Structural changes in the agri-food complex: priorities and management mechanisms

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Abstract. The article is devoted to the analysis of the current state and peculiarities of structural changes in the agri-food complex of Russia. The necessity of modernizing the functional and sectoral structure of the Russian agri-food complex, the transition to an innovative development model in the face of dynamic changes in the external and internal factors of the complex functioning is substantiated. The aim of the study is the theoretical and methodological substantiation of the structural modernization of the agri-food complex of Russia as a priority of its development strategy. The influence of state support and investment on the dynamics of structural indicators of the development of the complex is studied. The necessity of directing the state structural policy in the country's agri-food complex in key areas of the complex development and increasing national competitiveness is proved. Using the input-output method, the effectiveness of state support methods was assessed, which made it possible to evaluate alternative options for the impact of stimulating final demand, volume and structure of state support for industries on GDP growth and individual industries. The tendencies of strengthening the competitive position of Russia in the global agri-food market, especially products of the processing industry, are identified. Promising areas of state regulation are identified, the main of which is the stimulation of the formation of long technological chains of added value based on vertical integration.

1. Introduction
In the scientific literature, the works of many domestic and foreign scientists are devoted to the problems of structural changes. Structural policy, the conditions for its implementation, the types of structural changes and their impact on the economic growth rate are studied in many works, and almost all researchers recognize the thesis of the priority role of structural transformations.

For the development of the theory of interbranch structure, the theory of reproduction created by K. Marx was of great importance. It anticipated the study of intersectoral relations by the input-output method, which is the basis for predicting the development of intersectoral structure and the economy as a whole. The analysis of interindustry interconnections was carried out in the interindustry balance model developed by V. Leontiev. Studies of interindustry relationships in the economy are aimed at identifying patterns and trends in the structure of an object that are stable in the dynamics of parameters, and assessing the effectiveness of existing product flows.

Representatives of the modern theory of institutionalism A. Alchyan, J. Buchanan, H. Demsetz, W. Jevons, J. Commons, R. Couse, A. Cournot, D. North, M. Olson, K. Polanyi, O. Williamson, S. Winter, J. Hodgson, T. Eggertson investigated the system of institutions that promote economic
growth and the development of an intersectoral structure. General issues of the interaction of market structures and the competitiveness of industries, firms are considered in the works of M. Porter, M. Tracy, F. Scherer, D. Ross and other scientists.

Structural changes are associated with the development of global value chains in the global market. The modern theory of their formation in the most systematic form is presented by R. Kaplinsky [1] and G. Gereffi [2, 3], who emphasized the dynamic and controlled nature of global chains, and studied the effects of enterprises entering the global chains of countries with different levels of development.

Theoretical studies of the internal relationships arising in the economic system were carried out by the economist of the Lausanne school of marginal analysis L. Walras. A closed model of general economic equilibrium created by him was described in the work “Elements of pure political economy” [4]. The model of L. Walras gave an impetus to economic thought to the search for the relationship of dynamic equilibrium and economic growth.

The nature of structural interactions was studied by Y. Yaremenko. In modern conditions, the basis of the mechanism that determines the sustainability of economic dynamics and the new quality of economic growth is provided by targeted investments (as opposed to mass) aimed at the development of medium- and high-tech industries, types of products. At the same time, they have a positive impact on other sectors of the economy, determining the overall stability of a multi-level economic system [5].

Structural modernization of the economy in a number of studies is interpreted in connection with long waves of economic growth. According to A. Akayev, the period from 2010 to 2020 is the most favorable time for the development and implementation of a new wave of basic technological innovations. The logic of the author’s research is as follows: the emergence of a new innovation paradigm leads to the development of new innovative products and new industries. At the same time, it is necessary that the flow of innovations enter the “old” sectors of the economy, increasing the added value in them, creating conditions for the growth of labor productivity, leading to the emergence of new products through the merger of technologies [6].

Overcoming the structural constraints of economic growth, according to S. Glazyev, dictates the need for a radical intensification of investment and innovation, which is impossible without maintaining the economic growth rate of at least 8% of annual GDP growth, 10% of industrial production, 15% of investment in basic capital, 20% of R&D expenses. Moreover, the need to increase the growth rate of the Russian economy is determined by the logic of creating the fundamental prerequisites for the activation of investment and innovation processes for the implementation of structural and technological modernization in order to expand the opportunities for socio-economic development in the long term [7].

The theoretical conclusions arising from the analysis of structural modernization are refracted in relation to the agri-food complex as a complex multi-level system. High isolation of the agri-food complex, a significant multiplier effect of the influence of investments and state support on the final results of functioning distinguish it from other diversified structures and make an impact on the study of the features of structural modernization. The substantiation of the methodological principles of the study of interindustry structure showed the need to study the mutual influence of hierarchical levels - intra-complex and inter-complex relationships, inter-regional and inter-industry interactions. It revealed the importance of taking into account the dynamic characteristics of the agri-food complex system in the management of the interindustry structure - adaptability, non-stationarity, inertia, non-linearity, evolution, and balance.

2. Materials and methods
During the study, abstract-logical, economic-statistical, and monographic methods were used, which made it possible to assess structural changes in the agri-food complex of Russia. In the process of the study, the main provisions of the structural-functional and situational analysis using statistical methods of data processing were used.

Broad opportunities for implementing the reproductive approach to managing the development of
the agri-food complex are provided by the input-output method. Using the input-output method, a number of analytical conclusions were obtained on the analysis of structural changes in the agri-food complex as a complex diversified structure. The interbranch approach allows taking into account all the interconnections and interactions of the agri-food complex, and substantiates the directions of the structural modernization of the complex.

To substantiate the directions of structural changes, the method of studying value chains has been used. With its help, the directions of the inclusion of individual segments of the complex in global chains are determined.

3. Results
Assessing the readiness for the development of the Russian agri-food complex, the incompleteness of the structural adjustment should be noted. Structural problems are a major factor of low growth rates. These problems were aggravated, on the one hand, by the global crisis, which caused new systemic challenges. On the other hand, the economic growth model of the 2000s has exhausted itself, which is essentially a recovery model based on the involvement of idle capacities and labor in the production, as well as on the rapidly growing external demand for Russian commodities. Growth rates in the agricultural sector of Russia were not high compared to other countries. In 2000-2017, the volume of agricultural production in Russia grew 1.68 times, which is less than the average for ten CIS countries (1.82 times). Growth in Belarus (1.84 times), Kazakhstan (1.83 times), Ukraine (1.69) was higher than the Russian one [8]. A purposefully implemented import substitution strategy should contribute to structural adjustment. One of its goals should be the convergence of production and consumption patterns while improving the quality of products.

The task of managing structural dynamics objectively involves the creation of integrated mechanisms for regulating structural processes at the macro, meso and micro levels, taking into account not only the economic and technological results of structural changes, but also the social consequences of such transformations. The main direction of structural modernization was to ensure national food independence as a fundamental basis of the country's economic security. One of the tasks was the formation of intersectoral cooperation relations on a new basis, since the system of division and cooperation of labor that had developed in the USSR with its specialized complementary parts was destroyed in the 90s. The completion of the missing links and the formation of vertical relations required a large inflow of capital in the industry complex. The state has become involved in the creation of modern production cycles through the support of large companies of the agricultural holding type. Due to the concentration of capital at the growth points, large production systems have been formed in pig farming, poultry farming, sugar, oil and fat subcomplexes, which are able to successfully increase production volumes.

The combination of state support measures, improvement of the global environment for export-oriented industries, as well as favorable climatic conditions of recent years have contributed to maintaining positive dynamics in the production and financial performance of the agri-food industry, even in conditions of a recession in the Russian economy (Figure 1). After five years of continuous growth (2013-2017), in 2018, the physical volume of gross value added decreased by 1.9% compared to the previous year, while the economy as a whole recorded growth of 2.2%. Contribution of agriculture in the production of gross value added for the period from 2012 to 2016 grew from 3.5% to 3.8% [9]. In 2018, there was a decrease in the share of agriculture in value added, which indicates a relative deterioration in the conditions of reproduction in the industry. At present, the contribution of agriculture to the country's GDP is significantly less than it was in the 90s of the last century (maximum - 7.6%, accounted for 1999). The implemented agricultural policy aimed at increasing the growth rate of agriculture has led to imbalances in the development of the agro-food industry. The growth rate of agriculture is more than twice the growth rate of the processing industries of the complex.
The support provided by the state stimulated the growth of labor productivity in agriculture. In terms of the growth rate of labor productivity in recent years, agriculture is noticeably ahead of other sectors. Nevertheless, the achieved level of labor productivity significantly lags behind that in developed countries, which reflects a lower level of competitiveness of manufactured products and the efficiency of the functioning of the agri-food system of Russia as a whole.

Factors affecting the positive dynamics of the development of the agri-food complex in recent years are of a short-term nature and are mainly focused on agricultural production. A similar situation developed in the agri-food complex after the 1998 crisis, when the observed growth of the Russian economy and agri-food production, in particular, did not lead to a change in the quality of the structure and was caused by the market factors that have a time-limited effect. Most of the economic growth potential caused by the market factors (the presence of significant unused capacities, changes in cost proportions as a result of the devaluation of the ruble, increased opportunities for import substitution, favorable conditions on world markets) was exhausted in a relatively short time.

Over the years of economic recovery, internal sources and growth mechanisms associated with relative macroeconomic stability and the expansion of domestic final demand have been formed. However, the combined effect of these factors was small and did not significantly affect the quality of economic growth.

The structural changes of recent years in the agri-food complex were mostly stochastic in nature and were a response to new challenges and limitations. The introduction of an embargo on food imports from a number of countries required an increase in the volume of domestic production of agricultural products and foodstuffs to solve the problem of ensuring the country's food security and import substitution. To this end, the State Program for the period until 2020 was adjusted, and additional funds were allocated from the federal budget for the development of the agri-food complex. In 2017, 173.5 billion rubles were allocated to support agriculture, including 143.9 billion rubles - from the federal budget and 29.6 billion rubles - from the budgets of the constituent entities of the Russian Federation [10]. This contributed to the growth and development of agriculture.

Food industry sectors are mainly focused on the domestic consumer market. They remain insufficiently diversified, characterized by a low level of innovation and efficient use of resources,
which inhibits the growth of competitiveness of domestic producers. However, the growth potential of these sectors in the coming years will remain at a fairly high level, since the capacity of this segment has not been fully disclosed, and represents great opportunities for Russian and foreign investors. The strategic goal of developing food industry sectors is to realize its potential, which implies the development of export of products with a high share of added value, the production of environmentally friendly food products, import substitution in the domestic food product markets, primarily processed livestock products, to achieve threshold parameters for the country's food independence.

Growth in the competitiveness of the agro-food industry is limited by a deficit of investments and a technological lag. Investments in fixed assets by type of economic activity “agriculture, hunting and the provision of services in these industries” in 2017 compared to 2013 increased by 22.3% with a total increase in investment in the Russian economy by 4.6%. The increase in investment in the production of food and beverages over the same period also amounted to 4.6%. The dynamics of investments in the main sectors of the agri-food complex is not sustainable, which complicates the implementation of long-term priorities for the development of the complex (Figure 2).

![Figure 2. Dynamics of the volume of investments in fixed assets of the sectors of the agri-food complex (according to OKVED2) in 2014-2017, as % of the previous year. Source: Calculated by the authors according to the Federal State Statistics Service (Rosstat) “Dynamics of investment in fixed assets (in comparable prices) in the structure of OKVED2 (NACE Rev. 2)” URL: http://www.gks.ru/free_doc/new_site/business/invest/tab_din-OKVED.htm (reference date March 1, 2019).](image-url)

A new national goal in the agri-food sector is the accelerated development of exports. Over the past six years, the volume of exports of agricultural food products increased by 54.4% and amounted to $25.9 billion in 2018. Outstripping growth in the agricultural food sector in relation to other sectors of the economy also contributed to a steady increase in the share of food in the total value of exports. If in 2012 the share of food products was 3.2%, then in 2017 - 5.8% of all exports [11]. The growth of the export potential of the agri-food complex of Russia requires the formation of a new model of joining global value chains, which should ensure access to a higher level of production cooperation with the formation of national intersectoral segments of global reproduction systems.

The analysis of competitiveness by individual product groups showed that there is a steady strengthening of Russia's competitive position in the global agri-food market [12]. In 2012, high levels
of competitiveness existed only in the market of grain, vegetable oil and animal fats. Over the past three years, an improvement in competitive positions was noted in a wide range of products of the processing industry - in the products of the milling industry (for example, gluten production), animal feed, and others. Russia is a world leader in a number of commodity items, but in the total volume of agricultural raw materials and food exports, it holds a place that does not correspond to the country's potential.

The forecast of the Ministry of Economic Development of Russia until 2024 does not provide for high growth rates in agriculture [13]. According to the agency, they will be 1.3-1.6% in 2019 and 2020, and in the years 2021-2024 - 1.9-2.9%, which is significantly lower than in the economy as a whole (3.1- 3.3% in 2021-2024). It is obvious that inertial growth while maintaining the existing structure of production and export cannot provide the parameters defined by the Presidential Decree “On National Goals and Strategic Tasks of the Development of the Russian Federation for the Period until 2024” [14]. It seems that the implementation of the scenario with a doubling of the export of agricultural raw materials and food in 2024 is possible only on the basis of the structural modernization of the agri-food complex of Russia. Achieving the targets will require a change in the structure of exports by increasing the share of products with a high degree of processing and the targeted formation of export-oriented fragments of global value chains in Russia.

The most important direction of structural changes is to increase the degree of integration in the agri-food complex. Agroholdings solve their problems by focusing production activities mainly on the most profitable market segments. Less attention is paid to niche segments where it is difficult to obtain effects due to the scale of production. The requirement for the rational use of labor resources in rural areas and the climatic potential makes it necessary to diversify agricultural production. The development of production in niche market segments can provide small forms of economy.

Promising trends in government regulation are the stimulation of the formation of long technological chains of added value based on vertical integration as a key condition for ensuring modernization; increasing the integrability of the economic space through the intensification of interregional relations; expanding measures of state support for the development of territories.

A factor in the development of Russian exports of many types of food is government support for large vertically integrated structures within the framework of the program “Export of agricultural products”. The concentration of capital at growth points will contribute to the processes of formation of modern production cycles in pig farming, poultry farming, sugar, oil and fat food chains that can successfully increase production volumes.

The directions of the transition to a regionally differentiated state policy aimed at ensuring a rational territorial specialization of agricultural production and taking into account the changing positioning of the national agribusiness in the global agri-food system are using, as the main criterion for differentiating state support, the compliance of the allocated aid with the agro-climatic potential of the region; increasing the role of measures aimed at promoting the growth of the integrability of the economic space; gradual reorientation of agricultural production support programs to integrated rural development programs; stimulating the development of promising territorial-economic systems - areas of priority development (zones of guaranteed agricultural production; competitive clusters and other forms); more active use of the balance sheet and regulatory resource approaches to justify the size of state support in the regional context.

A feature of the current stage of development was the formation of such a model of supporting economic growth in the agri-food sector, in which the share of producer support is high due to negative price support to consumers. According to the OECD, in Russia, consumer spending on supporting agricultural producers increased from 268.6 billion rubles in 2013 to 435.6 billion rubles in 2017 at current prices [15]. The analyzed Percentage CSE indicator characterizes the ratio of total explicit and implicit transfers to consumers to the total cost of consumption of agricultural products at domestic prices. As a rule, a high level of price taxation of low-income consumers reduces the economic affordability of food, reduces demand, and the presence of a long period of negative price support for consumers does not simultaneously stimulate producers to increase competitiveness.
Using the input-output tables allows assessing the effectiveness of various support methods, for example, stimulating final demand, with a different structure of the economy and the agri-food complex. The total output of all sectors \(x\) consists of two components - output for final consumption \(y\) and output for intersectoral consumption (to ensure the production of products of other sectors). The output for intersectoral consumption using the matrix of technological coefficients is defined as \(A_x\). Thus, in total with the final consumption \(y\), we get the total output \(X\):

\[
X = A_x + y
\]  

(1)

From this equality it follows:

\[
X = (E - A)^{-1} y
\]  

(2)

Matrix \((E - A)^{-1}\) - matrix multiplier, since the actual expression obtained is valid (due to the linearity of the model) for increments of output:

\[
\Delta X = (E - A)^{-1} \Delta y
\]  

(3)

The proposed methodology for assessing the effectiveness of state support methods using the input-output tables allows analyzing alternative options for the impact of stimulating final demand, the volume and structure of state support for industries on GDP growth and individual industries. The growing importance of stimulating aggregate demand in the state support system is confirmed by model calculations based on the input-output tables for 2000 and 2014. An assessment of two development scenarios that we developed (the first - taking into account the prevailing share of imports in the structure of final demand, the second - focus on full import substitution) revealed that an increase in final demand by $1 million under the conditions of 2014 would ensure a GDP growth of $2,276. In 2000, this growth was 3.5 times smaller.

4. Discussion

Dynamically changing external and internal conditions for the development of the complex, its multifunctionality, aggravation of the world food problem predetermine the need to justify the development scenarios of the agri-food complex, its food chains, and trends in its structure. All researchers agree in assessing the high importance of structural transformations, but they present the main strategic priorities of structural modernization in different ways. It is necessary to refract theoretical conclusions as applied to the agri-food complex as a complex multi-level system.

An integral part of the study is an interbranch analysis, from the position of which it is possible to determine the important characteristics of the main changes in the structure of the food complex and its competitiveness. The underdeveloped theoretical and methodological base for the development of this problem and its debatable nature determine the relevance of the research topic.

The problem of structural balance can be largely solved by the focus of the strategic management system of the agri-food complex on the competition of integrated systems, value chains. For each specific industry, we can talk about our own recipes for changing the structure and increasing labor productivity. An approach to determining the degree of country involvement in global value chains is under development. On the issue of the effectiveness of the participation of the agri-food complex, there are various, sometimes mutually exclusive points of view. Indeed, the increase in the efficiency of individual links in food chains when entering global value chains can affect reproductive integrity in different ways in national contexts. This underlines the importance of a joint analysis of the relationship between security and development.

5. Conclusion

The transition to the stage of balanced effective growth of the agri-food complex involves the restoration and growth of the purchasing power of the population, the expansion of export opportunities, the creation of a favorable environment for the influx of investments corresponding to the scale of the tasks to be solved, and the growth of labor productivity.
The main criteria for the necessary structural changes aimed at the restructuring of the Russian agri-food complex are compliance with current trends in the development of the world agri-food system; requirements for intersectoral competitiveness; a changing pattern of food needs; the requirements of the integrative development of the complex.

The main directions of the structural modernization of the agri-food complex, carried out through the state program and project management, are to ensure priority in the growth of production profitability, and to reduce the areas for stimulating the growth of volume indicators; contributing to the activation of innovation processes; ensuring technological sovereignty; taking into account regional aspects in the implementation of structural policies in the agri-food complex. An important area is the capitalization of the competitive advantages of Russian regions with a high share of agri-food activity, their transformation into a growth factor.

New structural interactions in the agri-food complex involve integration into global value chains, support for business activity in critical areas in intersectoral value chains; ensuring national control of critical links. Among the most important structural transformations is ensuring technological sovereignty; protection from destructive competition from foreign manufacturers, especially the final stages of the longest value chains. These include livestock, meat and dairy industries.

Intersectoral balance as a criterion of structural modernization largely determines the competitiveness of the agri-food complex as a system. The use of an intersectoral approach opens up new possibilities for studying the level, dynamics and structure of imports of the agri-food complex due to the impact of related industries on the industry that produces the final product. This gives a more accurate picture of the import dependence of the complex and allows outlining the directions of effective import substitution. A feature of the current stage of development of the Russian agri-food complex is the growth in imports of intermediate products.

The specifics of the development of the export potential in the context of globalization and the development of international integration is that the main share of agricultural exports is agricultural raw materials, primarily grain crops and oilseeds. Export diversification, export growth of high value-added products will contribute to the sustainable development of agriculture and food industry. The scientific justification of the export-oriented strategy for the development of the agri-food complex of Russia presupposes the coordination of national interests related to the saturation of domestic markets and the growth of competitiveness in the world food market, the development and implementation of export potential.

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