as the Rostov Region. The second cluster is the most numerous and includes the Astrakhan region, the Republic of Ingushetia, the Republic of North Ossetia-Alania, the Republic of Kalmykia, the Chechen Republic and the Republic of Dagestan. The third cluster includes the Volgograd region, the Kabardino-Balkarian Republic and the Republic of Adygea.

The proposed model for assessing the effectiveness of the use of the accumulated potential in the agro-industrial complex with breakdown into the regions of the Southern Federal District and the North Caucasus Federal District and their clustering allows a strategy to formulate for ensuring the trajectories of sustainable growth in agricultural production, which will positively affect the level of food security not only on a scale of individual subjects of the Federation, but and the whole country (table 3).

Table 3 - Clustering of the subjects of the Southern Federal District and the North Caucasus Federal District by the nature of the import substitution potential in the agro-industrial complex

Cluster	Region type	Regions
I	Regions of "intensive growth"	Krasnodar Territory, Stavropol Territory, Rostov Region
II	Regions of "extensive growth"	Astrakhan Region, Republic of Ingushetia, Republic of North Ossetia Alania, Republic of Kalmykia, Chechen Republic, Republic of Dagestan
III	Regions of "combined growth"	Volgograd Region, Kabardino-Balkaria Republic, Republic of Adygea

The first group includes the Krasnodar and Stavropol Territories, as well as the Rostov Region. These regions have a sufficient level of implementation potential for the import substitution program. This is due not only to the high level of natural and climatic potential, but above all to the high level of investment activity in the agro-industrial complex, which is related with the activities of large agro-industrial holdings. It should also be noted that a high level of interregional trade in agricultural products, as well as foreign economic activity, is observed in the Krasnodar Territory. In the Stavropol Territory, it should be noted that in addition to the traditional crop production sector, the production of poultry and pork has become a locomotive of growth. It is common for all these regions that the further growth of the main industry complexes is possible due to the improvement of qualitative characteristics, which requires raising the level of investment activity of agricultural producers in the direction of their technical and technological modernization and introduction of modern production technologies in all stages from production to the sale of food products. In this regard, the regions of this group were assigned to the cluster of "intensive growth".

The second group of regions is the most numerous, it includes: the Astrakhan region, the Republic of Ingushetia, the Republic of North Ossetia Alania, the Republic of Kalmykia, the Chechen Republic, the Republic of Dagestan. These subjects have the lowest level of import-substituting potential of the agro-industrial complex, since the investment activity in those economic entities is at a minimum level, foreign trade operations are practically non-existent, agricultural land is not fully used, and the growth rates of production and its profitability have high amplitude of fluctuations. Thus, these subjects do not effectively use the available potential, therefore, the implementation of the import substitution process in these subjects of the Southern Federal District and the North Caucasus Federal District is possible primarily due to extensive growth factors that do not require the implementation of large-scale investment projects, as well as a significant amount of subsidies, grants and other forms of state support.

The third group includes the Volgograd region, the Kabardino-Balkarian Republic and the Republic of Adygea. These regions have a medium level of import-substituting potential in the agro-industrial complex, which is confirmed by the value of the share of investment expenditures being slightly higher than the average Russian level, but lower than in the leading regions of the Southern Federal District and the North Caucasus Federal District. In the Kabardino-Balkarian Republic and the Republic of Adygea, there is a low level of social development in rural areas, and in the Volgograd region there is a low level of output profitability with relatively high investment activity. As a result, realization of the existing import substitution potential of the regional agro-industrial complex is possible not only due to the factors of intensive, but also extensive growth, therefore they were included in the second cluster as the regions of "combined growth". It is the combination of these two groups of factors that will make it possible to form a stable development trajectory for the agro-industrial complex in these regions and fully realize the potential of import substitution and increase the level of food security.

Thus, the clusterization of the subjects of the Southern Federal District and the North Caucasus Federal District in terms of the potential of import substitution in the agroindustrial complex makes it possible to determine the strategic priorities for improving food security, the state support mechanisms that have been formed, and to transform the external and internal conditions of the territorial agro-industrial complex from the limiting nature of the impact to the stimulating.

Recommendations on the development of strategies for increasing the import-substituting potential of the regional agro-industrial complex

Simulation results should be used as a basis for developing a program to improve food security through the implementation of import substitution policies. The regional strategy of import substitution should be in line with

national priorities for ensuring food security, therefore, the measures to be implemented and the instruments used should be combined with federal support programs for key areas for the development of the agro-industrial complex [3]. In this regard, modernization of sectoral complexes, raising the level of social development of rural areas and introducing advanced technologies into the production cycle are at the forefront, which will help to achieve the targets of the provisions from the Doctrine for ensuring food security of the country, and will also allow achieving sustainable economic growth rates.

Despite the existing differences in the development of the agro-industrial complex and the difference in the potential for import substitution of the subjects of the Southern Federal District and the North Caucasus Federal District, and as a consequence, the need to use different tools, it is possible to outline the general key directions for achieving the goals and the tasks that are declared in the Doctrine on Food Security.

First, the deterioration of the foreign policy situation and the introduction of sanctions and counter-measures brought the problem of increasing the food security level to the key ones, and led to the intensification of the efforts of public authorities at the federal and regional levels. The regulatory and legal support for import substitution processes is reflected in the adoption of laws in the territorial entities of the Russian Federation aimed at stimulating the economic development of the agro-industrial complex, control and monitoring their proper implementation.

Secondly, the territorial entities of the Russian Federation, developing their own strategies for import substitution, and taking decisions on the use of specific organizational and financial instruments rely on the resource potential of the federal center. In this regard, they are being built into the system of federal special-purpose financing within the framework of increasing the level of food security.

A set of measures can be proposed as the key directions for increasing import-substituting potential in the system of ensuring food security in the subjects of the Southern Federal District and the North Caucasus Federal District, that will be common for all regions, despite the existing differentiation of the socio-economic development of the agro-industrial complex.

Evaluation of effective implementation of the import substitution program and its adjustment require monitoring of the implementation of the program for the selected indicators, both in the region as a whole and in the context of municipalities, if necessary. The generally recognized goal of food security monitoring is to provide the executive authorities with objective, comprehensive and integrated information on the current implementation of the import substitution program and the main trends in the development of the territorial agro-industrial complex, [9] which will allow for more adaptive management decisions and will contribute to the increase in the effectiveness of the program implementation. It is also necessary to include a food security level indicator in the long-term development strategies of the territorial entities of the Russian Federation, which would correspond to global trends in food markets, discussed, for example, in the work by S. Maxwell [10].

As shown by the analysis, despite significant differences in the level of territorial development, there are a number of common problems, the solution of which requires the implementation of the following activities:

- To stimulate technical and technological modernization of the agro-industrial complex within the existing logistics chains;
- To attract highly qualified personnel to work in the agro-industrial complex, what will contribute to the growth of the personnel potential of the industry and will promote the introduction of advanced innovative technologies;
- To develop modern social infrastructure of rural areas;
- To increase the level of investment activity of agricultural producers, especially in the direction of storage and processing of products.

The complexity and multidimensionality of the problem on ensuring food security predetermines the need to strengthen state

support for the agro-industrial complex. The effectiveness of spending budget means, on the one hand, the expediency of supporting sustainably functioning agricultural producers [13], but this practice can lead to increased differentiation of the socio-economic development of the territorial agro-industrial complex [6], since depressed regions that particularly need government support will not receive financial resources, which in the long term will lead to a decrease in the competitiveness of domestic producers of agricultural products and will have an adverse affect on the food security of the country, despite the fact that the individual territorial entities of the Russian Federation may increase its own import substitution potential.

In this regard, ensuring food security requires not only the implementation of selective measures to support the agro-industrial sector, but also the development of a comprehensive program to protect the domestic producer through the use of customs and tariff policies, the provision of additional tax benefits and preferences, and influence on pricing mechanisms for basic food products.

CONCLUSIONS

The results of the study demonstrated a significant differentiation of the regions of the Southern Federal District and the North Caucasus Federal District in terms of the import substitution potential, which makes it difficult to conduct an econometric analysis due to the high variance of the initial mass of statistical information. It should also be noted the fragmentary nature of the foreign trade policy of the Russian Federation, the lack of common principles and long-term priorities for supporting the basic sectors of the agroindustrial complex and ongoing sanctions pressure. From the standpoint of ensuring economic security and its food component, it should be noted that setting high import tariffs for investment goods in the agro-industrial complex is impossible due to the critical level of dependence of domestic agricultural producers on imported equipment, machinery and technologies, since such a level of tariffs will make such goods practically

inaccessible and reduce the level of financial stability of enterprises.

Thus, the complex and consistent implementation of a system of interrelated and coordinated legal, administrative, organizational, economic and social measures at the macro and meso-levels is a fundamental factor in the growth of the potential for import substitution in the context of ensuring food security. The combination of economic and administrative state support measures for the agroindustrial complex, taking into account the accumulated potential of import substitution and taking into account the specifics of the socioeconomic development of territorial agribusinesses, will make it possible to develop an adaptive mechanism for responding to changes in exogenous factors. In turn, this will lead to an increase in the level of food security through the creation of prerequisites for the formation of a stable trajectory for the development of the domestic agro-industrial complex.

Further reform of government policies to stimulate import substitution and improve food security requires an integrated assessment of macroeconomic consequences such as increasing the availability of basic food for the population, increasing the competitiveness of domestic agricultural producers in global markets, dependence on imports of critical technologies and goods.

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